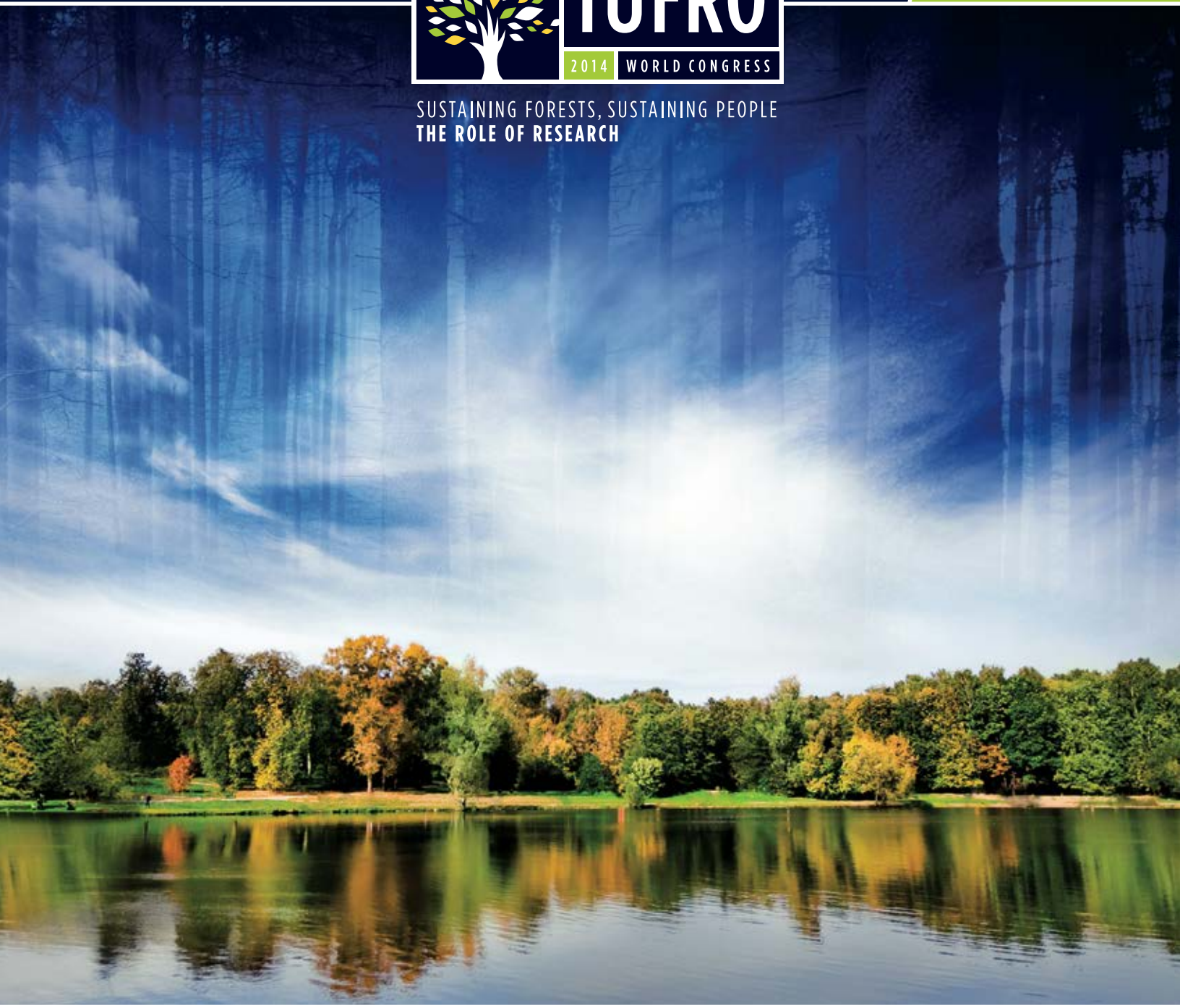
2014

IUFRO

2014 WORLD CONGRESS

SUSTAINING FORESTS, SUSTAINING PEOPLE
THE ROLE OF RESEARCH



IUFRO

2014 IUFRO WORLD CONGRESS

PROGRAM SUMMARY REPORT

www.iufro2014.com

THE AUTHORS

Richard W. Guldin was Chair of the Congress Organizing Committee. He was Director of Inventory, Monitoring, and Assessment Research Staff, United States Department of Agriculture, Forest Service, Research & Development, Washington, DC, and is now retired. Contact him at rwguldin_at_gmail.com

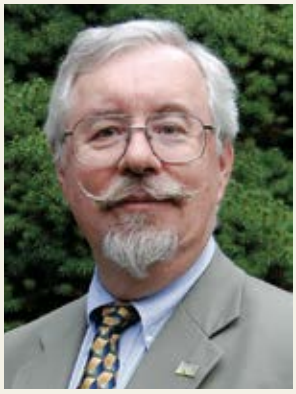
John Parrotta was Chair of the Congress Scientific Committee. He is Program Leader, International Science Issues, for the United States Department of Agriculture, Forest Service, Research & Development, Washington, DC. Contact him at jparrotta_at_fs.fed.us.

Jennifer Hayes was IUFRO Congress Project Manager. She is a Public Affairs Officer at the Rocky Mountain Research Station, United States Department of Agriculture, Forest Service, in Fort Collins, Colorado. Contact her at jenniferhayes_at_fs.fed.us.

Daryl Lederle was IUFRO Congress Project Specialist. She is a Program Specialist on the Inventory, Monitoring, and Assessment Research Staff, United States Department of Agriculture, Forest Service, Research & Development, Washington, DC. Contact her at drlederle_at_fs.fed.us.

PHOTOGRAPHERS

We would like to thank our photographers from the Congress: Cindy McArthur, Cass Cairns, Olivia Sanchez Badini, Eric Schramm, Ramin Khorchidi, Janelle Bianca Fernandez, Christopher Bentley, Jennifer Hayes, Richard Guldin, John Parrotta, and Sherri Eng.



Richard W. Guldin, Chair, Congress Organizing Committee

Dr. John Parrotta, Chair, Congress Scientific Committee

Jennifer Hayes, IUFRO Congress Project Manager

Daryl Lederle, IUFRO Congress Project Specialist

ACKNOWLEDGEMENTS

The Chair of the Congress Organizing Committee is deeply grateful for the countless hours and the dedication, persistence, and attention to myriad details contributed by Jennifer Hayes, IUFRO Project Manager, and Daryl Lederle, IUFRO Project Specialist. I could not have found two better core team members to work with me on this project. We had many partners, subcommittee members, advisors, and others. Hundreds of individuals contributed their time, energy, and advice to these organizing subcommittees. We are particularly grateful to the following for their leadership and personal initiative: James Allen, Vicki Berrett, Perry Brown, Nadine Block, Steve Bullard, Cass Cairns, Nan Christianson, Toby Eberly, Jan Engert, Rima Eid, Sam Foster, Susan Fox, George Garcia, Lisa Hansen, Michael Huck, Melissa Jenkins, Jim Johnson, Lilli Kaarakka, Stan Kitchen, Cindy Miner, Nalini Nadkarni, Meridith Perkins, John Parrotta, Carlos Rodriguez Franco, Terry Sharik, Patrick Shea, Bogdan Strimbu, Michael Sullivan, Tim White, and Dave Whittekiend.

Our thanks to the staff at the IUFRO Secretariat: Alexander Buck, Brigitte Burger, Sylvia Fiege, Margareta Khorchidi, Michael Kleine, Hugo Pierre, Renate Prüller, Heimo Schaffer, Eva-Maria Schimpf, Astrid Tippel, and Gerda Wolfrum, for their support, and to the IUFRO Management Committee members for their review comments and counsel along the way.

We also want to recognize the contributions by leaders and staff of the Society of American Foresters and Canadian Institute of Forestry: Recent SAF Presidents, notably Michael Lester (2010), Roger Dziengeleski (2011), Bill Rockwell (2012), Joann Meyer Cox (2013), and Dave Walters (2014), and SAF Council members the past five years; the CIF/IFC National Board of Directors; the SAF/CIF Program Committee, led by Jeremy Fried; the CIF/IFC Executive and Staff, principally Tat Smith and Matt Meade; and the SAF International Quiz Night Committee. We want to particularly mention the very substantive contributions made by the following individuals at SAF headquarters: Kelton Chapman, Jorge Esguerra, Michael Goergen, Matt Menashes, Louise Murgia, Carol Redelsheimer, and Christopher Whited.

A special thanks to all others who provided insights, leadership, advice, and assistance to our planning efforts: Nate Anderson, Martina Barnes, Dale Bartos, Mike Battaglia, Tim Beaty, Barbara Bentz, James Boulger, Steve Burr, Cass Cairns, Carita Chan, Jiquan Chen, Nan Christianson, John Colmey, Sally Collins, Charlie Condrat, Diane Denenberg, Nicole Dimotsis, Bill Dunning, Kelly Elder, Jan Engert, Don Evans, Rosann Fillmore, Marlene Finley, Renee Flanagan, Harv Forsgren, Susan Frankel, Jeremy Fried, Adam Garman, Brian Geils, Michael Goergen, Cindy Gordon, Kurt Gottschalk, Liz Hebertson, Sarah Hines, Jane Hodgins, Alex Hoppus, Darrel Kenops, Terrie Jain, Mike Jenkins, Morris Johnson, Cathy Kahlow, Kier Klepzig, Tracie Kirkham, Mike Kuhns, Al Lucier, Heidi McAllister, Cindy McArthur, Darrin McAvoy, Kevin Megown, Susan Meyer, Geoff McNaughton, Carlos Milan, Karen Mock, Don Motanic, Erin O'Connor, Maura Olivos, Wayne Padgett, Doug Page, Juan Pena, Cathy Pollock, Kurt Pregitzer, Roberta Quigley, Nora Rasure, Paul Rogers, Frank Roth, Anthony Salas, Yasmeen Sands, Mike Saunders, Jeff Schramm, Clark Seeley, John Shaw, Steve Shelly, Lynn Sprague, Bogdan Strimbu, Michael Sullivan, Michelle Thomas, Charmaine Thompson, Andree Walker, Kristen Waring, Ben Wigley, Dan Williams, Duane Williams, and Richard Zenn.

To our contractors and vendors: BAV, Convention Services of the Southwest, Hanlon Creative, SMG, and X-CD Technologies. Your contributions behind the scenes had much to do with the success of the event.

And finally, to the early partners who helped us envision a successful bid for the Congress and who provided support along the way: Ann Bartuska, Arthur Blazer, Robert Bonnie, Jimmy Reaves, Tom Tidwell, the Region 4 leadership team, and the Forest Service Research and Development leadership team; the Executive Committee of the National Association of University Forest Resources Programs; the Society of American Foresters; colleagues at Visit Salt Lake, including Michael Mack, Chris Peterson, Mark White, and Gian Zini; and to IUFRO past Presidents Robert Buckman and Jeffery Burley.

The Chair of the Congress Scientific Committee and his members deserve more thanks than can be provided in this book for their tireless efforts and many hours of dedication to ensure a diverse, robust, and high-quality scientific program: John Parrotta (Chair); Jens Peter Skovsgaard (Division 1); Yousry El-Kassaby (Division 2); Hans Heinemann (Division 3); Ronald McRoberts (Division 4); Andrew Wong (Division 5); Tuija Sievänen (Division 6); Tod Ramsfield (Division 7); Robert Jandl (Division 8); James Johnson (Division 9); Lisa Hansen (International Forestry Students Association); Su See Lee (Vice President); Mike Wingfield (Vice-President); and to the Congress Organizing Core Team (ex officio).

The Chair of the Congress Scientific Committee also wishes to thank the more than 300 colleagues worldwide who served as organizers and moderators of plenary, sub-plenary, technical, and poster sessions, whose efforts ensured a high-quality and successful Congress scientific program.

– Richard W. Guldin
Chair, XXIV IUFRO
World Congress
Organizing Committee

– John Parrotta
Chair, XXIV IUFRO
World Congress
Scientific Committee

TABLE OF **CONTENTS**

Sustaining Forests, Sustaining People – the Role of Research

INTRODUCTION

The US Forest Service, our partners in the National Association of University Forest Resources Programs, and our sponsors welcomed 2,492 delegates from 100 countries, including 700 students, to the XXIV World Congress of the International Union of Forest Research Organizations on 5-11 October 2014 in Salt Lake City, Utah. In response to an invitation from the Congress Organizing Committee Chair, the joint annual meetings of the Society of American Foresters and the Canadian Institute of Forestry brought another 1,300 professional foresters to join us. The combined meetings were the largest ever held in the United States of America focused on forests.

The XXIV World Congress, titled "Sustaining Forests, Sustaining People –the Role of Research," was highly successful in bringing together scientists from the many ecological, economic, and social disciplines that study forests and the communities that depend on them. The scientific papers presented captured the current state of science around the world. Creating this scientific program was a complex three-year effort, which required close coordination between the Congress Scientific Committee, the Congress Organizing Committee, and more than 300 colleagues worldwide who served as organizers and moderators of plenary, sub-plenary, technical, and poster sessions. The Congress scientific program included 1,245 paper presentations in 19 sub-plenary sessions, 172 technical sessions and special student sessions, and 1,192 poster presentations. The in-Congress tours effectively demonstrated how research is being applied by land managers, while also introducing delegates to stunningly beautiful Utah landscapes. The trade exhibition highlighted innovations in technologies, products, and services occurring around the world. Local community events, side events, and business sessions enriched the dialogue around forests and forest-research collaboration. The Special Programme for Development of Capacities brought a group of 71 delegates to a week-long training session the week before the Congress.

This report documents what occurred during the Congress. It is designed to be an aide-mémoire for delegates who attended, reminding them of the presentations and what happened in Salt Lake City that week. The synopses of the plenary, sub-plenary, and technical sessions that comprise the bulk of the report are reference material for scientists and policy makers worldwide who are interested in understanding the state of science in the forest sector. Additional details about the schedule and substance of the Congress are found on the Congress website (http://www.iufro2014.com). For the first time at an IUFRO Congress, the ceremonies, plenary presentations, and interviews with award winners and others were recorded. Over 12 hours of digital video are on the IUFRO YouTube channel (http://www.youtube.com/user/iufro). Links to specific videos are included in the body of this report, so the narrative descriptions of some elements of the ceremonies and the plenary presentations are very short. Interested parties are encouraged to view the videos.

This report has been designed first and foremost as an electronic document. It has many internal links and is fully searchable online. The compilers believe that electronic publication has become the current practice in the international scientific community. Hard copies have not been printed and are not available from either IUFRO or the Forest Service. People who want a paper copy for their records are encouraged and authorized to print a copy locally to meet their own needs.

As is customary in proceedings of scientific meetings, there are no details in this document about the organization of the Congress. The organizational details were absolutely critical to creating a memorable Congress. But because the compilers thought that there are two different audiences – a large audience for the scientific content of the meeting and a smaller, different audience interested in the organizational details – they chose to create this document to serve the former audience and deliberately omitted organizational aspects of the Congress. Persons in the latter audience who are interested in the lessons learned from organizing this Congress to help them create better regional or global scientific meetings should contact Richard Guldin, the Chair of the Congress Organizing Committee (rwguldin_at_gmail.com), who will be pleased to share what happened and what was learned.

IUFRO 2014 WORLD CONGRESS

Program Schedule

TIME	SUNDAY OCT 5th	MONDAY OCT 6th	TUESDAY OCT 7th	WEDNESDAY OCT 8th	THURSDAY OCT 9th	FRIDAY OCT 10th	SATURDAY OCT 11th	TIME
8:00		Opening Ceremony	Concurrent Technical Sessions	In-Congress Tours (start and end times vary by tour)	Joint Plenary Keynote Speakers (IUFRO/SAF/CIF) & Concurrent Technical Sessions	Concurrent Technical Sessions	Concurrent Technical Sessions	8:00
8:30								8:30
9:00								9:00
9:30								9:30
10:00								10:00
10:30		Refreshment Break	Refreshment Break		Refreshment Break	Refreshment Break	Refreshment Break	10:30
11:00	Registration Open (11:00-19:00)	Keynote Plenary Session	Keynote Plenary Session		Joint Plenary Panel Session	Keynote Plenary Session	Keynote Plenary Session	11:00
11:30								11:30
12:00		Posters	Posters		Trade Exhibition & Posters	Trade Exhibition & Posters	Trade Exhibition & Posters	12:00
12:30		Lunch Break, & IUFRO Business Sessions	Lunch Break, Poster Viewing & IUFRO Business Sessions		Lunch Break & Side Events	Lunch Break, Poster Viewing & Side Events	Lunch Break	12:30
13:00								13:00
13:30		Concurrent Sub-Plenary Sessions	Concurrent Sub-Plenary Sessions		Concurrent Sub-Plenary Sessions	Concurrent Sub-Plenary Sessions	Concurrent Sub-Plenary Sessions	13:30
14:00	IUFRO Tree Planting Ceremony							14:00
14:30								14:30
15:00		Refreshment Break	Refreshment Break		Refreshment Break	Refreshment Break	Refreshment Break	15:00
15:30		Concurrent Technical Sessions	Concurrent Technical Sessions		Concurrent Technical Sessions	Concurrent Technical Sessions	Closing Ceremony	15:30
16:00								16:00
16:30								16:30
17:00								17:00
17:30	Making the Most of the Congress			Trade Exhibition / Exhibit Hall Grand Opening Reception				17:30
18:00							Farewell Gala Dinner	18:00
18:30		IUFRO Welcome Reception			Side Events	Side Events & IUFRO Divisional Meetings		18:30
19:00			IUFRO Business Sessions					19:00
19:30								19:30
20:00				International Student Quiz Bowl				20:00
20:30								20:30
21:00								21:00

At each IUFRO World Congress, a formal announcement is made of the key messages from the Congress. The Salt Lake City Declaration is presented in the four IUFRO languages.

THE SALT LAKE CITY DECLARATION

Sustaining Forests, Sustaining People: The Role of Research – The Salt Lake City Declaration

Forests and trees play a critical role in supporting the livelihoods and quality of life of people worldwide, providing income opportunities, sustaining agricultural productivity, food security and nutrition, providing adequate supplies of clean water, affordable and sustainable sources of renewable energy, and forest-based products. Forests and trees also hold the key to our future well-being, improving the environmental quality of growing urban centers, contributing to the mitigation of, and adaptation to, climate change, and the conservation of our planet's biodiversity upon which our survival will ultimately depend.

The 24th World Congress of the International Union of Forest Research Organizations (IUFRO) "Sustaining Forests, Sustaining People: The Role of Research" brought together 2,500 scientists from more than 100 countries, and 1,300 professional foresters from North America. It provided a unique forum for presentation and discussion of current and future global research needs in forest science. The Congress explored the role of science in crafting practical measures to enhance the resilience of forests and their capacity to provide the environmental, economic, social, cultural, spiritual, and health benefits that sustain rural and urban societies worldwide.

Based on this World Congress, IUFRO commits itself to expand and intensify its efforts to develop and promote integrated solutions to the interrelated economic, social and environmental challenges we must face together. These efforts will also inform the discussions that will take place next year at the XIV World Forestry Congress 2015 and other important gatherings, including the United Nations Forum on Forests, which will promote ongoing efforts toward achieving a coherent and integrated development agenda beyond 2015.

Pursuing these goals will require effective collaboration among people across landscapes, sectors, and disciplines. During the next five years, IUFRO is committed to building on the strengths of its current global network. In particular, IUFRO will expand its interdisciplinary research and partnerships with scientists in related fields, and broaden its dialogue with, and service to, other organizations, communities, land managers, and policy makers.

The need for international cooperation in forest research and the dissemination of research findings has never been greater. As the global network for forest science, IUFRO shall do its utmost to meet this need.

Sosteniendo Bosques, Sosteniedo La Gente: El Papel De La Investigación – La Declaración De Salt Lake City

Los bosques y árboles desempeñan un papel crítico al dar apoyo al sustento y la calidad de vida de la gente en todo el mundo, proporcionando oportunidades de generar ingresos, sustentando la productividad agropecuaria, la seguridad alimentaria y nutricional, y aportando al abastecimineto adecuado de agua limpia, de fuentes accesibles y sostenibles de energía renovable y de productos de base forestal. Los bosques y árboles también son claves para nuestro bienestar en el futuro, mejorando la calidad del medio ambiente en nuestros crecientes centros urbanos, contribuyendo a la mitigación y adaptación del cambio climático, y a la conservación de la biodiversidad de nuestro planeta del cual finalmente depende la sobrevivencia de todos.

El XXIV Congreso Mundial de la Unión Internacional de Organizaciones de Investigación Forestal (IUFRO) bajo el lema "Sosteniendo Bosques, Sosteniendo la Gente: El Papel de la Investigación" juntó a 2,500 científicos de más de 100 países, y 1,300 profesionales forestales de Norteamérica y ofreció una plataforma única para presentar y discutir las demandas actuales y futuras de investigación mundial en la ciencia forestal. El Congreso exploró el papel de la ciencia en el desarrollo de medidas prácticas para fomenter la resiliencia de los bosques y su capacidad de suministrar los beneficios medioambientales, económicos, sociales, culturales, espirituales y de salud que sostienen las sociedades rurales y urbanas en todo el mundo.

En base a este Congreso Mundial, IUFRO se compromete a extender e intensificar sus esfuerzos de desarrollar y promover soluciones integrales para abordar los desafíos económicos, sociales y medioambientales entrelazados que tenemos que enfrentar juntos. Estos esfuerzos también servirán para informar las discusiones que tendrán lugar en el año 2015 durante el XIV Congreso Forestal Mundial y en otras reuniones importantes, como el Foro de las Naciones Unidas sobre Bosques, que van a promocionar los esfuerzos continuos hacia una agenda de desarrollo coherente e integral después de 2015.

En la persecución de estas metas hará falta de una colaboración eficaz entre personas a través de paisajes, sectores y disciplinas. Durante los próximos cinco años, IUFRO se compromete a aprovechar las fortalezas de su red actual de cooperación mundial. Especialmente, IUFRO va a extender su investigación interdisciplinaria y su colaboración con científicos de campos relacionados y ampliar su diálogo y servicios con otras organizaciones, comunidades, gestores de tierras y responables de políticas.

La necesidad de cooperación internacional en investigación forestal y diseminación de resultados de investigación, nunca ha sido mayor. En su capacidad de red mundial para la ciencia forestal, IUFRO hará todo lo posible para responder a esta necesidad.

Soutenant Les Forets, Soutenant Les Peuples: Le Role De La Recherche – La Declaration De Salt Lake City

Les forêts et les arbres sont d'une importance primordiale pour la qualité de vie des Hommes de par le monde. En effet, elles produisent des revenus, soutiennent la productivité agricole, sont cruciales pour la sécurité alimentaire et la nutrition, ainsi que pour l'apport en eau douce. Enfin, elles représentent une source d'énergie renouvelable abordable et durable, et fournissent divers produits forestiers. De plus, les forêts et les arbres sont la clé de notre bien-être futur, en ce qu'ils améliorent la qualité environnementale des centres urbains, contribuent à la mitigation et à l'adaptation aux changements climatiques, ainsi qu'à la conservation de la biodiversité, de laquelle notre survie dépendra à terme.

Le 24ème Congrès Mondial de l'Union internationale des instituts de recherches forestières (IUFRO), sur le thème « Soutenant les forêts, soutenant les peuples : le rôle de la Recherche » a réuni 2500 scientifiques venus de plus de 100 pays, et 1300 forestiers professionnels nord-américains. Cela a été une occasion unique de présenter et discuter les besoins actuels et futurs de la recherche en sciences forestières. Le Congrès a porté sur le rôle de la science dans la mise au point de manières concrètes d'améliorer la résilience des forêts, et leur capacité à fournir les bénéfices environnementaux, économiques, sociaux, culturels, spirituels et ceux liés à la sante, qui servent les sociétés urbaines et rurales dans le monde entier.

A l'issue de ce Congrès Mondial, l'IUFRO se donne pour objectif d'étendre et d'intensifier ses efforts visant à développer et promouvoir des solutions intégrées à ces défis sociaux, environnementaux et économiques interconnectés, auxquels il nous faut faire face ensemble. Ces efforts pourront également servir de base l'an prochain aux discussions du XIVème Congrès Forestier Mondial 2015 et celles ayant lieu à l'occasion d'autres rassemblements importants, en particulier le Forum des Nations Unies sur les Forêts qui devra promouvoir les efforts actuels visant à établir un agenda de développement post-2015 intégré et cohérent.

Travailler dans cette direction demandera une collaboration efficace entre des acteurs venus de secteurs et de disciplines différentes. Au cours des cinq prochaines années, l'IUFRO s'engage à s'appuyer sur les forces de son réseau mondial actuel. En particulier, l'IUFRO développera les recherches interdisciplinaires et les partenariats avec les scientifiques dans les disciplines liées à la recherche forestière. De plus, le dialogue avec les autres organisations, les communautés locales, les aménageurs du territoire et les décideurs politiques sera intensifié, et les services qui leurs sont offert étendus.

Le besoin de coopération internationale dans le secteur de la recherche forestière et celui de disséminer les résultats de recherche, sont aujourd'hui à leur apogée. En tant que réseau mondial pour la science forestière, l'IUFRO se doit de faire tout son possible pour répondre à cette demande.

Nachhaltigkeit Im Wald, Nachhaltigkeit Für Den Menschen: Die Rolle Der Wissenschaft – Die Deklaration Von Salt Lake City

Wälder und Bäume spielen eine Schlüsselrolle für den Lebensunterhalt und die Lebensqualität der Menschen auf der ganzen Welt; sie schaffen Einkommensquellen, tragen zum Erhalt der landwirtschaftlichen Produktivität sowie der Nahrungs- und Ernährungssicherheit bei, sorgen in entsprechendem Umfang für sauberes Wasser und sind zudem leistbare und nachhaltige Quellen erneuerbarer Energie und forstlicher Güter. Wälder und Bäume sind somit von essentieller Bedeutung für unser zukünftiges Wohlergehen; sie tragen zur Verbesserung der Umweltqualität in den wachsenden Metropolen sowie zur Anpassung an den Klimawandel und zur Abschwächung seiner Auswirkungen bei. Darüber hinaus steuern sie wesentlich zum Erhalt der biologischen Vielfalt unseres Planeten bei, von der unser Überleben letztendlich abhängt.

Der XXIV Weltkongress des Internationalen Verbandes Forstlicher Forschungsanstalten (IUFRO) unter dem Thema "Nachhaltigkeit im Wald, Nachhaltigkeit für den Menschen: die Rolle der Wissenschaft" vereinte 2500 Wissenschaftler aus mehr als 100 Ländern, sowie 1300 Forstpraktiker aus Nordamerika. Der Kongress bot eine einzigartige Plattform für die Präsentation und Diskussion heutiger und zukünftiger Anforderungen an die waldbezogene Forschung und Wissenschaft weltweit. Dabei wurde die Rolle der Wissenschaft beleuchtet und es wurden praktische Maßnahmen zur Stärkung der Widerstandskraft der Wälder definiert sowie zur Förderung ihrer Fähigkeit, Leistungen für Umwelt, Wirtschaft, Gesellschaft, Kultur, spirituelle Werte und Gesundheit zu erbringen, die sowohl der ländlichen als auch der städtischen Bevölkerung weltweit nutzen.

Ausgehend von diesem Weltkongress wird IUFRO seine Suche nach umfassenden Lösungen für die eng miteinander verflochtenen wirtschaftlichen, sozialen und umweltbezogenen Herausforderungen, denen wir alle gegenüberstehen, ausweiten und verstärken. Diese Bestrebungen werden auch in die Diskussionen einfließen, die 2015 am XIV Weltforstkongress und anderen bedeutenden Konferenzen wie dem Waldforum der Vereinten Nationen stattfinden werden und die laufenden Bemühungen zur Erstellung einer kohärenten und ganzheitlichen Entwicklungsagenda nach 2015 unterstützen sollen.

Die Verfolgung dieser Ziele erfordert eine wirksame Zusammenarbeit von Menschen über die Grenzen von Landschaften, Sektoren und Disziplinen hinweg. In den nächsten fünf Jahren wird IUFRO weiter auf den Stärken seines jetzigen globalen Netzwerks aufbauen. Vor allem wird IUFRO die interdisziplinäre Forschung sowie die Zusammenarbeit mit Wissenschaftlern aus verwandten Disziplinen ausweiten und den Dialog sowie die Dienstleistungen für andere Organisationen, die Bevölkerung, Landmanager und politische Entscheidungsträger verstärken.

Die Notwendigkeit einer internationalen Zusammenarbeit in der Waldforschung und der Verbreitung der Forschungsergebnisse war noch nie so groß wie heute. Als weltweites Netzwerk der Waldwissenschaft wird IUFRO sein Möglichstes tun, um diesen Anforderungen zu entsprechen.

Congress
CEREMONIES

Five major ceremonies were held as part of the Congress:

1. Tree Planting Ceremony
2. Opening Ceremony
3. Wangari Maathai Award Ceremony
4. SAF/CIF/IUFRO Joint Event Ceremony
5. Closing Ceremony

CEREMONIES

Tree Planting Ceremony

One hundred fifty people gathered on Sunday afternoon, 5 October, at the International Peace Gardens in Salt Lake City, to plant trees to commemorate the Congress and to leave a legacy gift to the host city. Four trees were planted by IUFRO and one by the Society of American Foresters (SAF). **Robert Bonnie**, USDA Under Secretary for Natural Resources and the Environment; **Thomas Tidwell**, US Forest Service Chief; **Brian Cottam**, Utah State Forester; **Todd Reese**, Salt Lake City Parks and Public Lands Program Director; and **Niels Elers Koch**, IUFRO President, each spoke on the importance of forest research and international exchange. Bronze plaques commemorating the IUFRO Congress and SAF were unveiled. Seven children from Utah who had won the statewide 2014 Arbor Day poster competition were invited, displayed their posters, and helped to plant the trees.

The trees planted were:

- Cedar of Lebanon *(Cedrus libani)*: To commemorate IUFRO's long history and the location of the planting in the Lebanese section of the gardens.
- European Beech *(Fagus sylvatica)*: To commemorate IUFRO's roots in Europe.
- Piñon Pine *(Pinus edulis)*: To commemorate the importance of trees, and this species particularly, to the Native Americans who originally inhabited the region.
- American Chestnut *(Castanea dentata)*: To commemorate the role of research in combating a deadly fungus, Chestnut Blight *(Cryphonectria parasitica)*, that virtually eliminated American Chestnut from America's forests in the early 1900s.
- Bigtooth Maple *(Acer grandidentatum)*: To commemorate the joint Society of American Foresters and Canadian Institute of Forestry meetings co-located with the IUFRO Congress.

The COC especially thanks Melissa Jenkins, Forest Service, and Meridith Perkins, Utah Department of Natural Resources, for their excellent assistance in organizing the Tree Planting Ceremony.

Native flute player

Niels Elers Koch's opening speech

Local children at the Opening Ceremony

Opening Ceremony

Delegates were welcomed to the United States and the Congress on Monday, 6 October. Native American performers from five tribes indigenous to Utah treated delegates to traditional flute music, dance, and song, honoring the first people of these lands (video 04:24-24:32). A 10-minute film, A Tribute to America's Forests, was produced and shown to honor the diverse forests of America. The IUFRO flag was raised, witnessed by US Forest Service Deputy Chief **Jim Reaves** and **Steven Bullard**, President of the National Association of University Forest Resources Programs.

Niels Elers Koch, IUFRO President, provided the opening address on behalf of IUFRO (video 39:05-48:36). He welcomed the nearly 2,500 delegates from over 100 countries to the 24th IUFRO World Congress. Niels Koch provided a special welcome to the nearly 700 students in attendance, as they represent the future of forest science and IUFRO. He reflected on his first World Congress in 1976 in Norway and how this changed the rest of his life – by finding the global network to the premier scientists in his field of study and colleagues who have become his best friends – and an appreciation for different cultures as a result of his exposure. He shared three wishes for all delegates at the Congress: first, that IUFRO provide them the same opportunities he has had; second, be willing to share your knowledge; third, get involved with IUFRO, as the people are its strength. His remarks also reviewed the IUFRO Strategy for 2010-2014 and how it influenced collaboration around its themes and the development of the Congress program. The meetings by IUFRO's Divisions, Research Groups, Working Parties, and Task Forces around these themes over the past four years are the "pulse" of IUFRO, bringing people together in the global network. He spoke to how IUFRO has also evolved as a major player in influencing the consideration of forest science in global policy forums, especially through the Collaborative Partnership of Forests. The partnership with the International Forestry Students' Association was also highlighted. He said, "The IUFRO World Congress provides an excellent global platform to present and discuss research results and to stimulate further research." The Congress program was reviewed, and he welcomed delegates to make the most of the Congress and wished for each that it would be the best World Congress that they have participated in.

United States Department of Agriculture Under Secretary for Natural Resources and the Environment **Robert Bonnie** provided the keynote speech (video 54:54-1:12:36), where he touched on the importance of understanding ecosystem services, the implications of a changing climate, the challenges and opportunities of managing forests for multiple uses, the need for a new era of forest stewardship and fire management, the importance of healthy watersheds, and, ultimately, the critical importance of collaborative approaches. "A healthy and prosperous planet depends on the health of our natural resources, and in particular on the conservation of the world's forests. But our success in conserving, managing, and restoring our forests depends to a significant degree on a solid foundation of science and research," said Bonnie.

Important partners also made addresses to IUFRO, the United Nations and the International Forestry Student Association. **Thomas Gass**, Assistant Secretary-General for Policy Coordination and Inter-Agency Affairs, Department of Economic and Social Affairs, United Nations, provided a video address to delegates (video 1:14:00-1:20:00) where he spoke about the Rio+20 sustainable development goals and how forests have been a key element in the discourse, especially in their vital role as watersheds; and how solid scientific advice is needed in policy discussions. **Eduardo Rojas-Briales**, Assistant Director General for Forests, United Nations Food and Agriculture Organization (video 1:20:20-1:29:28), spoke about the need for evidence-based information to inform political decisions in this globalized and complex world arena where forests are forced to compete against other priorities. Rojas-Briales spoke to the importance of both understanding the goods and services that forests provide and focusing attention on enabling their upstream flow (e.g., restoration) and the financial and governance mechanisms to ensure a sustainable future for these goods and services. He spoke to the sociocultural, economic, and environmental contexts that need to be considered by researchers and made a call for making forests more visible on the world stage. **May Anne Then,** President, International Forestry Students Association (video 1:29:50-1:34:21), informed delegates about IFSA and their role in knowledge and cultural exchange and in connecting students and promoting student learning.

The addresses were followed by the delivery of two major sets of awards, the Host Country Scientific Award and the IUFRO Scientific Achievement Awards.

The ceremony was moderated by Richard Guldin, Chair of the Congress Organizing Committee, Forest Service, and chaired by Niels Elers Koch, IUFRO President.

View the complete Opening Ceremony here:
https://www.youtube.com/watch?v=IxlsTbUyfFU&list=PLoCgwC3s55P4jHsu4lbsd6wYrR2Z8_rF-&index=1

Wangari Maathai Award Ceremony

Ruiz Corzo accepts award from Rojas-Briales

Congress organizers were honored when the Collaborative Partnership on Forests selected the Congress as the location to deliver the prestigious award. **Wangari Muta Maathai** was a Kenyan environmental and political activist, who in 2004 became the first African woman to receive the Nobel Peace Prize for "her contribution to sustainable development, democracy, and peace."

The award in her honor recognizes an individual who has made outstanding contributions to preserve, restore, and sustainably manage forests while raising awareness of the key role forests play in supporting local communities, rural livelihoods, women, and the environment. On Monday, 6 October, this award was given to **Marta "Pati" Ruiz Corzo** of Mexico. Corzo is recognized for making conservation profitable for rural communities in the Sierra Gorda Biosphere Reserve, one of the most ecologically diverse areas of Mexico. Her moving acceptance speech (video 9:18-24:35) and call to action for a more sustainable and equitable planet inspired many during the award ceremony.

Alexander Buck, IUFRO Executive Director, moderated the ceremony, and the award was presented by **Eduardo Rojas-Briales**, Assistant Director General for Forests, United Nations Food and Agriculture Organization, on behalf of the 14 international groups – including IUFRO – who are members of the Collaborative Partnership on Forests (http://www.cpfweb.org/77034/en).

View the ceremony here:
https://www.youtube.com/watch?v=QGIn0CAEilg

SAF/CIF/IUFRO Joint Event Ceremony

USDA Under Secretary Robert Bonnie delivers address


Prince Charles welcomes delegates

On Thursday, 9 October, the Society of American Foresters (SAF) and the Canadian Institute of Forestry (CIF/IFC) joined IUFRO in a ceremony to commemorate this joint event. It was also the opening ceremony for the SAF/CIF convention – which was held concurrently from October 9-11 and co-located with the IUFRO World Congress. Over 3,500 people were in the Plenary Hall for this event.

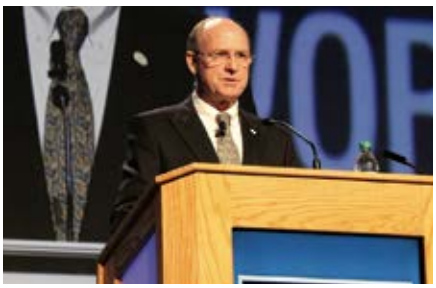
Robert Bonnie, United States Department of Agriculture Under Secretary for Natural Resources and the Environment, provided the opening address (video 2:48-8:04), where he spoke about the importance of forests and how forest conservation and restoration are critical to addressing climate change. Bonnie talked about the challenges of fires, urbanization, diseases, and forest loss and the need to reward landowners for good stewardship and expand incentives for maintaining forests and the goods and services they provide. Collaboration and partnerships were highlighted as a way to positively influence the science-management-policy interface and that many science disciplines are needed to create the knowledge required to address today's and the future's natural resources issues. "While the threats facing forests are significant…the opportunities facing us are also great…the stakes are high, but if history is any indication, we are up to the challenge," said Bonnie.

His **Royal Highness, Charles, Prince of Wales**, provided a video welcome address (video 8:13-14:00) where he emphasized that the "sustainable management of the world's forest ecosystems is of absolute critical importance." He expressed sincere concern for the fate of the world's forests but spoke to his hope that forests can recover. Prince Charles asked delegates to take a long-term view and work together and across sections (biologists with energy specialists, water experts, economists,

The Presidents of SAF (Dave Walters), CIF (Tat Smith), and IUFRO (Niels Elers Koch) welcome delegates to the joint plenary

Koch presents IUFRO Certificates of Appreciation to COC staff Jennifer Hayes and Daryl Lederle.

Honors and Awards Committee Chair, Shirong Liu



Incoming IUFRO President, Mike Wingfield delivers his inaugural address

and more) – to build a forest sector resilient to the many challenges we face – energy needs, climate change, population growth.

The leaders of the three organizations (**Dave Walters**, SAF President; **Tat Smith**, CIF/IFC President; and **Niels Elers Koch**, IUFRO President) came together on the stage to welcome delegates. To showcase the unique diversity of the combined event, delegates were asked to stand and be recognized as their country appeared on the projected globe (video 14:45-21:55).

Watch the entire ceremony here:
https://www.youtube.com/watch?v=0iCqtzuzD4A

Closing Ceremony

On the afternoon of Saturday, October 11, delegates came together for the Closing Ceremony of the 2014 World Congress.

Moderated by **Richard Guldin**, Chair of the Congress Organizing Committee, the ceremony began with recognizing all of the many individuals and groups that contributed to organizing the Congress. **Jennifer Hayes**, Congress Project Manager, and **Daryl Lederle**, Congress Project Specialist, were specifically thanked for the organizing roles they played. A slideshow of photos reflecting on the Congress was played (video 8:56-13:00).

John Parrotta, Chair of the Congress Scientific Committee, recognized the members of the Committee, session organizers, speakers, and poster presenters for their contributions and read the Congress Resolution (video 13:58-19:54; see The Salt Lake City Declaration on page 12).

Shirong Liu, Chair of the IUFRO Honors and Awards Committee, shared the names of the winners of the IUFRO Outstanding Doctoral Research Award, the Student Award for Excellence in Forest Science, and the Best Poster Award Winners (video 21:09-23:23). **Niels Elers Koch** presented Richard Guldin with the Distinguished Service Award (video 24:05-27:50) and presented **Don Koo Lee** with the Honorary Membership Award (video 27:55-34:00). Please see the Honors and Awards section for more details.

The decisions of the International Council were shared (video 34:09-36:10; see page 97) and the new IUFRO Board for 2014-2019 was introduced (video 36:22-39:00; see page 99).

Mike Wingfield was introduced as the incoming President of IUFRO and provided an inaugural address (video 41:22-58:00). In this address, Wingfield spoke to his history with the organization and set his goals for his presidency over the next five years. He challenged the students to tell their stories of how IUFRO touched them and to strengthen their networks and collaborate across the globe. He spoke to the importance of IUFRO in providing sound, reliable data and to help tell the story of forests and forestry to the global general public. He spoke to the diversity of goods and services that forests provide, in providing wood, as lungs of the Earth, in contributing to global food security, for housing biodiversity, and more. The IUFRO Strategy was discussed as the platform for organizing the important work of the next five years. He talked about the power of the intersection of the different disciplines and the value of regional meetings and various IUFRO meetings to draw on this strength. He spoke to his commitment to building IUFRO's network in Africa, Latin America, and other areas where IUFRO does not have a strong presence and that IUFRO needs to improve its recruitment of women into the network to provide for more gender balance and greater diversity.

Niels Elers Koch provided his final address as IUFRO President (58:20-1:04:58). He gave three wishes to all participants: that delegates have the same excellent opportunities and experiences that he has had through IUFRO; that delegates have used the Congress to share knowledge with others, so that all attending can benefit; and finally, that delegates will commit to getting involved in IUFRO, as it is the great strength of IUFRO to have committed members. He thanked the organizers, the National Association of University Forest Resources Programs, SAF, CIF, IFSA, and Congress delegates for all of their assistance and participation during the Congress. He also expressed thanks for all of those who supported him during his presidency and shared what an honor and joy it has been to lead IUFRO. His

Koch delivers his final address IUFRO President and congratulates delegates on a successful Congress

wish for the future of IUFRO was that the network improves and maintains IUFRO's relationships internally and externally. Koch said the voluntary commitment of its members and officeholders is notable and is the reason why good internal relations are so important; and IUFRO's vision requires many partnerships to make it a reality, which is why external relations are also so important.

Niels Elers Koch, **Richard Guldin**, and **Ann Bartuska**, Deputy Under Secretary of Agriculture, lowered the IUFRO flag for Research, Education, and Economics. She was the Forest Service's Deputy Chief for Research and Development in 2010 and received the IUFRO flag from IUFRO President **Don Koo Lee** at the end of the Seoul Congress. So she was invited to participate in this final act of the 2014 Congress and help deliver the flag to 2019 IUFRO World Congress Organizing Committee members **Joberto Veloso de Freitas** of the Brazilian Forest Service and **Yeda Maria Malheiros de Oliveira** of EMBRAPA Forestry.

Edson Tadeu Iede, Director of EMBRAPA Forestry, spoke about the historic nature of the next World Congress – the first one ever to be held in Latin America. He introduced delegates to the host city, Curitiba, Brazil, and the 2019 Congress co-host, EMBRAPA Forestry.

Marcus Alves, Director General of the Brazilian Forest Service, spoke to this opportunity for Brazil to showcase its policies and programs, opportunities and challenges; as Brazil is home to one third of the world's remaining rainforests, has the largest tropical forests in the world, and is the most biodiverse country on earth. He invited delegates to attend, especially Brazil's Latin American neighbors.

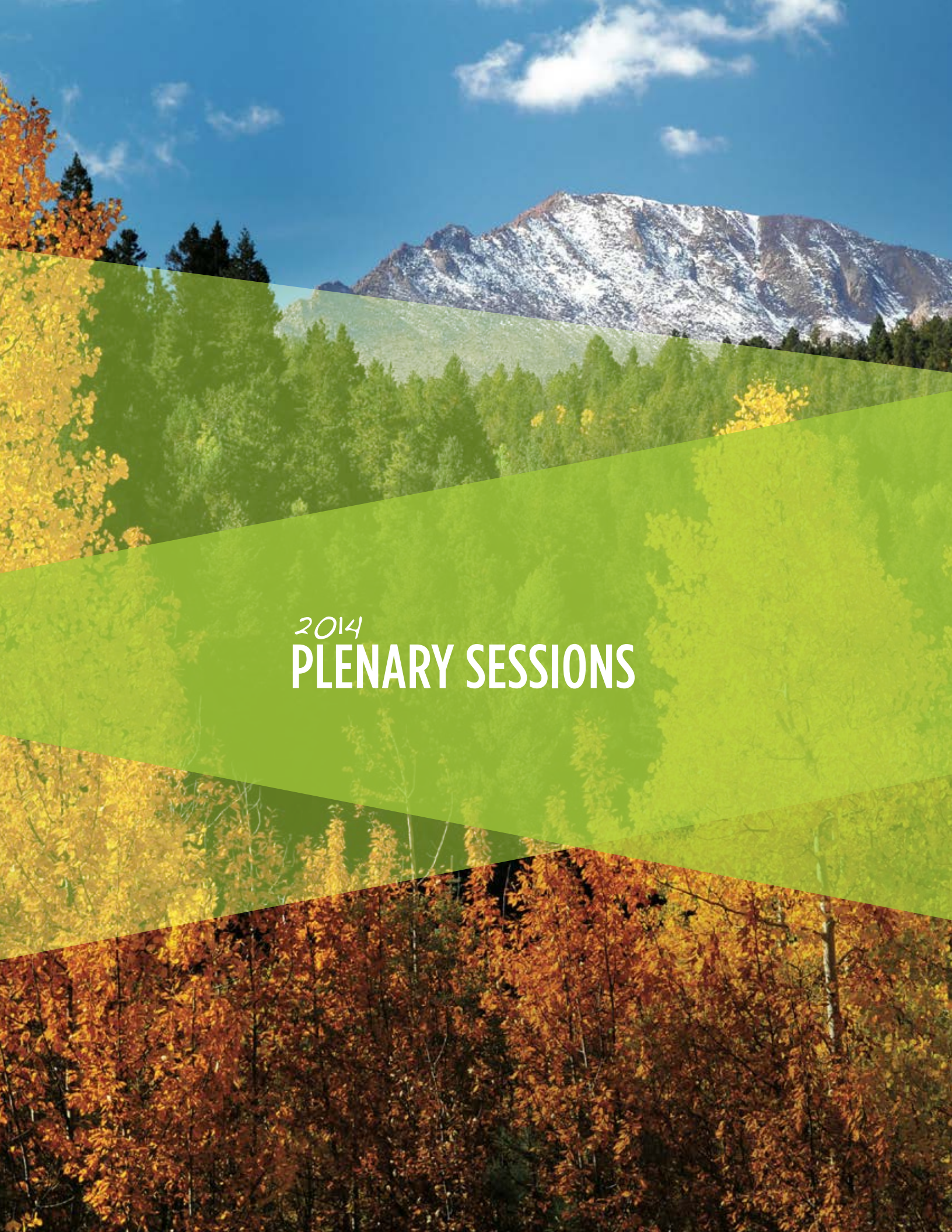
Outgoing IUFRO President Koch and incoming IUFRO President **Wingfield** thanked **Richard Guldin** for his service as Chair of the Congress and then officially closed the 24th World Congress of IUFRO.

Watch the ceremony here:
https://www.youtube.com/watch?v=6eLUh_VWLxA

Congress Scientific Committee, left to right: John Parrotta, Chair, JP Skovsgaard, Yousry El-Kassaby, Hans Heinimann, Ronald McRoberts, Andrew Wong, Tuija Sievanen, Tod Ramsfield, Robert Jandl, Jim Johnson, Su See Lee, Lisa Hansen, Mike Wingfield

Host country representative, Ann Bartuska, delivers the flag to Joberto Veloso-Frietas, Co-Chair of the 2019 Congress organizers, through outgoing IUFRO President Koch

Marcus Alves (EMBRAPA) and Edson Tadeu Iede (Brazilian Forest Service) welcome delegates to Curitiba, Brazil for the 2019 Congress



2014

PLENARY SESSIONS

Plenary Sessions

Five plenary sessions were held as part of the Congress, including a joint plenary between IUFRO, the Society of American Foresters, and the Canadian Institute of Forestry. A summary of each is provided below:

Monday, 6 October:	Andy Buchanan
Tuesday, 7 October:	David Newbery
Thursday, 9 October:	Joint Plenary, keynotes by Jack Dangermond and David George Haskell followed by a panel discussion
Friday, October 10:	Carol J.P. Colfer
Saturday, October 11:	Cecil Konijnendijk van den Bosch

Monday, 6 October: **Andy Buchanan**

Andy Buchanan is Professor of Timber Design at the University of Canterbury, New Zealand. He is a structural engineer with a broad range of interests, including timber engineering, sustainability, fire safety, and earthquake engineering. His talk, "Modern Timber Buildings from Sustainable Forests," started with the story of an earthquake that shook Christchurch, New Zealand in 2010. Buchanan showed many pictures of the different buildings made of different materials: timber, concrete, brick, etc. Solid wooden houses performed extremely well, as did engineered timber buildings.

Half of Christchurch was demolished, and many buildings were damaged beyond repair. As the city began to rebuild, there was much discussion about the type of city the population wanted. They considered rebuilding all in wood; there is a history in New Zealand of building solely out of wood, because it withstands earthquakes. However, architects are not well-versed in using wood as building material, and there are misconceptions about the flammability of engineered timbers.

The timber industry in New Zealand is based around a non-native species, Monterey Pine (Pinus radiata). Half of the wood in New Zealand is exported as logs, not pre-manufactured timber buildings. There are three types of engineered wood products that are developed in New Zealand to fill the demand for wooden buildings: glulam, cross-laminated timber (CLT), and laminated veneer lumber (LVL). Many of these products were engineered to work in structures designed to withstand earthquakes. CLT can be made into hollow beams that are then threaded with high-tensile cables that allow the building to move in an earthquake. Any damage that may be sustained is easy to repair and not as expensive as some other methods using non-wood materials. There are many examples of timber buildings throughout the world now: in Canada, Germany, and Switzerland. Even with the steel and concrete lobbies, there is a future in building with wood, especially as more engineers and architects become better versed in building with these materials.

Andrew Wong, Coordinator of Division 5 – Forest Products, moderated the session.

View Andy Buchanan's plenary address here:
https://www.youtube.com/watch?v=4OJDAN6NU9Q

Tuesday, 7 October: **David Newbery**

David Newbery is Professor for Vegetation Ecology at the Institute of Plant Sciences, University of Bern, Switzerland, with special focus on tropical forest ecology. His other areas of expertise lie in data analysis and theoretical ecology. David Newbery's talk was entitled "On Maintaining Cycles and Feedbacks in Tropical Forest Ecosystems: Some Thoughts from Basic Research." He discussed thoughts on what ecology can bring to forestry through ecosystem structure and dynamics, the role of environmental stochasticity, and prediction capabilities and uses. He argued that we need to reconsider ecology in forest management.

Ecology is a special science – the ecosystem is a part of ecology. Some, however, argue that ecosystems don't exist, are useless, or are just too complex. Newbery argued that not all ecosystems have to be complex to be worthy of ecological investigation. Natural systems are always in flux, and one cannot assume that nature is stable and maintains equilibrium. These are just boundaries we have imposed upon nature to ensure our models and methods create orderly data. Newbery cautioned against this impulse, instead noting, "the real world…is multi-causal and non-linear." Instead, we need to understand how nature functions and exercise control through management and pragmatic approaches at the mid-level. Newbery posited that this is the next challenge to all science, not just ecology. The ecosystem concept must be explored again.

Discussions of population dynamics must take into consideration, Newbery argued, because the ecological world is not full of straight lines. If we were to admit that more temporal variability in ecology and forestry exists, the "next 500 year" models would not even be considered. He encouraged more thinking on the meso-ecosystem level to ensure that in a one-, two-, and three-species mixture, planted or managed, the ecosystems' properties are shown and maintained. Detail matters, and the application of all-purpose models do the study of these systems a disservice.

Ecology is a historical science, and it is necessary to understand the past influences on a forest before any attempt is made to make sense of the present or future. Newbery offered three options in response to the question of admitting we do not know enough detail to understand fully what we want to manage. One is the conservation approach, which works well for a small percentage of forests. However, the majority of forests is immediately affected and managed by humans, and so requires a different approach.

Newbery has been very involved in two study sites for over 25 years: Sabah in northeast Borneo and Korup in southwest Cameroon. He detailed his findings on both sites. In conclusion, he said: "I am advocating a better recognition of, and hence more attention and thinking about, the role of environmental stochasticity [colored noise] on forest ecosystem dynamics."

IUFRO Vice-President for Task Forces Su See Lee moderated the session.

View David Newbery's plenary address here:
https://www.youtube.com/watch?v=W4b7SGuDzI4

Thursday, 9 October: **Joint Plenary**

Two individuals took the stage to deliver joint plenary keynotes. Jack Dangermond is the founder and president of Esri, the widely recognized leader in geographic information system (GIS) technology. David George Haskell is a Professor of Biology at the University of the South, and his work integrates scientific and contemplative studies of the natural world. Frank Roth, of the Intermountain Society of American Foresters, introduced the speakers.

Jack Dangermond talked about the science of geography and GIS as tools that allow us to better measure and understand the world around us. With new technologies, you may collect data once and be able to see it in a multitude of ways. GIS also gives the user a practical means of doing things. Today's forests are facing many challenges – climate change, fire, deforestation, invasive species, and a growing demand for wood products. Through web (Internet) integration, many maps from many different sources, that may or may not have the same parameters, can be overlaid on one another. The data you can pull from these many layers is very valuable, especially for forest researchers and managers. Dangermond also provided a demonstration of WebGIS by Esri. This demonstration showed the power of multiple sets of data from many sources in one map.

David Haskell just released "The Forest Unseen," which was a study of one square meter of land in Tennessee. His inspiration for the book came from a late-winter walk on a mountain slope in the southern Appalachians. "I wanted to conduct an experiment in experience," he said. "What would it be like to spend hundreds of hours in one place? I wanted to tell the stories of the forest for non-specialists." According to Haskell, the wonder of nature is too often buried away from the general public in scientific papers and technical reports. "We can't hope as a broader society to be responsible co-participants in life's community without knowing the nature of that community." There is inherent value in society at large in knowing about the community we live in and knowing something about our kin. Personal sensory experience gives us an awareness of small-scale processes and warns of the limits of our knowledge.

Animals are connected to a cross-species social network, alerting each other to what is happening and the threats in the world around them. "It's like nature's Facebook," he said, "but if you miss the status update, you are dead." To Haskell, the fundamental reality is not the self but the network. Without the network, the individual falls out of existence, but the challenge is that we barely understand most of the connections. Haskell concluded with an invitation to consider how the audience members might conduct their own experiments. To quote T.S. Eliot: "Be still and wait."

View the joint plenary addresses here:
https://www.youtube.com/watch?v=0iCqtzuzD4A (video 25:03-1:55:12)

The keynote speakers were joined by three panelists for a panel discussion following the keynotes: Mila Alvarez, Principal of Solutions for Nature, a consulting firm specializing in research and analysis in the fields of domestic and international natural resources policy, management, and decision-making; Sally Collins, the first Director of the United States Department of Agriculture Office of Environmental Markets, and Co-chair of MegaFlorestais, an organization established to informally connect the top forest leaders in the world; and Mike Wingfield, the President-Elect of IUFRO. The panel was moderated by Nalini Nadkarni, a pioneer in forest canopy studies and in communication of forest canopy research to scientists and the public from the University of Utah.

The panelists were asked to consider the question "How can we effectively integrate the many ways of understanding forests to create the best paradigms to manage them?" The panelists agreed that a good way to start is to slow down and be more deliberate. However, Wingfield pointed out that the real world doesn't always slow down; Alvarez mentioned we often take time as a constant variable. Many forested ecosystems are thousands of years old, but our society lives in the present. The panel also discussed some of the obstacles that must be overcome in the interface between forest science and forest management. Scientists work more slowly than managers, who often would like an immediate answer to a problem. Integrating science into management is an art form, pointed out Collins, and the two cultures have to meet in the middle to be effective.

Panelists also favored clear communication to help bridge the gap between science and management. Haskell pointed out that storytelling is a mechanism that encourages conversation and listening across big divides. Branching out into areas that are not directly in line with one's profession helps to bridge gaps as well. The panel also discussed the place of ethics, especially as it relates to sharing, or not sharing, data and even how those data are displayed. Knowledge is power, and Dangermond noted that the world seems to be moving toward a more open sharing of data through the power of the Internet.

View the panel discussion here:
https://www.youtube.com/watch?v=QEBeFFGlobk

Friday, 10 October: **Carol J.P. Colfer**

Carol J. P. Colfer is a Senior Associate at the Center for International Forestry Research (CIFOR) and a Visiting Scholar at Cornell University's Southeast Asia Program in Ithaca, New York. In her keynote, entitled "The People and Forests Trajectory – 1994-2014 and

Beyond," she discussed the gradual growth of forestry's interest in people, the importance of addressing gender, and why addressing this nexus is important.

The new millennium brought even more interest in forests and people; in 1978, the World Forestry Congress first discussed forests for people. Colfer gave the example of people-forests research that CIFOR and its partners are conducting: giving attention to human well-being, working collaboratively with communities and their subgroups, attention to people's knowledge about forests, and focus on power relations (including ethnic and gender studies). Many forestry institutions around the world have a single-minded focus on timber, without paying much attention to biodiversity or non-timber forest products. Their staffs rarely have social scientists, and very little interaction with local communities leads to antagonism toward local people who are just going about their daily lives.

However, she pointed out that the results are less than favorable: Forests remain in decline, human well-being has hardly improved, and benefits continue to be inequitably distributed. There has been more and more research done in the last three years on women and forests. Looking at women alone, though, is not enough. There is a tendency toward academic silos where one group knows a lot about women and another knows a lot about forests. The two need to be brought together, as well as discuss male-female relations, and subjects that were previously taboo, such as population growth, social vacuums, and the threat of violence toward women that venture into enterprise.

Colfer sees potential in the future of research that works closely with communities via adaptive collaborative management or participatory action research. "Research should try to marry what the local communities know and want with broader goals," said Colfer. "We can figure out ways to minimize damage while benefiting local people and the environment."

In conclusion, in terms of sustainability, there is still much work to do. There are a lot of assumptions about men and women that vary from place to place and need to be overcome. We need to gather more information and look at that information through a gender lens. Often, the current research does not need to be completely redone but rather just tweaked to address gender concerns. Finally, we need to think about how we can integrate this information into ongoing forest management.

Daniela Kleinschmit, Coordinator of IUFRO Division 9 – Forest Policy and Economics, moderated the session.

View Colfer's plenary address here:
https://www.youtube.com/watch?v=36gmKt09lpc

Saturday, 11 October: **Cecil Konijnendijk van den Bosch**

Cecil Konijnendijk van den Bosch, a Dutch national based in Sweden, holds the post of Head of the Department of Landscape Architecture, Planning, and Management at the Swedish University of Agricultural Sciences. He is also part-time professor of green space management at the University of Copenhagen. During his keynote, entitled "City Forests, Forest Cities – Exploring the Complex Liaison Between the Sylvan and the Urban," Konijnendijk discussed urban forests and the populations that interact with them.

Urban forests bring a range of benefits to cities. They can cool the air, clean the atmosphere, and provide shade on hot summer days. But according to Konijnendijk, perhaps most important of all is the fact that they can make us smile. "I would argue that we as urban foresters are in the business of creating happiness," he said. "And that is a very good goal to have." Most of the world's population lives in cities, so much of the world's experience with forests comes from that interaction. Focusing on growing forests in cities is increasing in importance as the world's population continues to urbanize. This urbanization may make many aspects of life better, but it also carries with it unfortunate consequences. "We are not as mobile as we once were," he said. "As a result, obesity is on the rise, which has an impact on public health."

Fortunately, even though encouraging urban forests might not be as common as it could be, it is not a new concept. There is a long tradition of cities connecting to their natural heritage by embracing and conserving trees. If there are no trees, they plant trees. People bring the forest into the city. The benefits of urban forests go beyond the traditional environmental considerations. People move to cities to find livelihoods and economic opportunities. Urban forests can serve many communities and needs. For example, urban agriculture is important in providing food. A sense of community also is important. We flock to cities to build communities, and when we create new green spaces, we have to build communities around them. We establish a connection between people and place. Urban forests also enhance biocultural diversity, resiliency, creativity, and happiness. "Trees can even," he said, "help us reach self-actualization, the top level of Maslow's hierarchy of needs."

Calling to mind the work of writer Richard Louv, Konijnendijk noted that our society has developed "nature-deficit disorder." Society today relies heavily on technology, and we are losing the connection between nature and ourselves. To bring people back to nature, it is possible that we can use that same technology. Communities can bring Wi-Fi access to public parks to encourage people to take their technology outdoors.

There are other barriers to bringing forests to the cities. It is important to convince policy makers that trees have value. He noted there are groups and tools available to help urban foresters overcome those barriers, such as the Canadian nonprofit 8-80 Cities and the US Forest Service's i-Tree. Finally, one key area in which Konijnendijk would like to see more emphasis is the creation of forests in urban areas in developing countries. "Clearly there is a need for urban forestry in developing countries," he said. "We need to become more engaged."

Tuija Sievänen, Coordinator of Division 6 – Social Aspects of Forests and Forestry, moderated the session.

View Konijnendijk's plenary address here:
https://www.youtube.com/watch?v=YFOOPu6R6nY

2014

SCIENTIFIC PROGRAM

Scientific Program

Overview and Summary of Congress Program

The Congress scientific program included, in addition to the five plenary sessions, 19 sub-plenary sessions, 168 technical sessions, and poster sessions organized around the seven themes encompassing the various facets of the Congress title "Sustaining Forests, Sustaining People: The Role of Research":

- Forests for People
- Forest Biodiversity & Ecosystem Services
- Forests & Climate Change
- Forest & Water Interactions
- Forest Biomass & Bioenergy
- Forests & Forest Products for a Greener Future
- Forest Health in a Changing World

The sub-plenary and technical sessions included in the program were developed by the Congress Scientific Committee (CSC) following an open call for session proposals after which 142 of the 225 session proposals were accepted. An additional 25 technical sessions were subsequently created by the CSC to fill topical gaps in the program.

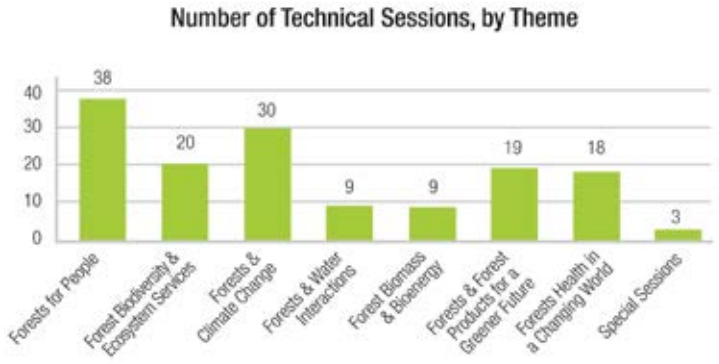
Sub-plenary sessions were designed to highlight the state of knowledge on key topics and issues within each of the seven Congress themes. Among these were seven organized jointly by IUFRO Divisions and Task Forces that covered the six emphasis areas of the 2010-2014 IUFRO Strategy, and three special sessions focused on IUFRO Student Award winners, the IUFRO Directors' Forum, and the IUFRO 2015-2019 Strategy.

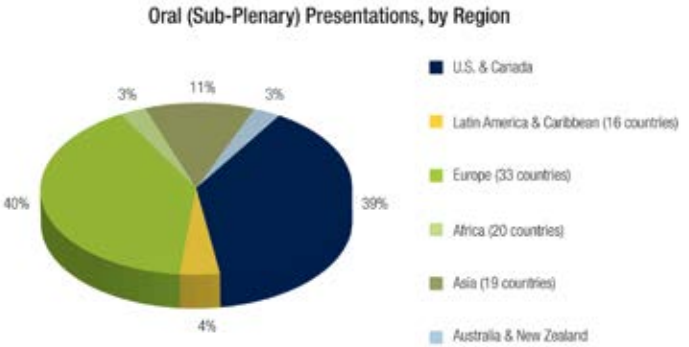
Technical sessions generally focused on more specific topics and emerging issues within each of the Congress themes. Among these were 33 technical sessions that included in-session poster presentations and another eight sessions that featured "guided tours" of posters associated with their sessions in the Poster Exhibition Hall. Also included were three special sessions ("The IUFRO Incubator") designed to give over 170 graduate students and recent graduates an opportunity to present brief summaries of their undergraduate, masters, or PhD theses in a dynamic, interactive forum. During most of the eight 2.5-hour time slots designated for technical sessions over the Congress week, 19-24 sessions were held concurrently.

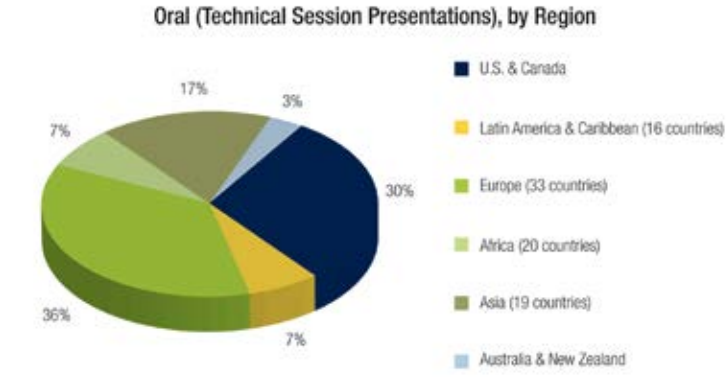
The poster program included a weeklong exhibition of all posters in the Poster Exhibition Hall, with designated periods on October 7th and 10th during which all poster presenters were available to discuss their work with Congress delegates. These posters were organized within the Poster Exhibition Hall by IUFRO Division. As noted above, many poster presenters also had an opportunity to present their work as part of technical sessions.

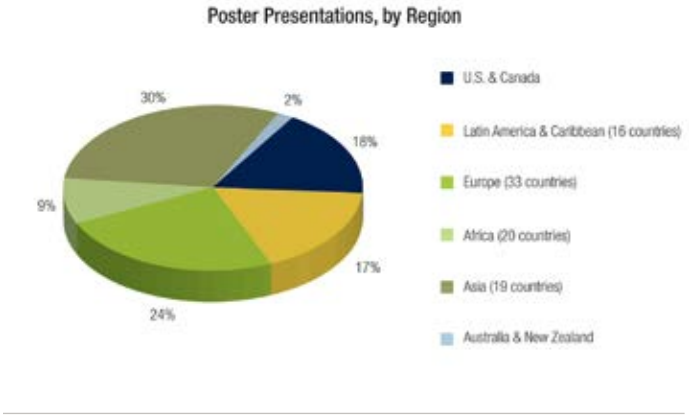
The number of oral and poster presentations, and the diversity of their authors, was unprecedented. In response to the open call for abstracts in late 2013, more than 3,900 abstracts were received, of which over 3,600 were accepted following a two-stage review process by session organizers and the Congress Scientific Committee. These included 740 abstracts by lead authors from the United States and Canada, 435 from 20 countries in Latin America and the Caribbean, 970 from 34 countries in Europe, 410 from 27 countries in Africa, 968 from 26 countries in Asia, and 82 from the Australia-Pacific region.

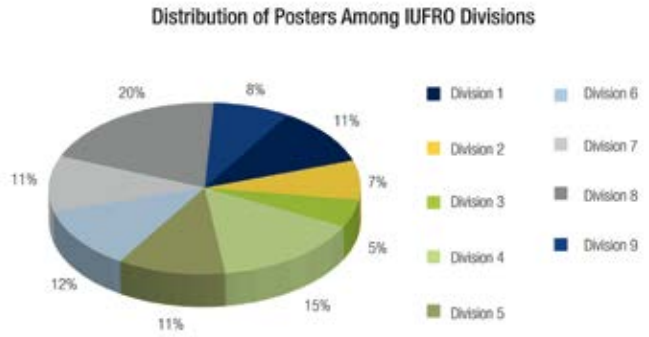
Of these, 2,437 presentations were ultimately included in the program: 70 as oral presentations in sub-plenary sessions, 1,175 as oral presentations in technical sessions, and 1,192 as poster presentations.











Congress Themes

Forests for People

Forests, woodlands, and agroforests play a vital role in the lives of people in both rural and urban communities, supporting livelihoods, food and energy security, human health and well-being, and culture. This theme, which focused on social, cultural, and economic aspects of the management and use of forest resources, included a broad set of topics such as: human health and well-being, urban forestry, small-scale and community forest management, rural development, nature-based recreation and tourism, landscape planning and management, conservation and forest ethics, forest history, traditional knowledge and culture, forest policy, governance and tenure issues, communications, and education.

Forest Biodiversity and Ecosystem Services

The conservation and sustainable use of forest biodiversity is essential for maintaining the full range of environmental, economic, social, and cultural goods and services provided by forests. Sessions within this Theme considered such topics as the role of biodiversity in the provision of ecosystem services; the effects of deforestation, forest degradation, natural disturbances, and human management activities on forest ecosystems, habitats, and species and provision of ecosystem services at different spatial and temporal scales; assessment and valuation of forest ecosystem services; strategies for forest biodiversity conservation and restoration; and challenges in achieving a balance between biodiversity conservation and management of forests for a variety of ecosystem services.

Forests and Climate Change

Understanding and anticipating the impacts of climate change on forest ecosystems and the services they provide to people are critical to efforts to develop and implement effective policies and management strategies for climate change mitigation and adaptation. Sessions within this theme considered climate change effects on forest ecosystem structure and function; interactions with other natural disturbances and forest-management regimes; land-use and land cover change; monitoring and modeling of forest conditions, biomass, carbon and climate change – related impacts on forest ecosystems, landscapes, and communities; and environmental, social, and economic implications of forest-based climate change adaptation strategies and mitigation opportunities (such as REDD+).

Forest and Water Interactions

An understanding of the linkages between forests and forested wetlands and hydrological processes is essential for managing ecosystems at watershed or landscape scales to sustain the availability and quality of water resources critical for human well-being. Sessions within this theme examined the influence of land cover and land use, large-scale natural and human-induced disturbance (including climate change), and forest management on watershed hydrology, biodiversity, and provision of water-related ecosystem services, as well as the latest findings from long-term watershed research, studies of mangrove and riparian forests, and adaptation of trees and forests to drought.

Forest Biomass and Bioenergy

The rapidly growing use of wood and biomass sources for bioenergy, biofuels, and bio-based products requires the development of innovative production systems; more efficient use of material from plantations based on end-user, raw material, and processing requirements; and management of competition for biomass from planted and natural forests for energy versus other forest products and environmental services. Sessions within this theme explored these issues as well as current research on genomics, biotechnology, and breeding and selection of trees to meet changing biomass and bioenergy objectives; and life-cycle analyses and "eco-efficiency" of forest bioenergy production systems and technologies.

Forests and Forest Products for a Greener Future

The future of forest management in the face of forest loss and ever-increasing demands for food, timber and wood fiber, water, and other ecosystem services, and uncertainties posed by globalization and economic, social, and environmental uncertainty, is a fundamental challenge for the forest sector and the forest research community alike. Innovation, including development of economically and socially sustainable and environmentally responsible production systems and end-products, will play an important role to meet these challenges. Sessions within this theme explored these issues as well as forest sector trends, new research developments in forest operations, forest management, innovations in wood-based and non-wood forest product development, and forest certification.

Forest Health in a Changing World

Healthy forests are foundational to the delivery of ecosystem goods and services, yet these benefits are under threat from sources ranging from climate change to globalization. Sessions within this theme focused on trends in hazard occurrence (air pollution, responses to climate change, invasive-species introduction, fire, and global trade pathways); vulnerability of forests (tree resistance, shifts in pest and host species relationships, and forest resilience); society and forest health (socioeconomic impacts associated with forest health); mechanisms of risk mitigation (pest- management solutions, alternative forest-management strategies, modeling); and global trade issues (surveillance strategies, forest pest incursion management, and phytosanitary protection).

Publications

All abstracts presented as oral or poster presentations during the Congress were published in a special volume of the International Forestry Review (2014, volume 16, issue 5), edited by John Parrotta, Cynthia Moser, Amy Scherzer, Nancy Koerth, and Daryl Lederle. A separate publication including the abstracts of presentations in the special student (IUFRO Incubator) sessions was also prepared, edited by Lilli Kaarakka, Hugo Pierre, and Lisa Hansen of the International Forestry Students' Association (IFSA).

In addition, the organizers of over 40 technical and sub-plenary sessions are planning to publish selected papers from their sessions, mostly in special issues of international peer-reviewed journals but also as edited book volumes. The journals for which Congress-related special issues are planned include: *Forest Policy and Economics, Agroforestry Systems, Biodiversity and Conservation, BioEnergy Research, Canadian Journal of Forest Research, Change and Adaptation in Socio-Ecological Systems, Environmental Conservation, Environmental Research, Folia Forestalia Polonica, Forest Ecology and Management, Forest Pathology, Forest Policy and Economics, Forests, iForest, International Forestry Review, International Journal of Biodiversity Science, Ecosystem Services & Management, International Journal of Wildland Fire, Journal of Environmental Science, Journal of Forest Research, Journal of Forestry, Plant Hydraulics, Silva Fennica, and Wetlands Ecology and Management.*

Sub-plenary Session Reports

SP-01 Forest Foods, Medicines, and Human Health

Organizers: *Hannu Raitio (Finnish Forest Research Institute), James Chamberlain (US Forest Service), Carsten Smith-Hall (University of Copenhagen, Denmark), & Tuija Sievänen (Finnish Forest Research Institute)*

Moderators: *James Chamberlain & Carsten Smith-Hall*

This sub-plenary session provided high-quality reviews of the state of knowledge as well as new empirically based global-comparative findings. The presentations provided the latest information about food and medicines from forests and the derived health impacts. Presentations explored how forests are used for provision of these health benefits and identified challenges and opportunities to integrate foods and medicines into sustainable management of the forest resources. The versatile approach to introduce the impact of forests on human well-being supports our goal to improve awareness of the potential of forests for improving human health.

- Wild-harvested food is critical to household incomes, particularly in subsistence economies.
- The global value of nature-based medicines is estimated to exceed US $60 billion.
- Food gathered from urban forests is critical to people's food security, particularly for recent immigrants to the US
- Bushmeat and wild-harvested animals are just as important as wild-harvested foods.
- Integrating food and medicines into forest management will require that policy makers recognize the ecological, economic, and social values of these resources.

SP-02 Integrating the Economics of Ecosystem Services into Sustainable Forest Management

Organizers: *Donald Hodges (University of Tennessee, USA), Donald Grebner (Mississippi State University, USA), and Lidija Zadnik-Stirn (University of Ljubljana, Slovenia)*

Moderator: *Lidija Zadnik-Stirn*

This session included three papers presented by: Donald Grebner: "The Role of Bioenergy as an Ecosystem Service"; Elisabeth Kindler (Germany): "Influence of the EEB DE Study on Forest Reporting and Management"; and Shashi Kant (Canada): "Valuation of Ecosystem Services Using the Life Satisfaction Approach." These papers examined:

- Specific ecosystem services (ES); e.g., biodiversity, forest biomass for bioenergy, social and cultural services, etc.
- The state of ES within sustainable forest management (SFM)
- Measuring the values of ES (also in monetary units)
- How to incorporate ES into SFM paradigm
- Advantages and disadvantages of including the ES into SFM
- Conflicts and synergies between different ES, and between ES and SFM
- The state of the research and new methodologies in the field of economics of ES and their use for solving the problems of multifunctionality in SFM
- Relations in the research, economics, and society triangle regarding ES within SFM

The main session findings/discussions included:

- The important role of bioenergy, treated as an ES, and the increasing need for wood (forest biomass) as an energy source
- The state-of-the-art approaches for the increased use of wood for energy in the SFM context from a US perspective, as well as their limitations and drawbacks
- The need for research analyzing conflicts and synergies associated with the use of woody biomass for bioenergy
- The German view on The Economics of Ecosystems and Biodiversity (TEEB) project used for financial reporting on ES and for the support for SFM
- The use of TEEB for measuring the loss of biodiversity and ecosystem degradation in Lower-Saxony forests, and the extension of knowledge of

measuring ecosystems to knowledge of ecological ecosystems; i.e., how economic systems can benefit from ecological systems and vice versa

- Discussion emphasized the importance of the inter-relationships between research, economics, and ecology triangle and how TEEB could be used as a support tool for treating the problems of ES within SFM.
- The methodology for measuring nonmaterial forest products (here ES) was discussed; contingent valuation and hedonic method were criticized in the context of private goods markets and transaction cost.
- The life satisfactory method for valuing ES and other public goods was introduced, using a case study on aboriginal forests in Canada; this method, based on surveys, could be useful for measuring above all social and cultural issues within ES, particularly if combined with the multiple criteria methodology.

SP-03 Forest Health in a Changing World

Organizers: *Tod Ramsfield (NRCan-Canadian Forest Service) & Eckehard Brockerhoff (Scion/New Zealand Forest Research Institute)*

Moderators: *Tod Ramsfield & Eckehard Brockerhoff*

Four speakers discussed various aspects of how global change and increased trade are affecting pest population dynamics, forest resilience, and ecosystem processes. Main topics discussed:

Ian Thompson: "Loss of resilience leads to low productivity in a Chilean hardwood forest"

- Forests move through stable states after a tipping point is passed, but can we predict when a tipping point will occur?
- An assessment method based on an "r-value" in combination with stocking diagrams was formulated through which degradation can thus be calculated and tipping points can be avoided.

Kimiko Okabe: "Forest biodiversity and forest health"

- Through understanding the drivers of biodiversity loss, scenario models have been developed based on a 1,000 km^2 land area.
- Multiple management scenarios that included: production for export, production for local use, or conservation were tested in the modeling environment; these suggested that production forestry reduced biodiversity.

Allan Carroll: "Synergies, feedbacks, and tipping points: Mountain pine beetle's rapid range expansion threatens invasion of North American boreal pine forests."

- It is hypothesized that the mountain pine beetle explosion in western North America can be partially attributed to climate change.
- The mountain pine beetle crossed a tipping point by crossing the Rocky Mountains of Alberta and now there is potential for impact on jack pine and eastward expansion through the boreal forest.

Mike Wingfield: "International trade in live plants: rationale for mitigating a high-risk pathway for the introduction of forest pests and pathogens."

- Trade in live plants is a major pathway for invasive organisms.
- The Montesclaros Declaration was prepared in 2011, advocating a ban on the trade of live plants, but perhaps the suggested blanket ban is unrealistic due to trade forces.
- Several recent introductions were described and he mentioned the importance of "Black Swan Events" and "unknown unknowns."
- Latent endophytic fungi are a very real risk.
- Regulatory agencies need to remain vigilant.

Following these presentations, there was a lively discussion on the importance of the live plant trade and movement of organisms around the world. It is recognized that this movement has increased the probability of invasive alien species establishment, leading to potential detrimental effects on natural and production ecosystems.

SP-04 The IUFRO Directors' Forum: Crossing Science Boundaries for the Benefit of Forests and People

Organizers: *Konstantin von Teuffel (Baden-Württemberg Forest Research Institute – FVA, Germany), Peter Mayer (Austrian Research Centre for Forests – BFW), & Jimmy Reaves (US Forest Service)*

Moderators: *Peter Mayer & Konstantin von Teuffel*

The IUFRO Directors' Forum brings together heads of forest research institutes and deans of forest faculties, providing a platform for the exchange and development of views on the management of forest research.

The research landscape and the policy agenda dealing with forest research are becoming increasingly fragmented. Against this background, the Directors' Forum 2014 discussed how to organize, fund, and manage research in order to maintain the relevance of forest-focused research institutions. The session was moderated jointly by Konstantin von Teuffel (Baden-Württemberg Forest Research Institute) and Peter Mayer (Austrian Research Centre for Forests).

Jimmy Reaves, US Forest Service Deputy Chief for Research and Development, presented the results of a survey of heads of IUFRO member organizations in preparation for the Directors' Forum. The results of the survey reflect an expanded scope of forest research institutions from a focus on forest research to broader interests on research priorities such as climate change impacts, landscape level issues, water, and social issues. To meet these broader challenges, research institutions have also shifted from a more applied science focus to general science focus to bring to bear an integrated approach to addressing natural resources issues.

Björn Hånell, Coordinator of IUFRO Division 1 on Silviculture and incoming Vice-President for Divisions, gave a brief overview of major research challenges from an IUFRO perspective, putting major societal developments in relation with the five new themes guiding the IUFRO Strategy 2015-2019. He emphasized that the challenges being faced are far bigger than current forest research management can overcome. Thus, the Strategy challenges IUFRO Divisions to work across disciplinary boundaries.

A panel of distinguished speakers then shared their perspectives:

Ann Bartuska, Deputy Under Secretary for USDA's Research, Education, and Economics mission area, noted that societal interests in forests and trees, such as recreational and health effects, agroforestry, or urban ecosystems, are gaining increasing relevance, accompanied by an increasing interest of students in doing societally relevant research.

Martin Apple, President Emeritus of the Council of Scientific Society Presidents, talked about the challenges stemming from the need to solve

complex matters while catering to disciplinary necessities. He identified the need to bring together as many disciplines as necessary to solve those problems, so complex that no one discipline can tackle them alone.

Leena Paavilainen, Acting Director of the Finnish Forest Research Institute (Metla), then shared the experiences gained as the Head of an institute undergoing a merger. She explained that in order to lead the bioeconomy research efforts, three institutes are being merged. While this allowed for greater synergies, she also pointed out risk regarding funding and the provision of services to clients.

Tony Simons, Director General of the World Agroforestry Center ICRAF, underlined the need for more social science and dwelled on the necessity of interdisciplinary research to attract funding. Recognizing the advantage of the IUFRO network in this extent, he then went on to the advantages of a landscape approach in forest-related research.

In the following discussion, it was pointed out that:

- Forests can no longer be viewed in isolation but rather as systems that are interconnected with other environmental or human elements.
- The grand challenges faced by the forest community require integrated networks of scientists to gain comprehension of these complex systems in all their multi-temporal and multidimensional complexity.
- There is a need in forest research to bring together as many disciplines as possible, among them the social sciences, to solve these highly complex issues.
- IUFRO is a unique platform offering forest research managers and forest researchers the opportunity to learn from each other and exchange their respective experiences. Other important sectors lack similar platforms. Yet there is a need to further expand the involvement of scientists and institutions from developing countries.
- Overall, change is happening at an accelerated pace, therefore business as usual will not be sufficient.

SP-05 Biodiversity and Ecosystem Services in Planted Forests

Organizers: *Eckehard Brockerhoff (Scion/New Zealand Forest Research Institute), Hervé Jactel (INRA, France), & Peter Freer-Smith (Forest Research, UK)*

Moderator: *Eckehard Brockerhoff*

This session reviewed a range of ecosystem services linked to (or potentially linked to) biodiversity in planted forests, identified the state of knowledge for each area, and outlined innovative measures by which the provision of ecosystem services from planted forests could be enhanced, at the stand, forest, and landscape scales. Speakers in this session included Peter Freer-Smith, Hervé Jactel, and Michael Scherer-Lorenzen.

Key findings:

- Invasive forest insects and pathogens have wreaked havoc on forests of several tree species in the United Kingdom and other parts of the world. Apart from the damages to trees and forests, these invasions have resulted in a substantial reduction of biodiversity and associated ecosystem services that were previously provided by these forests. This impact of invasions deserves more attention.
- Planted forests are typically composed of a single (or few) tree species. Therefore they are less biodiverse than most natural forests. As several ecosystems are related to biodiversity, one could expect that planted forests are less effective than more diverse forests at providing certain ecosystem services.
- The effects of biodiversity on resistance to damage from insect pests were examined in a series of studies in France and elsewhere. There is good evidence that mixed planted forests are less affected by pests than single-species forests, indicating that forest biodiversity contributes to resistance against forest pests.
- A comprehensive study of the relationship between biodiversity of planted experimental forests in several countries and the provision of forest ecosystem services yielded a range of responses. The preliminary results indicate that some ecosystem services are positively related to biodiversity while others are neutral or negatively related. This suggests that there are certain trade-offs in these relationships, and it may not be possible to maximize biodiversity and the delivery of all ecosystem services. It should be possible, however, to develop optimal solutions by carefully selecting combinations of tree species that provide biodiversity and a selection of desired ecosystem services.

SP-06 Cultural Values, Quality of Life, and Forest Landscapes

Organizer: *Mauro Agnoletti (University of Florence, Italy)*

Moderator: *Steven Anderson (Forest History Society, USA)*

This session focused on the historical and current role of cultural values in shaping and conserving forest and woodland landscapes worldwide, with specific attention to the interrelationships between cultural and biological diversity. A relatively new term, "biocultural diversity" contends that the diversity of life on the planet should be characterized not only by the biological diversity of plants, animals, habitats, and ecosystems, but also by the diversity of human cultures and languages. Studying these interrelationships is essential if we accept that biodiversity and cultural diversity evolve together in a socio-ecological, adaptive system.

The session included an overview on the Joint Programme between the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the Secretariat of the Convention on Biological Diversity (SCBD) on the links between biological and cultural diversity (Ana Persic). Case studies were presented from Italy (Mauro Agnoletti), the Bohemian Forest in the Czech Republic (Jiri Woitsch), and China (paper by Jinlong Liu, presented by Juanwen Yuan). The session was well-attended with an audience including a mix of students and scholars coming from both ecological science (biodiversity) and the social sciences (cultural diversity).

Key findings:

- All forests are cultural forests. Forests shape our culture and our culture shapes our forests. When biodiversity and cultural diversity are considered separately, both types of diversity are eroded together.
- Some designated wilderness areas are being misinterpreted as wild or untouched when they are clearly cultural landscapes. Reconciliation of traditional cultural values and contemporary cultural values remains elusive and a ripe area for research.
- Forest Certification and Sustainable Forest Management criteria and indicators do not adequately consider cultural heritage, cultural diversity, and landscape history.

- Cultural diversity, including traditional knowledge, can help reshape strategies for achieving biodiversity sustainability.
- The UNESCO–CBD Joint Programme on the Links between Biological and Cultural Diversity (2010 to 2020) has links to the Millennium Ecosystems Report, the World Heritage Convention, and the Man and the Biosphere program.
- A significant challenge is how to relate policies to what is actually happening on the ground. Many agree that implementation will require local partnerships. The Joint Programme can only work in countries that ask the Secretariat to help.
- IUFRO should encourage and support additional investigations on biocultural diversity research questions; sharing of research approaches and results; and increased interaction between the biological diversity, forest culture, and the forest history and traditional knowledge research areas.

SP-07 The Importance of Quantifying Uncertainty in Managing Forests

Organizers: *Ruth Yanai (State University of New York – ESF, USA), David Paré (Canadian Forest Service), Peter Clinton (Scion, New Zealand), & Bogdan Strimbu (Louisiana Tech University, USA)*

Moderator: *Peter Clinton*

Pierre Bernier highlighted that uncertainty occurs at a range of scales for forest management decisions. Uncertainty around the future is high due to current climate change and events such as fire or pest or disease outbreaks. Current approaches to weather forecasting are not able to deal with uncertainty due to the chaotic nature of many systems. An extreme example is the acts of piracy off the Somalian coast disrupting climate data collection and prediction. These events and realities have impacted our ability to manage for uncertainty. Key finding: Research is needed to develop risk analysis approaches for strategic planning and optimisation tools that can deal with stochasticity, and managers need to adopt adaptive management practices to address uncertain futures.

Oswaldo Carrillo presented current methodologies for forest carbon stock assessments in Mexico and outlined the process to do this, which has resulted in less uncertainty around Mexico's carbon position. The presentation highlighted the importance of reducing uncertainty in carbon monitoring from a policy standpoint. Although no cost benefit was reported for the analysis, the political benefits for Mexico are considered large enough to justify the effort.

Key finding: National estimates of carbon stocks can be further enhanced by ongoing research that addresses areas of uncertainty, and this should be addressed.

Ruth Yanai demonstrated the impact of accounting for uncertainty in ecosystem carbon and nutrient budgets by isolating causes of variation and using this to design appropriate sampling programs to estimate uncertainty. Based on the analysis presented, inherent variability in soil properties had the largest impact on the case study catchment nutrient budget. As a result, for inputs and outputs and change in vegetation pools, the errors were not overwhelming, but the uncertainty in the change in soil pools was larger than the budget discrepancy (the missing source of nitrogen) in the example presented. Key finding: This presentation highlighted the need to understand how such estimates and their uncertainty will be applied in decision-making and policy development. Once this is known then studies can be appropriately designed with the appropriate sampling programs in place to address uncertainty at the level required. One size won't fit all needs.

Annika Kangas illustrated how stochastic programming can be used to produce better than expected solutions by accounting for uncertainty in a variety of forest management decisions. Key finding: The approach is not widely practiced as these problems are still difficult to solve at scales relevant to forest management. Further developments are needed before the techniques can be operationalized.

Ruth Yanai, USA, gives her presentation during a sub-plenary session (SP-07)

Sub-plenary audience listens to a presentation (SP-08)

SP-08 The Future of Our Forests

Organizers: *William Nikolakis & John Innes (University of British Columbia, Canada)*

Moderator: *John Innes*

This session addressed the broad topic of the future of our forests. It started with an overview by David Cohen of the many different pressures on our forests, foremost of which is the growing demand of a steadily increasing global population that is becoming increasingly affluent and thus ever more demanding on resources. Referring to the increasing demand for "stuff," the global increase in price of finite materials, such as fossil fuels, was demonstrated, whereas the price of renewable resources has increased much more slowly. This paper was followed by an examination of future demands for wood in Europe, given by Gert-Jan Nabuurs. While the growing stock in Europe continues to increase, rates of harvest are declining, a trend that has been accelerated by the desire for near-to-nature forest practices. For example, many plantations are being converted to more natural forms of forest, but this is coming at the cost of reduced production. At the same time, there is pressure to switch from fossil fuels to renewable energy. The combination of reduced supply and increased demand is resulting in changes in the global movement of wood products, exemplified by the increasing importation by Europe of wood pellets from North America. Chadwick Oliver then described the different trade-offs associated with carbon and biodiversity, emphasizing the importance of gaining a better understanding of how carbon is stored in wood products harvested from forests. Such an understanding is critical if a true picture of the carbon dynamics associated with forests is to be achieved. This theme was picked up in a final paper describing the New Generation Plantations approach of WWF. There is a recognition in this project that wood is an important sustainable material but that the growing population of the world will result in increasing demands. The most efficient way of meeting this demand is through plantations, which currently already supply between one-third and two-thirds of industrial roundwood supply. Such plantations could be integrated with natural forests in the landscape, playing an important role in landscape restoration and conservation while meeting the objective of timber supply.

Key findings:

- The growing world population, and the growing affluence of this population, will result in a progressive increase in the demand for "stuff," placing increasing pressure on the world's resources.
- Renewable resources will become increasingly important (and competitive) as the price of finite resources increases.
- Environmental and social policies may be at odds with economic needs. In Europe, declining harvests due to ecological and social concerns will increase the demand for forest products from outside Europe.
- In examining trade-offs between, for example, biodiversity and carbon conservation, it is essential to account for harvested wood stored in wood products.
- We must attach economic value to forests, otherwise many will be converted to other forms of land use.
- Plantations will play an increasingly important role in the supply of renewable forest products in the future. Such plantations need to be well-planned and integrated into landscape approaches in order to maximize their environmental and social benefits.
- Greater attention needs to be given to economic interests, as these play an important role in determining how forests will be used. The recent New York Declaration on Forests is an important step in engaging those economic interests.

SP-09 Forests for People: Ecosystem Services Under Pressure?

Organizers: *Ulrike Pröbstl-Haider (University of Natural Resources and Life Sciences, Austria) & Perry Brown (University of Montana, USA)*

Moderators: *Ulrike Pröbstl-Haider & Perry Brown*

The session integrated the concept of ecosystem services and the IUFRO Strategy Forests for People. Against an introduction on the concept of ecosystem services, the presentations illustrated the four main themes of the strategy: Livelihoods; Health, Recreation, and Tourism; Landscape Development; and Culture and Education.

The presentation by Felix Kabala represented the link to the provisioning services illustrating the significant dependencies from forests and forest products in Africa. He highlighted that beside the "normal" dependencies also the shock situation must be considered. Characteristic economic shocks are climatic impacts (draught) as well as social impacts (loss of family members, marriage). In this situation forests tend to be overused.

The presentation from Sally Aiken discussing biological and societal perspectives on genetic decisions under conditions of climate change addressed provisioning and regulation services of forests in the future. The presentation underlines the discrepancies between the scientific knowledge and the insecurity of the general public, which votes against inactivity but has no clear understanding of genetically feasible opportunities and their consequences.

Ken Cordell addressed the cultural services in the field of outdoor recreation in the United States. He described an increasing relevance of these services.

Sarah Welter addressed cultural services of spiritual character education and historical practices reporting results from Community-Based Ecosystem Management with First Nations in Canada.

The introduction and conclusion by Ulrike Pröbstl-Haider underlines that all presentations highlighted the role of social science and the increasing relevance of trade-off decisions or at least the necessity to make trade-off decisions transparent. The session also showed the explanatory quality of the concept of ecosystem services and its significant link to the IUFRO strategy forests for people.

Key findings:

- The ES approach provides a strong link to sustainable development through accounting, understanding of relationships, motivating actions and payments, and avoiding payment for substitutes. In order to understand and model ES, much of the current research is still very much focused on single services.
- ES-related research focuses on a narrow subset of the suite of services provided by forests. A truly cross- and interdisciplinary cooperation is the exception rather than the norm.
- In decision-making, the trade-offs are often insufficiently considered.
- Considering geographic scales, the "world service" scale is insufficiently considered in current research.

SP-10 Resilience of Forest Ecosystem Services to Changing Disturbance Regimes

Organizers: *Rupert Seidl (University of Natural Resources and Life Sciences, Austria) & Tom Spies (US Forest Service)*

Moderators: *Rupert Seidl & Tom Spies*

The session addressed questions of how forest disturbance regimes have changed in the past and how climate change might alter disturbance regimes in the future. It furthermore discussed the vulnerability of ecosystem services to such changes and how ecosystem management can foster resilience to changing climate and disturbance regimes. Examples were given from forest ecosystems of the western United Sates and Europe.

Key findings:

- Disturbance regimes are changing as a result of climate change; disturbance-mediated changes might be the most prominent effects of climate change and have the potential to override and/or modulate other impacts of climate change (e.g., changes in species distribution and range).
- Changing disturbance regimes have a predominately negative effect on ecosystem services provisioning.
- Changing disturbance regimes need to be addressed from a coupled human and natural systems perspective; resilience is a promising concept in this regard.
- Resilience does not mean returning to a past state – the changed future conditions and thus also the future range of variability of the system needs to be considered.
- Knowledge gaps exist with regard to the dynamics and impacts of disturbance processes; a better process-based representation of disturbances in simulation models is needed for robust projections under scenarios of global change.

However, there is sufficient knowledge to start acting now – considering their long lead times, adaptation managers should start implementing

measures such as a diversification of forest structures at the landscape scale or a reduction of other stressors now.

SP-11 Advances in Large-Scale Forest Inventories to Support the Monitoring and the Assessment of Forest Biodiversity and Ecosystem Services

Organizers: *Anna Barbati (University of Tuscia, Italy), Piermaria Corona (Consiglio per la Ricerca e la Sperimentazione in Agricoltura, Arezzo, Italy), Frédéric Gosselin (Irstea, France), & Ronald E. McRoberts (US Forest Service)*

Moderator: *Anna Barbati*

The session turned the spotlight on experiences of applications of forest inventory-based data- collection methods for the estimation of forest biodiversity and ecosystem service indicators.

Key discussion topics:

Forest biodiversity assessment

- Unbiased estimation of potential and total species richness, as well as other diversity indices.
- Forest naturalness evaluation and monitoring.
- Joint analysis: dendrometric, floristic, and genetic diversity of tree populations.
- Alien and invasive species monitoring.

Ecosystem services assessment

- Unbiased dendrometric estimations (e.g., LiDAR supported biomass estimations) and potential for unbiased spatial estimation of ecosystem services (carbon sequestration).
- Actual and potential use of non-wood forest products.

SP-12 Policy Learning for Multilevel Governance

Organizers: *Daniela Kleinschmit (Swedish University of Agricultural Sciences) & Ben Cashore (Yale University, USA)*

Moderator: *Daniela Göhler (World Bank, USA)*

The session explored the potential and pitfalls of policy learning as a way to link scholarly and practitioner communities around problem solving, identified the types of problems policy learning might be able to address, and discussed the current scientific understanding of policy learning processes and how policy learning can be fostered. Presenters also addressed specific case studies where the policy-learning framework is currently being applied.

Ben Cashore presented the overall analytical framework currently under development, linking the four pathways of influence (described by Bernstein and Cashore) and the policy-learning frameworks. He argued that this framework has the dual benefit of both a) helping better explain processes that are in the midst of institutionalization (i.e., for those interventions in which it is plausible that the most important potential impacts have yet to occur) and b) helping identify strategic intervention to achieve greater influence as events unfold. In other words, he explained that policy interventions must be nurtured by a range of stakeholders who collectively understand and undertake strategic decisions that are consistent with the "causal logic" through which policy pathways are being traveled. Cashore also presented a typology of problems (types 1, 2, and 3), since structural features of problems can act as antecedent forces in limiting the type of solution available, and/or in determining what types of learning processes are most promising.

Gabriela Bueno applied the analytical framework above to the case of legality verification and illegal logging in Brazil. First she gave background information about the project, which involves two teams of scholars and practitioners that aim to understand the potential uptake and impacts of legality verification strategies in the Amazon forest. Bueno explained that the team is focusing on one particular intervention (legality verification) and analyzing which pathways of influence are being travelled or can be travelled by non-governmental organizations (NGOs) and other stakeholders, with a focus on the domestic access pathway. One example is how the team is looking at technology strategies to improve timber tracking systems that can have potential impacts on the overall future costs of legality verification systems and potential implications for uncovering illegal behavior.

Daniela Gohler presented another case study involving collaborative efforts in policy learning between GIZ and ASEAN. GIZ provided advisory services and financial resources to both formal intergovernmental bodies, such as the ASEAN Senior Officials on Forestry, and the more informal ASEAN regional knowledge networks. Focused discussions on specific policy interventions were led by the ASEAN Working Group on a Pan-ASEAN Timber Certification Initiative. These helped foster understanding and agreement by all 10 ASEAN member states on a regional guideline for a phased approach to forest certification and on the ASEAN criteria and indicators for timber legality. Gohler argued that the ASEAN case provides the clearest example of cross-coalition learning being supported and institutionalized through an explicit learning architecture.

Margaret Shannon presented a critical view about the concepts of learning and knowledge and introduced a few points of reflection about the policy learning framework. She reviewed the differences of problem-centered research versus what she calls "mysteries," that is, the types of problems whose origins, development, and impacts are uncertain. She discussed the limits to knowledge and the necessity of grounding policy learning on the assumption of uncertainty, instead of circumventing it. Finally, Shannon presented a few remarks on the role of crises in fostering change in learning and policy and what this means for scientific and collaborative research.

Discussion points:

The presenters were asked a variety of questions, most of them focusing on specific aspects of the analytical frameworks presented, as well as on the challenges of learning and of doing comparative analysis between countries. Specific questions addressed:

- Whether the typology of problems addresses the question of power of who defines the types of problems that should be tackled.
- The role of compromise (type 2 problem) and what this means for the "losing parties."
- The role of uncertainty in the policy learning framework.
- How policy learning occurs in comparative studies.

SP-13 Forest Biodiversity, Ecosystem Services, and Human Well-being – Harnessing Biodiversity for Adaptation to Global Change

Organizers: *Bryan Finegan (CATIE, Costa Rica), Robert Jandl (Research and Training Centre for Forests, Natural Hazards, and Landscape, Austria), Eckehard Brockerhoff (Scion/New Zealand Forest Research Institute), & JP Skovsgaard (Swedish University of Agricultural Sciences)*

Moderator: *Bryan Finegan*

This session explored the current state of knowledge regarding the role of taxonomic and functional diversity in the provision of various forest ecosystem services, the trade-offs often required for successful multi-functional management of forests for different ecosystem services, and associated management and policy challenges including governance at the territorial scale.

Eckehard Brockerhoff set out the state-of-the-art regarding biodiversity, ecosystem services, and resistance to invasion of planted forests. He described how the relationship between biodiversity and vulnerability to invasion has been the subject of important theoretical approaches in ecology for decades. This talk illustrated how resistance to invasion can be understood and applied as one of the ecosystem services provided by forest biodiversity.

In his talk entitled "On Beyond S: Why Other Metrics of Biodiversity Can Tell More about Ecosystem Services Than Species Richness," David Hooper summarized the advances of the last two decades in the measurement of biological diversity in the context of research on its relationships to ecosystem processes and services. He showed how the functional traits paradigm has come to be of fundamental importance in this area of research and its potential application to the management of ecosystems and the services they provide to people.

Sandra Luque's talk, entitled "Forest Landscape Heterogeneity and Local Plant Species Richness Effects: A Proxy for Biodiversity Monitoring," focused on the multiple scales at which biodiversity must be assessed in relation to its relationship to ecosystem service provision and on the relationships between biodiversity at different scales.

Finally, Ronnie Camino emphasized how ecological understanding of biodiversity and ecosystem service provision, to achieve its potential, must be matched by sustainable participatory mechanisms for the implementation of evidence-based management practice. His talk, entitled "Effective Territorial Governance for the Maintenance and Restoration of Ecosystem Services: Analysis of Experiences," focused on the achievements of the International Model Forests Network. He showed how the management of model forests is based on the construction of a fully participatory inter-sectoral social platform for territorial-scale management, an approach currently being applied in 29 model forests in 15 countries.

This sub-plenary session provided an interdisciplinary showcase for research that is at the forefront of the drive to understand and manage forest biological diversity as a provider of vital ecosystem services to humanity during the current century of global change.

SP-14 Energy from Trees: Technology, Opportunities, and Challenges

Organizers: *Woodam Chung (Oregon State University, USA) & Hans Heinimann (Swiss Federal Institute of Technology in Zurich, Switzerland)*

Moderator: *Woodam Chung*

This sub-plenary session featured six invited speakers, each of whom discussed a different aspect of forest biomass utilization for energy production, sharing their views and research outcomes around challenges and opportunities for forest biomass and bioenergy.

Key findings:

- Despite the recent development of multiple-scale approaches and tools to improve woody biomass feedstock logistics and supply chain management, challenges still remain around technical and financial efficiency of biomass operations dealing with logging residues, small-diameter trees, or stump removal.
- Forest biomass harvesting is often subject to a social license to operate but can be reconciled within the social realm along with environmental and economic opportunities of bioenergy production.
- Forest biomass harvesting can be accomplished with few negative impacts on long-term soil quality and have the potential to improve soil quality if biochar is added back to the soil.
- Environmental performance assessment has become an essential part of operational performance metric for forest biomass supply systems, but there are only a few studies that address this issue. A holistic approach, such as life-cycle assessment, can be used as a means to measure environmental performance of forest biomass supply systems.

SP-15 Historical Responses of Research to Global Forestry Issues

Organizer: *Jeffery Burley (University of Oxford, UK)*

Moderator: *Niels Elers Koch (IUFRO President, Denmark)*

Juergen Blaser presented a leading paper describing the challenges that have faced forestry over the last 25 years, as seen by three leading foresters who have been deeply involved in the international forestry policy scene for many years. His co-authors were Hans Gregersen and Hosny El-Lakany.

They took as the overarching challenge the meeting of increasing needs for forest goods and ecosystem services in a more efficient, effective, and sustainable manner. Within this they identified three strategic challenges – reduce the loss of existing natural forests; create new productive planted forests, including a restoration of degraded lands; and improve the efficiency and effectiveness of management, processing, and use of both natural and planted forests and trees outside forests.

Within these they recognized operational challenges arising from globalization, relocation of industrial activity, governance reform, inter-sectoral relations, and advances in information and communication technology, in recognition of the links between forest, climate change, biodiversity, watershed protection, forest products development, and livelihoods of forest dwellers.

The responses of four IUFRO past Presidents fell into two groups that were related to the provision of timely proactive and reactive research, and the impact on international and national policy processes. They stressed the continuity and responsive development of IUFRO at all levels.

Salleh Mohd.Nor (President 1991-1995) stressed the special situation, needs, and IUFRO activities of developing countries. The lack of political support, financial support, and human resources were barriers to effective research, and IUFRO formed the Special Programme for Developing Countries and the Asia Pacific Association of Forestry Institutions. In this period the Consultative Group for International Agricultural Research established the Centre for International Forestry Research in Indonesia.

Jeff Burley (President 1996-2000) saw the period as a time of consolidation and innovation to take IUFRO into the new century. The major elements included interdisciplinary approaches to problem solving with increasing multidisciplinary meetings and projects together with the creation of task forces to address specific policy problems; adoption of modern information technology for dissemination of research results; and publication of books, brochures and leaflets that include guidelines for action on major topics. IUFRO recognized good research through awards and through nominations of scientists for awards by other organizations, including the Marcus Wallenberg Prize. The union also sought actively to attract new members, including nontraditional institutions, and continued the interaction with international agencies.

In the period of Risto Seppala (President 2001-2005), IUFRO sought to open itself up and to make itself useful, attractive, visible, and credible. In particular it established agreements and collaboration with several international agencies. To do this it required increasing its visibility through its logo, its flag, new publications, attractive annual reports, electronic newletters and representation at meetings of the major agencies. The period was important also for the establishment of substantive financing arrangements, the development of formal strategic planning processes, and the first independent external review.

The period of Don Lee (President 2006-2010) recognized the continuing lack of resources and expertise, especially in developing countries. It also identified the lack of attention to traditional knowledge sources and actions. The union played significant roles in UNFCCC and UNCBD. With particular attention to students and younger scientists, the strategy of the period was identified as "the five I's" – invite, inform, involve, ignite, and influence.

In response to a question from the audience, the past Presidents variously felt they would have liked to have further encouraged women in forestry, sought support for forestry research in Africa, and spent more effort on direct support of research with less on reorganization of internal structures.

Another questioner requested short messages for future scientists and IUFRO. These included "Partner or perish"; "Specialise but be open to other disciplines"; "Learn from the (sometimes distant) past"; and "Double the size of IUFRO."

Past and current IUFRO presidents presented during SP-15. From left to right: Mike Wingfield, Niels Elers Koch, Don Koo Lee, Risto Seppälä, Jeffery Burley, Salleh Mohammed Nor.

SP-16 Triumphs, Tribulations, and Transitions – The Graduate Research Experience from the Student IUFRO Award Winners

Organizers: *Shirong Liu (Chinese Academy of Forestry) & Lisa Hansen (IFSA/University of British Columbia, Canada)*

Moderators: *Lisa Hansen & Shirong Liu*

Recipients of the IUFRO Outstanding Doctoral Research Award (ODRA) and IUFRO Student Award for Excellence in Forest Sciences (ISA) participated in a panel discussion about the personal and intellectual triumphs and tribulations encountered while conducting their winning research projects. Designed as an informative session for existing and prospective graduate students, participants answered a series of prepared and audience-directed questions. Questions were framed around major challenges, skills learned that were unique to the graduate experience, self-awareness development, future plans, favorite aspects of grad school, and overcoming moments of weakness.

Key findings and discussion points:

- Common challenges identified among graduate students included: access to funding to do research, learning a new language while studying abroad and learning new research methods and research tools not learned during prior degrees.
- Common self-awareness lessons learned included: learning they were more extroverted than originally assumed and learning how to stay motivated.
- The majority of participants were planning to continue in academia and research; many of them had secured positions in research institutions, however a few had instead moved into the private sector and were hired for their skills learned in the graduate research process.
- The greatest lessons learned in the graduate research experience related to the art of how to properly develop a research question and apply scientific methods.
- The challenges of present-day job markets were outlined, particularly for academics in North America and Europe; publishing was identified as the most integral criteria for hiring. However, China and countries with other rapidly developing economies are actively recruiting international researchers, and students were encouraged to begin looking at the job market in these locales.

SP-17 Forests, Water, and People

Organizers: *Shirong Liu (Chinese Academy of Forestry); Ge Sun (US Forest Service), & Tony Simons (World Agroforestry Centre, Kenya)*

Moderator: *Xiaohua Wei (University of British Columbia, Canada)*

This session explored the interactive relationships among people, climate, forests, and water resources, and addressed emerging environmental threats such as water shortages and climate change. Three speakers provided the respective review of state-of-the-art knowledge from the different perspectives, covering forest and water relations at multiple geographical scales, water availability for ecosystems and people under multiple global change stressors, and forest watershed management policies to meet increasing multiple needs and adapt to a changing world. Three speakers presented respective reviews.

Key findings and discussion points:

- A significant and negative relationship exists between forest cover change and annual runoff in both small and large watersheds; and the hydrological responses to forest change are likely watershed-specific, with dry watersheds being more sensitive. The interaction between forest and water at multiple scales is still not fully understood, and more studies, particularly in large watersheds, are needed.
- Both water supply and use (ET) are ecosystem services to people; there are trade-offs and synergies among ecosystem services. A trade-off between forest growth and water use must be well-recognized in order to ensure water supply and water safety, while achieving the utmost forest ecosystem services, such as C sequestration, soil conservation, and clean and abundant water from forests.
- There is very little examination of the performance of the watersheds in large systems in terms of how efficient these are or whether they are performing at their potential. Gaps in performance must be translated to the capacity of the water supply system to supply residents, financial costs and revenues, and the ultimate capacity. There must be active involvement of community consultation and enthusiasm by the community in achieving greater catchment efficiencies.
- Responding to climate change, the biggest environmental threat to forests in the 21st century, requires novel approaches in watershed management. We need to better understand the consequences of human actions at local, regional, and global levels to avoid big mistakes we have made in the past.

SP-18 Stemming Invasions of Forest Insects and Pathogens: Research Supporting Pathway Risk Management and Phytosanitary Policy

Organizers: *Andrew Liebhold (US Forest Service) & Eckehard Brockerhoff (Scion/New Zealand Forest Research Institute)*

Moderators: *Andrew Liebhold & Eckehard Brockerhoff*

This session covered various aspects of research on pathways via which non-native forest insects and diseases invade new regions. Invasions by pests and pathogens are severely impacting forest ecosystems worldwide. Identifying the pathways by which these species accidentally arrive and establish is a critical first step to the development of strategies to minimize future invasions. Three of the presenters described patterns of invasions and invasion pathways in various world regions. The fourth presenter described an evaluation of the economic value of International Standards for Phytosanitary Measures No. 15 (ISPM-15), a recent phytosanitary treatment of wood packing material that is implemented among the world trading partners. This analysis indicates that while ISPM-15 has not stopped invasions of wood-boring insects, it has reduced their rate of arrival and that there is a substantial net benefit.

SP-19 IUFRO Strategy 2015-2019 – Research Excellence and Information for the Benefit of Forests and People

Organizers: *Niels Elers Koch (IUFRO President, Denmark) & Mike Wingfield (FABI/University of Pretoria, South Africa)*

Moderator: *Mike Wingfield*

This session was organized to provide the nine incoming IUFRO Division Coordinators with an opportunity to highlight for the World Congress participants their intentions in executing the IUFRO Strategy 2015-2019. This would include the five themes of the strategy and its Institutional Goals as approved by the IUFRO International Council. In order to achieve this objective, the session was introduced by outgoing IUFRO President Niels Elers Koch, and each of the Division Coordinators was provided with an opportunity to consider five key questions, including the following:

- Priority topics in the five themes that the Division and its constituency would use to promote increased global scientific collaboration.
- Priority issues requiring collaboration between the Divisions and with scientists outside IUFRO.
- Activities such as joint conferences and outputs that the Divisions might apply to promote the objectives of the Strategy.
- Opportunities for IUFRO to significantly increase the visibility of research findings emerging from Divisions.

These presentations were followed by an open discussion including the Division Coordinators and the audience, moderated by incoming IUFRO President Mike Wingfield.

Key discussion topics:

- A lively debate arose from the brief presentations of the incoming Division Coordinators. Overall, the Division leadership displayed a clear and deep commitment to executing the key elements of the new IUFRO strategy. Most Divisions had already planned inter- and, in some cases, intra-divisional activities for the coming five-year board term. In addition to these, they saw substantial opportunity to develop inter-divisional meetings as part of the various larger meetings during the 2015-2019 board term (i.e., FAO World Congress, IUFRO 125th Anniversary Meeting, Regional Meeting planned for Southeast Asia).
- In addition, there was a clear plan to engage actively in developing and contributing to the new task forces. In this regard, there was a strong belief that the task force activities should be closely linked to those of the Divisions and that they should actively pursue cross-disciplinary opportunities relating to Forestry Research. It was clearly understood that substantial forestry research is undertaken by scientists outside IUFRO's core structures and that opportunities should be sought to bring these scientists closer to IUFRO. It was felt that this would be in the interests of both IUFRO and those scientists working beyond the core structures of IUFRO.
- Improving the gender balance in IUFRO's management was discussed, and all Division Coordinators showed strong commitment to improving a currently unequal situation. Efforts would be made to mentor young and particularly female scientists in IUFRO and to bring them into the union's leadership stream. It was understood that this would need to be a gradual process but that “fast tracking" should also be considered.
- Likewise, the Division Coordinators were deeply committed to improving the geographic reach of IUFRO, and many had plans to hold meetings in areas that have poor exposure. In this regard, it was noted in the discussion that it was difficult to hold meetings in areas that did not have strong forestry activities and that "champions" willing to hold meetings were difficult to find in some areas.
- Division Coordinators expressed enthusiasm for the new IUFRO website and provided various suggestions to improve the visibility of their activities. In addition, there was some discussion regarding the possibility of establishing an "open access" journal for IUFRO. It was felt by some that this would provide IUFRO research with greater visibility and that this issue deserved further debate.

Technical Session Reports

Forests for People

A-01 Forests and Human Well-being: Life Satisfaction and Behavioral Approaches

Organizers: *Shashi Kant (University of Toronto, Canada), Sen Wang (NRC-Canadian Forest Service), Martin Hostettler (Cycad Inc., Switzerland) & Peter Deegen (Technische Universität Dresden, Germany)*

Moderator: *Shashi Kant*

The session focused on new approaches to analyzing the role of forests in human well-being including social, cultural, forest use, education, employment, health, and recreation domains.

Matilda Annerstedt van den Bosch discussed, based on a systematic review of the literature, a high evidence for urban parks as promoters of physical activity and moderate evidence for the capacity to reduce obesity. The results provide support for establishing public health indicators based on urban citizens' access to green spaces and the use of urban green space indicators by authorities, planners, and decision makers to improve public health and promote urban green establishments.

Miki Toda and Misa Masuda's presentation focused on the impact of health care provisions on the contribution of medicinal plants to the health and livelihoods of people living in the Peruvian Amazon. The authors discussed the role of facilitators and hindrances related to medicinal plants based on a household survey using structured and semi-structured questionnaires as well as interviews with key persons in health care facilities.

Michel Soucy discussed a new concept of an index of the socioeconomic potential of forest stands, inspired by the concept of wildlife habitat, intended to isolate the capacity of the forest to support benefits from the actual level of benefits observed. Results from a case study over 3.3 million hectares were presented. The index allows monitoring of the amplitude and location of changes in potential with time, technology, markets, and regulations, and the spatial nature of the index helps to identify areas of conflicting potential and provides a powerful tool for communicating the effects of policy changes.

The focus of Jarzebski and Yamamoto's presentation was on the incorporation of community resilience, social capital, natural capital, and economic capital in analyzing the outcomes of community forestry in the Philippines, and they presented results from four (two indigenous groups and two non-indigenous groups) case studies. The main conclusion was that enhancing the resilience of people who practice traditional methods could drive long-term sustainable development, as these people are more concerned with nature and livelihood subsistence. However, other groups of non-indigenous people find forest resources attractive and favor them despite a modern lifestyle expansion.

The presentation by De Zoysa et al. covered woodlot management and sustainable livelihood development in Sri Lanka, and the contributions of the farmers' woodlots program, based on empirical data, on livelihood development in terms of human capital, natural capital, physical capital, financial capital, social capital, and governance were discussed. The conclusion was that the program, incorporated with rural development strategies, has made very important contributions to livelihood development.

In summary, the session highlighted the role of forests in human health, employment, and overall welfare of rural communities.

A-02 Forests and Human Health: The Role of Research Toward Evidence-Based Practice

Organizers: *Takahide Kagawa (Forestry and Forest Products Research Institute, Japan) & Liisa Tyrväinen (Finnish Forest Research Institute)*

Moderators: *Liisa Tyrväinen & Takahide Kagawa*

The session focused on research methodologies and recent findings on the effects of forests on human health, and the application of these findings into medical practices, landscape planning, recreational use of forests, and nature-based tourism.

Takahide Kagawa presented an overview of forest therapy research in Japan. The research evidence is largely based on field experiments, where health effects are documented through the nervous system (blood pressure and the autonomic nervous system), endocrine system (stress hormone concentrations), and immune system (NK activity). In Japan, there are currently 53 forest therapy bases and trails, and forest therapy is widely used in municipalities nationwide.

Jeonghee Lee presented the current development of the forest healing industry in Republic of Korea. The research on the healing effect of forests started in 2007 and has followed the forest therapy in Japan. Currently, Korea's own direction of forest healing has been established.

Bing Ye demonstrated the therapeutic effect of urban forests that can help to improve the health of urban residents. A long-term monitoring approach was developed to track the dynamic of the health benefit of urban forests.

Yuko Tsunetsugu presented a study looking at the effects of wooden odors on human physiology by conducting laboratory experiments. The physiological measurements they use are cerebral hemodynamics to assess activity in the prefrontal area, blood pressure, and pulse rate. The smell of Japanese cedar wood chips significantly decreased systolic blood pressure and cerebral activities, and the smell of α-pinene significantly decreased infants' heart rate.

Eva-Maria Nordstrom presented a study quantifying characteristics of rehabilitation forests and analyzing trade-offs between wood production and rehabilitation forests. The five most important stand-level variables were age, stem density, height, diameter, and standing volume. Preliminary results show that 15-25% can be maintained as rehabilitation forest without considerable decrease in Net Production Value.

Ulrike Stigsdottir presented Danish work conducted at the Nature, Health & Design Laboratory that consists of two settings: the Health Forest (for health promotion) and the Healing Forest Garden Nacadia (for treatment of stress).

Liisa Tyrväinen presented results about stress-reducing effects of different urban green areas based on an experimental study using several

psychological and physiological measures. The participants felt more restored after visiting green areas compared to the city center. However, the urban woodland had somewhat more restorative qualities than the urban park. Practical projects to implement research knowledge in the field have been started in different parts of Finland recently.

A-03 The Value and Challenges of Integrating Food and Medicinal Forest Products into Forest Management

Organizers: *James Chamberlain (US Forest Service), Carsten Smith-Hall (University of Copenhagen, Denmark), & Tytti Sarjala (Finnish Forest Research Institute)*

Moderators: *James Chamberlain & Carsten Smith-Hall*

Forests support the livelihood of people and communities as well as the economies that affect them. The flora and fauna that are harvested for food and medicine are essential elements to forest biodiversity and ecosystem services. The loss of understory flora can impact forest hydrology and disturb other ecological processes. Yet incorporating them into our daily lives can lead to a greener world. This two-part session explored how forests around the world provide products and services that maintain and improve human health and well-being. It also considered the values and challenges of integrating into forest management the forest resources that supply these products and services.

Key presentation points:

- In Colombia, palms are used mainly for food and the most used are the most abundant.
- In Ghana, the food value from the forests constituted about 50% of household budgets.
- Raphia palms in Nigeria are harvested to make wine, shelter, and construction.
- Essential oils made from Pistacia in Tunisia have medicinal value in healing wounds; though only used locally, it has global implications.
- The export of Peumus, commonly known as Boldo, from Chile has increased drastically over the last decade; the restriction of leaving at least 35% basal area in the forest does not appear to be warranted.
- The harvesting of the bark of Afzelia africana, in Burkina Faso has a significant negative impact on fruit production.
- Through a case study approach, the value of wild-harvested foods and medicines to households in Sweden, Ukraine, and Russia was estimated. In each case 11-44 wild species were collected.
- The use of medicinal forest products in Nepal was influenced by negative education and if the household was run by a single female parent.
- Mushroom production in Japan has been negatively impacted by the 2011 nuclear reactor incident; conventional production methods were found to be better than new farm approaches.
- Comanagement of non-wood forest products will require a significant shift in forest management paradigm, which may attract young people to the profession and IUFRO.

A-04 Resilience and Identity with Urban Forests: A Landscape System Approach

Organizers: *Wybe Kuitert (Seoul National University, Republic of Korea), Cheng Wang (Chinese Academy of Forestry), Giovanni Sanesi (University of Bari, Italy), & Amila Brajic (FOPER-University of Sarajevo, Bosnia-Herzegovina)*

Moderator: *Giovanni Sanesi & Cheng Wang*

The role that green spaces play in the lives of people in urban communities is crucial, essential to human health, well-being, and culture. To reach a more integrative approach in management and planning, urban forests should be seen as belonging to the ecological system of a city, to its landscape. This landscape has a historical and cultural dimension as well as a natural scientific one.

This session considered various perspectives on urban forests as a landscape solution to problems of loss of identity and resilience that face today's often uncontrolled, rapidly urbanizing way of living. Rather than proposing landscaping as an expensive investment, the presenters wanted to explore research on the natural landscape that is already present under the asphalt and concrete of the city in the form of topography, water, and potential vegetation, as a cheap and evident potency to sensible planning, development, and management. This session included researchers and students on forests and cities, historians, geographers, ecologists, planners, and developers who presented an interdisciplinary view on urban forests and green infrastructures.

Key discussion topics:

- Influence of land use (in terms of urban and periurban green spaces) over the last decades on landscape matrix pattern and morphology and how these changes can affect different ecosystems' functionality.
- Importance of remote sensing and GIS approaches for supporting landscape analysis and planning of urban green spaces for providing greater benefits.
- The crucial role of urban water in landscape also in terms of environmental impact assessment.
- Climate change impacts on the frequency of flooding on urban settlements and vegetation, and how it may influence tree planting approaches.
- The green infrastructure approach at the metropolitan scale and the need for multidisciplinary and strategic planning;
- Importance of understanding citizen behavior and preferences for visiting green areas.
- Complex urban landscape systems require multidisciplinary approaches.
- The importance of resilient urban forests for resilient people.

A-05 Challenges and Opportunities in Forest Management and Utilization in Rapidly Changing Asian Economies

Organizers: *Ajith Chandran, Lianzhen Xu, Weiye Wang, & Monika Singh (University of British Columbia, Canada)*

Moderators: *Guangyu Wang (University of British Columbia, Canada) & Simmathiri Appanah (FAO, Thailand)*

This session examined recent research combined with rural community-based forest management experiences, highlighting the value of learning from a diverse knowledge base and the importance of effective communication strategies in Asian economies.

Presentation findings:

- Joint Forest Management in India – despite its successes – continues to face multiple challenges that require attention. Key communication challenges highlighted by senior Indian Forest Service officers included the importance of having a communication strategy by the government, increased women forest officers, officers with social sciences background, and funding arrangements. Learning from the research by IFS officers coming to the University of British Columbia for mid-service training was also discussed.
- The ASEAN-Korea network model of Asian countries and its efforts in human resource development and local community improvement highlighted the role of international cooperation and learning. The discussions involved looking at future strategies with sustainable funding and increased partnerships between institutions. The importance of such networks for information dissemination and improved communication were also discussed.
- Empirical research based in Bangladesh suggested the need to look beyond forests for reducing pressure on forests through increased tree cover. Issues and trends in agroforestry, marketing opportunities, reasons for lack of widespread adoption, loan arrangements, and knowledge and information gaps were discussed.
- China's massive and largely successful national forestry program was discussed. Improved land tenure systems, private holding of forests, understory NTFP resource improvement, information dissemination, and investment opportunities were discussed. Meeting the expectations of farmers for improved livelihoods continues to be a challenge.
- The "fishing and grazing ban" policy of China highlighted the impact on community and natural reserves. Strategy and action avenues were discussed.
- Case studies from Indonesia highlighted the opportunities and challenges in community involvement in forest management. Information gaps, training requirements, and tourism were discussed.

A-06 Forest-Dependent Community Development

Organizer: *Tuija Sievanen (Finnish Forest Research Institute)*

Moderator: *Tuija Sievanen*

This session focused on research of rural communities in which forests are an important asset for livelihoods, incomes, subsistence, health, and culture. The majority of the presentations dealt with issues related to communities in the context of forest-dependent livelihoods, or nature protection and livelihoods. Many presentations discussed also the participatory approaches in planning and management on the local level. All presentations presented studies made in developing countries.

Key findings:

- In many cases local people have very little to say about the use of forests surrounding their villages, and rights to take and use traditional forest products are under threat.
- When local people gather forest products to be sold at commercial market, the income to the gatherers is often only less than one percent of the value of the end-product. The low cash gained by local communities does not support the sustainable use of the forest products in question.
- Traditional use of forest products is replaced by cheap commercial products, which may cause damage to the cultural values of the locals related to those forest products.
- Illegal harvest of protected species for commercial markets is a serious threat to their protection.

A-07 The Social Outcomes of Community Forestry: What Do We Know and How Do We Know It?

Organizers: *Susan Charnley (US Forest Service) & Rebecca McLain (Portland State University, USA)*

Moderator: *Susan Charnley*

The trend toward community-based forest management has been increasing worldwide, with associated expectations that it will lead to improved local forest management institutions, forest conservation, protection and enhancement of ecosystem services, and increased local community benefits. But there remains a gap in the published literature regarding the outcomes of community forestry in meetings its goals, and its social goals in particular. What are the best methods for monitoring and assessing the social outcomes of community forestry? What have these outcomes been, and for whom? Are they substantive enough to provide an incentive for sustainable, community-based forest management? These are the questions addressed in this session. If community forestry as an institution for forest governance does not create social benefits for local people who live in forest communities, then it is unlikely to be an effective mechanism for sustainable forest management and forest conservation.

Key findings:

- There is little research that evaluates both the social and environmental outcomes of community forestry; most focuses on one or the other.
- National-scale assessments of community forestry have been undertaken in Nepal and Thailand. In Nepal, community forestry has been beneficial in terms of enhancing natural and social capital, but not so much in terms of creating financial capital. Middle- and upper-class people are benefiting most from community forestry; the poorest people and lowest castes are benefiting little. In Thailand, the main benefits from community forestry are associated with improved access to and management of non-timber forest products.
- Community forestry typically requires external financial, technical, and material support to be successful (from outside the community).
- The social benefits of community forestry can be direct (e.g., increased income from forest products) or indirect (e.g., other types of livelihood improvements that are associated with community forestry projects, such as commercial tree nurseries, agricultural improvements). Without concrete social benefits, community forestry is unlikely to promote forest conservation.
- Two general categories of community forests are "production forests"

where activities that generate income, such as timber and non-timber forest product harvesting for sale occurs; and "protection" forests, where few extraction-oriented activities are allowed and the main goal is to protect water quality, biodiversity, etc. Especially in the latter case, external entities that aim to promote forest conservation through community forestry should have livelihood improvement activities as a project component in order to increase the social benefits of community forestry and provide a conservation incentive.

- In Canada, Crown Forests are managed under a number of different forest tenures, including community forestry. In British Columbia, community forestry has been found to create more local jobs, and to support a greater diversity of mills, than other forms of forest tenure.

A-08 Small-Scale and Community Forestry for People, Biodiversity, and Ecosystem Services

Organizers: *John Herbohn (University of the Sunshine Coast, Australia), Gun Lidestav (Swedish University of Agricultural Sciences), Gary Kerr (UK Forestry Commission), Jessica Leahy (University of Maine, USA), & Christoph Hartebrodt (Forest Research Institute Baden-Württemberg, Germany)*

Moderators: *Christoph Hartebrodt & Emily Silver (University of Maine, USA)*

In many regions of the world, private and community forests play a substantial, sometimes dominant, role. Consecutively, the attitudes, behavior and especially the decisions of individual owners or respectively the communities impact the provision of different types of ecosystem services. However, the framework in which owners and communities act influences these impacts. Here, political decisions and organizational structures, e.g., Forest Owners Associations (FOA), can lead to either the improvement or deterioration of future provisions of ecosystem services. This session included presentations on the complex and multidimensional nature of small-scale and community forestry systems, with a focus on the economic, institutional, and policy issues; uneven-aged and mixed-species silviculture of small-scale and community forestry; forest land ownership in change and its significance for management and policy; and the links between attitudes and behaviors of small-scale forest landholders.

Key findings:

- Regeneration after shifting cultivation works comparatively fast and can lead to situations that are close to untouched secondary forests within 30-40 years.
- Forest owner typologies in Europe differ widely and were hard to apply so far. It is an open question whether forest owner typologies have been applied so far in forest policy decisions.
- Three key drivers are identified that influence small-scale forestry in Europe: restitution processes, heritage regimes, and defragmentation policy within the individual states of the EU.
- Associations are founded for economic and political reasons. However, state support of associations has decreased notably during the last years. The risk that the existing FOA will reduce their activities remains. The proficiency of FOA in lobbying must be, at least regionally, improved.
- In Slovenia there is mixed satisfaction with FOA. As its strength are seen the possibility to join group activities and to find assistance and education. Weaknesses are seen in the individualism of the members, the poor cooperation with other institutions, and the lack of willingness to cooperate.
- The cultural settings influence attitudes and behavior substantially.
- Life-cycle assessments can be improved by integrating the cultural perspective.
- The creation of the cultural indicator matrix has increased the visibility and recognition of cultural impacts within a sustainability framework.
- In Sweden, small-scale forest owners focus mainly on two strategies: saving timber volume for a later use and enhancing the productivity of forests. The size of the property can be seen as a key factor that determines the choice of strategy.
- In the United States, potential solutions to family forest management issues are not well-researched.
- Understanding family forest owner risk perception lacks empirical research globally; there is no scientific consensus on a quantitative measure of forest owner risk.
- Agent-based modeling has the potential to broaden our understanding of landscape scale patterns of family forest owner decisions and behaviors.
- Landowner payment for ecosystem services has the potential to assist small-scale owners in keeping their forests as forests in lieu of timber harvesting.

A-09 Communities, Forests, Forest Industries, and the Social License to Operate

Organizers: *Peter Edwards (Swedish University of Agricultural Sciences), Justine Lacey, & Kieren Moffat (CSIRO, Australia)*

Moderator: *Peter Edwards*

This session included presentations on a variety of aspects related to how the forest industry earns and maintains the informal approval and acceptance that communities and other stakeholders grant to a company or industry engaged in forest resource use and management. The breadth of topics included Corporate Social Responsibility (CSR), industry and government perspectives, and case studies from developed and developing countries. The session was rounded out by several presentations that introduced contested views on the negotiation and granting of a Social License to Operate (SLO). Presenters included researchers, NGO, and government representatives. More specific topics of discussion included community forestry, plantations, introduction of non-native species, indigenous peoples, regulation, and research-based models of SLO. This session highlighted that SLO cuts across many dimensions of forestry and divisions and research groups in IUFRO.

Key findings, discussion points, and knowledge gaps:

On Corporate Social Responsibility (CSR) and SLO:

- CSR is intimately linked to SLO, but they play different roles.
- With larger companies, there is a need to investigate whether stronger CSR will aid in granting an SLO.
- Small and medium enterprises (SMEs) may be a different story as they are often embedded in communities.

- Through CSR reporting, SMEs are seen as transparent, one element in SLO.

On government and industry views:

- In a British Columbian example, industry is on an SLO trajectory, with government support.
- Industry/community relations had to reach an all-time low in order for this to come about.
- As industry changes, the SLO needs to be renegotiated.
- The need for an SLO is not restricted to industry – governments may also need to earn an SLO; people need to be confident that they can trust government and that government can govern/monitor industry appropriately.

On indigenous people, development, and the rights component:

- With indigenous peoples and in developing countries, there is often a question of rights that raise questions about the roles of industry, government, and SLOs.
- Where industry engages early with communities and stakeholders, this helps communities achieve their expectations and aspirations;
- There is a need for a range of actions – no one mechanism that can deliver what indigenous peoples require.
- Currently in the indigenous space, with the rights question, there is a requirement for more formalized processes than the informal SLO.

A-10 Establishing Social Institutions for Comanagement of Public Forest Lands

Organizers: *Jamie Barbour (US Forest Service), Cassandra Moseley (University of Oregon, USA), & Susan Charnley (US Forest Service)*

Moderator: *Cassandra Moseley*

Presentations in this session examined the socioeconomic and sociopolitical constraints on establishing comanagement of public lands worldwide and the potential biophysical benefits from different management approaches. Presentations covered a range of comanagement examples from those initiated by governments to those promoted by stakeholders living in the affected area. In one situation Kanna Siripurapu discussed the resiliency of these systems by documenting the return to a community comanagement system that had been in place in India before British occupation and was reinstituted when residents became unhappy with centralized control and planning imposed by the current government. Many of the speakers emphasized the importance of bringing the right groups and individuals into discussions and agreements about how these sometimes quasi-official arrangements can operate successfully within official structures where objectives may differ from those of local stakeholders. They spoke about finding ways to provide direct and measurable benefits to community members, such as value chain clarification and enhancement for non-timber forest products sold locally and regionally by community members.

Common findings and lessons:

- If possible begin the process by identifying a set of desired future conditions that all stakeholder groups can accept if not agree to.
- Make sure the set of stakeholder groups includes all relevant groups.
- There is a need to build capacity within stakeholder groups in a variety of areas including organizational skills and interacting effectively with established government agencies and non-governmental groups that may be affected by changing governance arrangements.
- Efforts that do not include the full range of stakeholder groups are less likely to succeed than those that do, but it is difficult to create effective incentives for stakeholder groups who may have something to lose through initiation of new comanagement arrangements.
- There is often an uneasy tension between community members, who may feel they have traditional knowledge on their side, and experts about the right roles for western scientific information and traditional ecological knowledge in these discussions.

A-11 American Indian Forestry

Organizer: *Donald Motanic (Intertribal Timber Council, USA)*

Moderator: *Donald Motanic*

This session explored the perspectives and forest stewardship practices used by Indian tribes in the United States to address contemporary challenges such as forest health, climate change, and declines in forest products processing infrastructure.

Key findings and discussion points:

- Tribes managed their forests using prescribed fire techniques long before Europeans occupied the United States; the first federal forest regulation was on the Menominee Reservation in 1890, and not with the US Forest Service.
- The National Indian Forest Resource Management Act (NIFRMA; 1990) and Tribal Forest Protection Act (TFPA; 2004) have improved federal policies with tribes and documented the federal government's trust responsibility to tribes.
- Tribal forests are managed at $2.82 per acre and US Forest Service lands are managed at $8.57 per acre with tribes addressing the same environmental laws.
- Anchor Forest is a project aimed at developing on-the-ground collaboration among multiple government landowners to sustain a large geographical forest with infrastructure.
- Tribal members have overcome historical trauma (due to removal from homeland and families during federal government's policies and boarding school eras) to evolve with new policies, like the NIFRMA and nonprofit organizations like the Intertribal Timber Council, American Indian Science Engineering Society, Society for the Advancement of Chicanos and Native Americans in Science, universities, and others.
- These organizations provide support for tribal communities to gain education and tribal professionals to manage their forests. There is an immense investment opportunity in recruiting and retaining Indian people as future management leaders, and recommendations such as integrated coursework, mentorships, and internships specialized for Indian students can help facilitate the development of tribal students.

A-12 Participatory Protected Area Management at the Human Needs and Sustainable Wildlife Conservation Interface

Organizers: *C.A.M. Sylvestre Djagoun (Université d'Abomey-Calavi, Benin), Hugues Akpona (National Forest Office, Benin), Edward D. Wiafe (Presbyterian University College, Ghana), & Achille Assogbadjo (Université d'Abomey-Calavi, Benin)*

Moderators: *C.A.M. Sylvestre Djagoun & Hugues Akpona*

Participatory approaches were introduced into management of protected areas more than 20 years ago. Since then different approaches were developed worldwide to implement participatory management of forest or wildlife reserves in Africa. However, information is required on the importance of participatory Protected Area management at the interface of human needs and sustainable wildlife conservation needs to evaluate the sustainability of the management system. This technical session highlighted different experiences in participatory wildlife management in Protected Areas throughout the world, but particularly in Africa, and inspired further investigations into the threats to wildlife. Moreover, it provided an overview of the best practices, which could be applied to forest conservation, and how this could improve the sustainable access of local community members to forest resources.

The session included four presentations covering different approaches: Chabi Djagoun highlighted how monitoring resource-selection functions of bovids can be a powerful tool to detect potentially negative effects of human activities on those ecologically and economically important species in multiple-use areas. A presentation by Hugues Apkona on conflict mitigation between spotted-necked otters and fishermen suggested that otter damage could be reduced if fishermen checked fishing equipment at least twice a day, and recommends a maximum interval between checks of 12 hours. Achille Assogbadjo pointed out the importance of rodent species as food supply and impact of hunting on the rodent populations and dynamics, and proposed sustainable harvesting techniques. Edward Wiafe's study results indicated that encounters with illegal wildlife use in Protected Areas increased with increased patrol efforts before encounter rates started decreasing. Neither the rainfall seasonal activities nor prosecution were as effective in reducing illegal activities as increased patrol efforts.

The general discussion at the end of the session focused on two related questions: (1) How effective is our management approach in the Protected Areas? (2) To what extent is the local community engaged in Protected Areas management and conservation in developing countries. While there was no resolution to either of these very pressing issues, and it is clear that there must be further debate before they can be resolved, the following recommendations were made by participants during the discussion:

- Build the volunteering spirit among the local population around the Protected Areas.
- Promote self-financing and/or long-term funding support for the Protected Areas to avoid negative impacts on Protected Areas following short-term projects.
- Promote education in the local communities living around the Protected Area.
- In the case of trans-boundary Protected Areas, harmonize the management rules between the different countries involved.
- Promote effective benefit-sharing mechanisms around Protected Areas to reinforce local communities' engagement.
- Promote innovative participation mechanisms with an effective representation of a high proportion of local community members.
- Establish a permanent data-collection system on Protected Areas management effectiveness and sharing of best practices.

A-13 Innovative Planning and Managing Approaches for Sustainable Tourism in Forests and Natural Areas

Organizers: *Taylor Stein (University of Florida, USA), Peter Fredman (Mid Sweden University, Sweden), Nobuhiko Tanaka (Tokai University, Japan), & Liisa Tyrväinen (Finnish Forest Research Institute)*

Moderator: *Taylor Stein*

This session addressed the multiple dimensions associated with tourism in forests and natural areas including benefits to society and local people. Speakers from Europe, Japan, and the United States addressed the complicated role forests have with tourism and highlighted innovative research that examined the planning and management in forest-based environments. Specifically, speakers described research that examined the appropriateness of tourism development in forest-based environments, and perceptions of tourists and tourism providers on the ecological impacts of tourism, as well as the benefits tourism could provide to rural areas.

Key findings:

- Nature-based tourism and recreation areas in Florida are currently in good condition and could receive more visitations to provide benefits to more visitors and surrounding communities; however, monitoring must occur to ensure quality experiences and environments.
- Forests play an important role in Sweden for nature-based tourism providers. This includes an indirect role in providing aesthetic environments and habitat for fish and wildlife.
- In Japan, tourism destinations are continuously changing due to the discovery of new tourism resources or with the establishment or removal of facilities; research suggests methods to evaluate tourism potential in nature-based areas with changing mosaic land uses.
- Research that examined tourists' environmental and accommodation preferences in northern Lapland tourism destinations of Finland found building density and patterns are important in defining the quality of the environment in tourism destinations, as they affect the nature experiences associated with accommodation.
- To assist in designing appropriate tourism development for protected areas in Brazil, research showed that zoning of the conservation unit was possible to select areas suitable for ecotourism, as well as guide managers to restrict use in environments not suitable for tourism development.
- Research of off-highway vehicle recreation use in Utah shows differences in perceived and actual supply of OHV infrastructure and attractions, and these differences are affected by a variety of social and physical factors.

A-14 Integrating Landscape Protection, Nature-Based Recreation and Tourism, and Rural Development

Organizers: *Tuija Sievanen (Finnish Forest Research Institute), Ellyn K. Damayanti (Bogor Agricultural University, Indonesia), & Taiichi Ito (University of Tsukuba, Japan)*

Moderators: *Ellyn K. Damayanti & Taiichi Ito*

This session dealt with research, planning, and management of protected and recreational areas in rural communities, highlighting research on integration of local communities with the parks to enhance local community and visitor benefits, and conflict resolution.

Key topics discussed:

- Presentations focused on ecotourism topics, how to develop research based on evidence, and ecotourism for rural development.
- Research methods in ecotourism study are improving, not only using social-economic methods. Among new methods introduced in the session are: Q-methodology, scenario analysis, RS/GIS in landscape analysis, and RS/GIS in forest inventory and vegetation analysis.
- Identifying the target of research and defining the terms are important in ecotourism research, including definition of local people, forest degradation versus thinning, addressing gender issues, etc.

A-15 The Future of Recreation in Forests and Other Nature Areas

Organizers: *Peter Fredman (Mid Sweden University, Sweden), Frank S. Jensen (University of Copenhagen, Denmark), Tuija Sievänen (Finnish Forest Research Institute), & David Edwards (Forest Research UK)*

Moderator: *Peter Fredman*

The purpose of this session was to look at trends and foresights regarding outdoor recreation opportunities in different countries from Northern Europe and other regions around the world. The session also included new methods for monitoring outdoor recreation; development of outdoor recreation indicators; and adaptations to climate change, conflict management, and forest aesthetics. The following key findings were reported in the session:

- In Finland, the national outdoor recreation demand survey has been conducted two times, and trend information covers participation rates of 86 recreational activities, characteristics of close-to-home recreation occasions and nature trips, and use of different types of recreation areas. Current research is now using several different approaches to forecast outdoor recreation participation.
- National inventories of outdoor recreation in Denmark show that access facilities are present on more than half of the Danish forest area. It is revealed that national forest inventories can include a number of recreational/social indicators, which generally are not available otherwise.
- In Sweden, outdoor recreation participation is currently measured through a "last-visit" web-based panel approach including 700 responses each month during one year with questions concerning participation, accessibility, motivation, and constraints. The survey will provide information on indicators to follow up the new Swedish outdoor recreation policy.
- The monitoring program National Inventory of the Landscape in Sweden (NILS) combines field inventory with aerial photo interpretation. The aim is to monitor prerequisites for biodiversity, but data can also be used for recreational assessments. Twenty-eight thousand photos are systematically collected, and the data is suggested as indicators for outdoor recreation.
- Great Britain has a long-established program of outdoor recreation monitoring. A considerable body of data has been generated over the last 20 years revealing patterns and trends in forest-based engagement. There is now a need to move away from indicators of sustainable forest management toward natural capital accounting and an ecosystems approach.
- Research in Maine about adaptive capacity of tourism destinations to climate change shows different levels of concern exist among the diversity of stakeholder types (private, non-governmental organizations). Few stakeholders have embraced emission mitigation strategies as part of their business practices.
- Research in Denmark suggests that some outdoor recreation groups have a willingness to travel farther than the average to reach a forest with few visitors. This research can assist in a development of policies aimed at managing conflict among forest user groups.
- Studies on attitudes to aesthetic considerations among forest owners and consultants in the northern parts of Sweden show that societal interest in forest aesthetics is high, but policies regulating these values are vague. Aesthetic values are considered primarily based upon egoistic motives among forest owners rather than altruism.

A-16 Ethics and Values in Relation to Forest, Wildlife, and Recreation Management

Organizers: *Christian Gamborg & Frank S. Jensen (University of Copenhagen, Denmark)*

Moderator: *Christian Gamborg*

This session explored the underlying values and ethical aspects related to forest, wildlife, and recreation management and the understanding of conflicts, situations, and approaches for handling conflict situations, including human-human, human-nature, and human-wildlife interactions.

Key findings and important knowledge gaps:

- The relation between forest and people is complex, and we need to have a better understanding of these relations in terms of underlying values and in terms of understanding what divergences exist.
- Natural resource management is conflict management.

Important findings of conflict understandings and values from specific studies in the session:

Related to forests:

- The use of fire is a contested intervention, and here forms of local, collaborative governance have a place.
- In tropical human-dominated forest landscapes, top-down exclusive approaches to forest and biodiversity conservation frequently create local conflicts due to unequal distribution of power, rights, and benefits.
- Modern policy interventions may have conflicts with and displace

traditional knowledge in community practices. With the increased influence of industrialization and marketization, forests may be faced with more powerful interventions that displace tradition.

Related to wildlife:

- While researchers have examined many models of collaboration, along with the interests and roles of participants, less attention has been paid to possible interactions between different processes or the effects of these. Here, there is a need to negotiate; e.g., indigenous collaboration in forestry, including hunting.
- While there is a high value of subsistence hunting for nutritional purposes, there is also important cultural values, and there are dynamic networks of bushmeat that consolidate indigenous identity and solidarity.

Related to recreation:

- Criteria and indicator frameworks are an important tool for implementing and evaluating Sustainable Forest Management (SFM). While indicators are generally designed with some participation from interest groups, the values or criteria that members of the public use to evaluate forest management have received less attention.
- Recreational hunting is something completely different from subsistence hunting, and is getting more controversial as underlying values in western societies are changing toward less utilitarian.

A-17 Linking Landscape, Forests, and People: The Historical Roots of Biocultural Diversity

Organizers: *Mauro Agnoletti (University of Florence, Italy), Jinlong Liu (Renmin University of China), & Steven Anderson (Forest History Society, USA)*

Moderator: *Mauro Agnoletti*

This session sought to explore the historical development of biodiversity patterns associated with "natural" and "cultural" landscapes, including those shaped by local and landscape-level traditional forest management practices and uses of biodiversity, and the evolution of policies affecting biological and cultural diversity and heritage. It also considered how a fuller understanding of biodiversity is revealed when its historical dimension is explored, recognizing the actors, factors, and processes that have shaped each forest landscape in the more general process of "environmental biodiversification" through human history. The speakers reported the results of case studies from North America, Central America, Africa, Asia, and Europe, presenting a wide range of perspectives, highlighting not only the different values associated to biocultural diversity in the different socioeconomic environment but also a range of research tools and methodological approaches, showing the advancement of these studies in different parts of the world.

Key findings:

- The influence of humans on all the features of forest can be dated back several millennia. This was especially evident in the case studies presented on Europe and Central America. Forests' species composition, density, and structure have been shaped according to the needs of society, and can still be studied today. Specific uses, such as timber for railroad constructions, have affected large forest areas as shown in the case study from Wyoming, USA, where forest utilization had an important relationship with the ecology of pine forests, creating gaps favoring the regeneration of pine. In forests shaped by ancient societies such as the Maya, different research tools used to trace their history differ in their ability to determine historical species composition and their use.
- The role of biocultural landscapes resulting from the historical development of human/nature relationships are today associated with important initiatives aimed at valuation of cultural landscapes and their role in the competitiveness of the rural territory, the environmental quality, and the quality of life of the rural population. These approaches were presented in the case of the Italian register of historical rural landscapes in Italy and the Satoyama initiative from Japan. The importance of a landscape approach considering forests as a cultural product is important not only for the promotion of landscape resources for tourism and the local foods, but also to recover a better integration between farming and forestry. These two are very often living "separate lives," compared to the integration existing in the past. The landscape as one of the services offered by the ecosystem, presented for Japan, is a concept that has still to be clarified and more widely debated. Cultural landscapes developed through history determine the qualities of the range of ecosystem services offered.
- The possible negative effects of traditional practices (compared to the conservation of forest integrity) were discussed for Nigeria and Cameroon, as well as the perception of the indigenous population of the positive role of forests and trees. It appears that a wide set of long-lasting immaterial values associated with forests, as well as the traditional role of trees for socioeconomic activities, can still be found in these countries. These papers reflected the paradigm of human degradation theories concerning the African continent, largely discussed in the past decades in the field of historical ecology. In this respect the negative role of human influence, if compared to the ideal state of a forest, is taken as the point of reference. The different types of forests (e.g., savannah types) produced by local culture are judged according to the same view. However, use of the forest by a community should also be judged according to the amount of services that the modification induced to forest ecosystems produces, creating a biocultural dimension that requires a different assessment.

A-18 Value of Traditional Knowledge for Sustainable Forest Management

Organizers: *Yeo-Chang Youn (Seoul National University, Republic of Korea), Jinlong Liu (Renmin University of China), William Armand Mala (University of Yaoundé I, Cameroon), & Ronald Trosper (University of Arizona, USA)*

Moderator: *Yeo-Chang Youn*

This session focused on the relevance of traditional knowledge (TK), practices, and social/governance institutions in the conservation, management, and restoration of forests and sustainable use of forest biodiversity.

Key findings:

- There are many countries where traditional knowledge is being eroded, although some countries have scientific-based research evidence on this issue.
- Traditional knowledge has been contributing not only to ecosystem conservation and landscape restoration in traditional or modern ways, but also maintaining the livelihood of communities.

- Involving local people by integrating traditional knowledge into conservation practices is an important factor for the success of conservation efforts.
- Traditional worldviews, particularly causal relationships based on religious or spiritual beliefs, must be considered in the exchange of knowledge and interactions with communities.

Discussion points:

- The terminology of "traditional knowledge" was debated as a replacement of the term "traditional ecological knowledge."
- Gender is a crucial aspect to practice, inheritance, and innovation of the traditional knowledge.
- While TK is threatened by international trade-related treaties and government interventions, it may survive given its utility for biodiversity conservation.
- People/communities should be viewed as a part of the ecosystem – traditional knowledge of a given locality can be used for governance of the local ecosystem, and the knowledge innovation should also be based on the traditional knowledge originated from the local community and ecosystems.
- As we try to understand the role of traditional knowledge in Sustainable Forest Management (SFM), it is important to recognize that traditions and TK have been evolving when faced with threats and interventions by modern technology and institutions.
- While many may consider all the changes in TK are bad for SFM, perhaps some innovations of TK may be good for SFM.
- Greater effort is needed to identify and recognize the value of traditional knowledge for sustainable forest management.

A-19 Wood and Forest Culture: Merging the Past with the Present

Organizers: *Howard Rosen (US Forest Service) & Woo Chun Young (Kookmin University, Republic of Korea)*

Moderator: *Howard Rosen*

This session examined the historical, religious, artistic, and other social values of wood and forest culture, emphasizing the economic, environmental, and scientific impacts to different regions of the world.

Key findings:

- Identification of wood species in early wooden objects, such as wooden coffins in Egypt, can give insight into the historical presence of forest species in ancient lands.
- Use of wood products in non-residential buildings can give way to plastic products because of lack of availability of mature and durable timber in Nigeria, reflecting need for affordable timber products with acceptable properties for commercial structures.
- The importance of the use of historical species, which had excellent mechanical properties and color, was emphasized. The importance of identifying these species and historical techniques of construction can be useful in rehabilitation projects.
- The rainforests of Brazil are renowned for their biodiversity and importance to the "people of the forests" in relation to the cultural, economic, historical, and social aspects. More programs and enforcement are needed to protect the Amazonia forest in the future.
- The importance of wood and forest products is (and was) critical to the advancement of human culture. We feel the necessity to look at these developments and make sure they continue in the future.

A-20 On-Farm Trees: Toward the Promotion and Development of a Traditional or Local Silviculture in Tropical and Subtropical Forest Regions

Organizers: *William Armand Mala (University of Yaoundé, Cameroon), Jinlong Liu (Renmin University of China), Steven Anderson (Forest History Society, USA), & Yeo-Chang Youn (Seoul National University, Republic of Korea)*

Moderator: *Valentina Robiglo (CIFOR, Peru) & Emeline Assede (University of Abomey-Calavi, Benin)*

This session examined the status of on-farm trees research and discussed the integration of traditional silviculture and local ecological knowledge of multipurpose trees for the design of small-scale forestry practices. A total of 10 oral presentations and 11 posters were presented in this two-part session, covering a variety of agroforestry and other forest and tree-based systems managed for fruits, and other food crops in a number of countries in tropical Asia, Africa, and Latin America.

Key findings and discussion points:

- On-farm trees are managed under a variety of simple and complex forest to agroforestry systems. They serve multiple uses including food, firewood, and timber.
- There is gender differentiation in on-farm trees management related land and trees ownership.
- On-farm tree management is part of an adaptation strategy to cope with uncertainties.
- Discussions on drivers of on-farm trees management.
- Traditional knowledge of forests and trees is important for establishing complex and resilient tree-based natural resource management systems.
- Land and trees rights status affects the planting behavior or the management of trees.
- Role of policy and technical support such as the extension services.
- Knowledge gaps highlighted during the session included: integration of gender issues in multipurpose species survey, importance of selective logging and pruning to improve on-farm tree production, and ecological issues of on-farm trees.

A-21 Coppice Forests – A Tradition with Future

Organizer: *Gero Becker (Albert-Ludwigs-University Freiburg, Germany)*

Moderator: *Gero Becker*

This interdisciplinary session focused on the silvicultural, ecological, management, utilization, and social aspects of coppice forestry. The session included 10 oral presentations and three poster presentations from all parts of Europe and from South Africa. The European COST Initiative EuroCoppice was presented and participants were encouraged and showed interest to cooperate in the future. The large number of participants underlined the high

interest in and relevance of coppice forest issues as well as the need for an interdisciplinary approach of coppice-related research.

Discussion questions and identified research needs:

- Until what age or after how many repeated cuts do coppiced stools have a good growth potential?
- Do trees developed from coppice have inferior root system mechanical stability compared to trees from seeds?
- How does the reduction of many sprouts from one stool to one single shoot influence the growth of height, diameter, and total volume?
- What is an optimal coppice clear-cut size to achieve both good regeneration and growth?
- Which combinations of number of cuttings and rotation age fulfill the specific needs of different types of forest owners; i.e., smallholders versus pulp industry?
- What is the right balance and ecological and financial benefits of different numbers of standard trees in a coppice system?
- How do different terrains and social conditions affect the feasibility and performance of low and higher mechanized harvesting systems?
- Official forest policies in many countries do not favor coppice management systems despite their beneficial effects for local communities – how can this be changed?
- Do coppice forests deliver different, more, or better, services – e.g., watershed, erosion, biodiversity, and cultural values – compared to high forests?

A-22 Forests Under Pressure: Prerequisite Conditions for Forest-Related Sustainable Development

Organizer: *Pia Katila (Finnish Forest Research Institute)*

Moderator: *Glen Galloway (University of Florida, USA)*

The session introduced the new book *Forests Under Pressure – Local Responses to Global Issues* produced by the IUFRO Special Project World Forests, Society and Environment. Four case studies were presented from different parts of the world (Mexico, Brazil, India, Mozambique) to illustrate conditions and interaction between conditions that foster or hinder progress toward sustainable forest management and forest-related development. The session also presented the main findings across the 27 case studies analyzed in the book, and discussed the findings in relation to future outlooks and scenarios.

Key findings:

- A more holistic understanding is essential of the context in which SFM is being pursued, including the interacting processes and emerging trade-offs affecting SFM. More comprehensive policies and approaches are required to address key issues in local contexts and to generate positive synergies among conditions for SFM.
- Globalization of markets and investments steer forest-related developments in many countries. It can lead to large-scale land concessions to the detriment of local forest-related development and livelihoods. But these processes can also lead to employment creation in forest-related production or forest-based services. The local context and preconditions for SFM shape the impacts of globalization on local forest management and sustainable forest-related development.
- Outcomes of SFM should be monitored on a continuous basis to detect positive and negative interactions among prerequisite conditions and the mechanisms whereby these interactions lead to changes in local livelihoods and forest conditions. In like manner, policies and measures that may influence the prerequisite conditions for SFM should be tracked, recognizing that adjustments to policies will be required over time to bolster conditions favorable for SFM.

A-23 Transitions to Sustainable Forest Management: Economic, Social, and Cultural Parameters

Organizers: *Jinlong Liu (Renmin University of China), Wil de Jong (Kyoto University, Japan), Yeo-Chang Youn (Seoul National University, Republic of Korea), & De Lu (Asia-Pacific Network on Sustainable Forest Management and Rehabilitation, China)*

Moderator: *Wil De Jong*

This session examined recent studies that shed new light on the comprehensive and dynamic interrelations between forest transition and economic, social, cultural, and political changes and discussed the implication for forest policy and related environmental and climate change policies.

Key findings, discussion points, and knowledge gaps:

- There is a set of factors deriving transition to sustainable forest management, which can be interpreted differently for different countries under different situations.
- Land tenure exerts profound impact on forest cover change.
- Different stakeholders can interpret a policy of the government differently. This is especially so when the implementation is delineated to a lower level of government bodies interacting with local stakeholders.
- In the case of empirical studies, the selection and measurement of variables is critical for meaningful results.
- Women's participation in management decision-making is important.
- The rules need to be adaptive to the social and economic changes of the locality to maintain better forest management.
- Theoretical frameworks are needed for systematic understanding of the relationship between forest transition and economic, social, cultural, and political changes.

A-24 Smallholders and Forest Landscape Transitions: Locally Devised Development Strategies of Tropical America

Organizers: *Benno Pokorny (University of Freiburg, Germany) & Wil de Jong (Kyoto University, Japan)*

Moderators: *Benno Pokorny & Wil de Jong*

This session focused on the responses of peasant communities to the forest development approaches emerging in tropical America's forest landscapes, and the resulting economic, social, and environmental outcomes.

Key findings:

- Tropical America's forest landscapes show a huge diversity of contexts, people, and livelihood strategies.
- When dealing with forested landscapes, it is challenging to overcome the (academic) routine of looking first to forests to identify win-win opportunities and only then to people.
- In current policy contexts, the capacities of smallholders are often insufficient to deal with the livelihood and resource use challenges and to compete with other actor groups.
- However, in some contexts local people have managed to establish feasible livelihood strategies relying on the effective use of natural resources.
- Smallholders do have the potential to contribute to local development but, from a national perspective, capitalized actor groups employing input-intensive land use systems are often providing more attractive benefits.
- A rural development approach that targeting on local and not on national interests would allow local resource uses to more actively influence local development dynamics.

A-25 Reforming Forest Tenure and Governance for Mitigating Climate Change and Improving People's Livelihoods

Organizer: *Runsheng Yin (Michigan State University, USA) & Shashi Kant (University of Toronto, Canada)*

Moderator: *Runsheng Yin*

The session updated recent advances in implementing forest tenure and governance reform based on the experiences of different countries, and addressed the knowledge gaps and policy challenges encountered in the process.

Key findings:

- Forest devolution and tenure reform has gained broad academic attention and made noticeable progress. This is because of its importance to reducing deforestation and forest degradation and increasing forest regeneration and growth in general and the implementation of REDD+ initiatives in particular.
- There has been a great need to recognize and reward carbon rights; however, they may or may not coincide with existing customary or statutory tenure rights. Also, without substantial commitments by developed countries to forest-based climate change mitigation, it seems impractical to expect developing countries to undertake substantive reforms.
- Moreover, it will be a long, complex, and challenging process, implying that it is unrealistic to expect major advances. Regardless of climate change mitigation, international organizations must provide adequate assistance and advice in capacity building and policy design and implementation.
- Gaps remain on how to effectively assess the reform initiatives as well, because of the lack of appropriate frameworks, models, and empirical data. More and better work on the linkages between devolved tenure and governance systems and forest conditions is needed.

A-26 Impact of Tenure Arrangements on Forests, Livelihoods, and Gender Dynamics

Organizers: *Purabi Bose (CIAT, Colombia), Anne Larson (CIFOR, Peru), Han van Dijk (Wageningen University, Netherlands), & Bimbika Sijapati (CIFOR, Indonesia)*

Moderators: *Purabi Bose & Han van Dijk*

This session examined the implications of forest and land tenure reforms in Asia, Africa, and Latin America with emphasis on local institutions, governance, livelihoods, and gender dynamics. The seven presentations represented different country case studies on forest tenure and gender dynamics.

Key findings:

- The presentation by Pam Jagger reported the results a studied 360-village study through the Poverty Environment Network (PEN). The key findings indicated that higher levels of subsistence of income are associated with state-run forests compared to forests run by communities or private individuals.
- Han van Dijk highlighted from his extensive research on dryland forests in Sahelian zone and the impact of conflicts on women. He stressed that lack of access to forest resources impacts women and causes children's malnutrition.
- Purabi Bose's comparative case study on collective forest tenure in India, Bolivia, and Uganda showed that gender difference is not just about men and women, but that differences exist within men and women from different caste, religion, education level, economic status, and power position. However, in general, men usually prefer land to be privately owned while women prefer collective tenure.
- Anne Larson presented collaborative research work on women's participation in Nicaragua using Adaptive Collaborative Management (ACM).
- Madhu Ghimere described progressive reform in Nepal that mandates equal participation of women and men on executive committees, but women are underrepresented.
- Kanna Siriparupu presented his preliminary finding on women's participation in forest committees in the Odisha province of India.
- Aida Lapis highlighted the important role of women and youth in mangrove restorations. Women's involvement in success of rehabilitation is critical.

The key points raised during the discussion included the need for: development of gender-integrated methodologies, more cross-country comparative case studies, and implementation of policies to encourage women's active participation.

A member of the audience in a technical session asks a question

A-27 International to Local Forest Governance: Taking Stock of Theories, Methodologies and Findings

Organizers: *Lukas Giessen (University of Goettingen, Germany), Bas Arts (Wageningen University, Netherlands), Florian Kraxner (International Institute for Applied Systems Analysis, Austria), & Constance McDermott (University of Oxford, UK)*

Moderator: *Lukas Giessen*

This session took stock of innovative theoretical, methodological, and empirical achievements in the broad and growing field of forest governance research, from the local to the global level. The high number of submissions to this session illustrates both the variety of empirical fields that may be covered by forest governance research and the intense scholarly activities from multiple forest science disciplines on questions about how forests are governed.

Key findings:

- High relevance of research on REDD+, FLEGT, and illegal logging at global, regional, national, and sub-national levels.
- Theory-based analytical frameworks are needed for forest governance research analyses; pure descriptions only slightly advance scientific knowledge.
- Analytical frameworks may fruitfully draw on a number of social science disciplines and their theories such as political science, sociology, anthropology, economics and others.
- Governance research is needed on both individual levels and across levels; e.g., applying a multilevel governance perspective.

A-28 Ineffective International Forest Policy? The Role of Forest Information, International Law, and Politics

Organizers: *Lukas Giessen (University of Goettingen, Germany), Georg Winkel (University of Freiburg, Germany), Christoph Kleinn, & Peter-Tobias Stoll (University of Goettingen, Germany)*

Moderator: *Lukas Giessen*

The session included contributions from political science, international law, social psychology, and forest inventory and monitoring. It provided innovative multidisciplinary insights into main factors influencing the effectiveness of international forest policy. The main results include:

- Main factors influencing the effectiveness are international and national forest-related bureaucracies, legal and forest inventory systems, individual decision makers, and wood-related industries.
- Additionally it revealed the importance of clearly defining and justifying the dependent variables as well as being aware of methodological challenges when analyzing the effectiveness of international policies.

A-29 The Knowledge that Counts – Analyzing Science Policy Interactions in Forest Policy

Organizers: *Michael Böcher (Georg-August-University Goettingen, Germany) & Georg Winkel (University of Freiburg, Germany)*

Moderators: *Michael Böcher & Georg Winkel*

The session focused on the interactions between scientific research and forest policymaking and practices, including problems and prospects for scientific knowledge transfer in forest policy and assessment of long-term trends of the science-policy interface.

Key findings:

- Existing science-policy interface models (e.g., the "linear model") have to be seen critically.
- In some countries forest research is not appropriately in accord with the strategic challenges of the forest sector – a strengthening of forest policy/governance research is necessary.
- Forest owners do not always have an interest in research results.
- Ideals of scientific forestry have sometimes crumbled in the face of material, financial, and politico-economic constraints.
- Focusing on management decision tiers provides a more nuanced picture of the forest science-policy nexus.
- Work with Bayesian Belief networks is a promising strategy for advising forest management practices.
- Science policy interactions in forest policy is a highly relevant topic that needs to be further investigated.
- The network of researchers agreed upon meeting again in 2015.

A-30 Achieving Policy Integration Across Fragmented Domains: Forest Policy Perspectives

Organizers: *Karl Hogl (University of Natural Resources and Life Sciences, Austria) & Daniela Kleinschmit (Swedish University of Agriculture Sciences)*

Moderator: *Daniela Kleinschmit*

The goal of the session was to review the state-of-the-art in the policy coordination and integration literature for describing and analyzing the evolving relationships within and among a number of substantive resource policy sectors from a forest policy perspective. All contributions to this session took forest and forest-related policy as a central subject matter. Analogously to the more familiar studies of environmental policy integration (EPI), forest policy is characterized by developments that call for enhancing cross-sectoral and multilevel policy coordination and integration. Furthermore the session considered policy coordination and integration in the wider field of forest-related policies against the background of the literature on policy integration (PI) in general and the rich literature on environmental policy integration in particular.

Issues raised and discussed during the session:

- If policies adjust to another or if one policy dominates another; e.g., if agricultural policy "eats up" forest policy in the landscape approach.
- Policies are easier to integrate when framed as business opportunity.

- The integration of bioenergy policy as environmental integration or economic integration.
- Challenges of multi-stakeholder approach: emergence of new groups and influence from outsiders, competition of different groups of stakeholders, often focused on budgetary issues.
- Collective forest tenure reform in China: unwillingness to coordinate – not obligation; lack of information interaction – little feedback.
- Policies in Europe: reason for not having a forest policy lies with countries of active forest sector; instead, other policies increasingly affect forest policy.
- Ecosystem services help to better approach multi-functionality and understand trade-offs and synergies (allocate the goals in the landscape where they fit the best).
- In different sectors, fundamentally different/competing policy paradigms exist: forestry and timber paradigm in conflict with nature conservation paradigm.
- Substantial policy integration is hard to achieve (lacking interest of important economic players and different policy sectors).
- Policy integration is not an innocent content but a strategic approach.

A-31 Forest Policy Science: From Rational Choice to Discourse, from Local Level Forest Owners to a Global Learning Architecture

Organizers: *Karl Hogl (University of Natural Resources and Life Sciences, Austria), Alexander Buck (IUFRO), & Peter Mayer (Federal Research and Training Centre for Forests, Natural Hazards and Landscape)*

Moderator: *Peter Mayer*

The session was dedicated to the memory of Prof. Dr. Peter Glück and highlighted the theoretical-conceptual work and thematic areas to which Peter significantly contributed in the course of his academic career. These included:

- A discussion on rationalist vs. communicative approaches to forest policy, taking the conceptual work on national forest programs as an example.
- The analysis of the obstacles and challenges in the development of forest owners associations in the Western Balkans.
- The assessment of forest governance in Europe and the pan-European region and possible scenarios for future arrangements.
- The outline of a problem-focused policy learning architecture as a recommendation of IUFRO to the Collaborative Partnership on Forests (CPF).

Key findings:

- Participation is a critical and complex issue when it comes to the design and implementation of national forest programs. A mix of rationalist and communicative approaches has to be considered in their design.
- Political science analysis demonstrates a high interest in the formation of forest owners associations on the Western Balkans; nevertheless the implementation faces obstacles rooted in the policy sphere of the respective countries.
- In the European Union a de-facto common forest policy exists through regulations in various forest-related fields such as climate change and biodiversity. The potential options for the establishment of a more centralized forest policy for Europe range from legal to voluntary as well as mixed scenarios.
- Policy learning can help to overcome constellations of conflict among various stakeholders and is especially applicable as a way forward in international (forest) policy negotiations.

A-32 Innovative Forest and Environmental Legislation for Better Diversity

Organizers: *Peter Herbst (Villach, Austria) & Rastislav Sulek (Zvolen Technical University, Slovak Republic)*

Moderators: *Peter Herbst & Rastislav Sulek*

This session examined contributions, effects, and conflicts between specific forest and other environmental legislation in addressing the challenges and manifold threats to forest biodiversity.

Key findings and discussion points:

- Forests, being a natural resource providing not only forest products but also a number of ecosystem services, need to be considered as an important object of environmental law as a public law, while the issue of property rights in the case of forest resources is also very important. During the session, the legal framework of community forestry of indigenous people in Latin America was broadly discussed and compared with the situation in other parts of the world. Also, special attention was devoted to the development of forest ownership structure in the former Ottoman Empire and present-day Turkey.
- There are many contradictions in both forest legislation as well as environmental (especially nature protection) legislation that need to be dealt with. Considering that forests are the main type of ecosystem in protected areas, it is obvious that especially the legal issues of administration and management of forests in protected areas are of the utmost importance.
- As a number of session participants are actively involved in negotiating processes on a legally binding agreement on forests in Europe, the latest developments in this area were broadly discussed. While there is a general consensus about the significance of such an agreement, the concrete actions toward finalizing this process are not facilitated in a best way possible.

A-33 Richer Economies, Better Environmental Policies? Analyzing the "Environmental Question" in Forest Policy in OECD Countries

Organizers: *Georg Winkel (University of Freiburg, Germany), Cassandra Moseley (University of Oregon, USA), & Metodi Sotirov (University of Freiburg, Germany)*

Moderator: *Cassandra Moseley*

In the last 30 years, forest policy in some OECD countries has been characterized by virulent conflicts between environmental groups and the forest sector. The "spotted owl" controversy in the US Pacific Northwest, the heated debate on Tasmanian forests (Australia), the "Great Bear Rain

Forest" (Canada), or remaining old growth forest in Scandinavian countries have gain much public and scholarly interest. In some cases, these conflicts resulted into major changes in forest policy and had significant effects on societies. In other countries, environmental conflicts in forest policy have been much more hidden and lingering, contained to experts' debates and decision-making.

This session started with the presupposition that there is what one may label an "environmental question" in forest policy in almost all countries that contain managed forestland. Distinct societal perspectives on forest and related interests (e.g., forest as a renewable resource to be managed sustainably versus forest as place for "pristine" wilderness and biodiversity, forest for recreation versus forest for income of land owners) and forest management paradigms coexist in almost all countries, and forest policy is continuously striving for balancing these different stakes, with very different "'outcomes" depending on the country and region. With this session, we sought to shed light into the "environmental question" in forest policy and responses by forest policy makers (i.e., policies and governance arrangements and their effects) in OECD countries. Although this panel had very diverse presentations, a number of common themes did emerge. Most forest policy and management issues discussed did have areas of conflict, but those cleavages do not necessarily break along expected lines, and may not be the same across countries. The adage that politics makes strange bedfellows appears to hold true. For example, in the case of policies banning imports of illegally harvested logs and lumber, we learned that in both the European Union and the United States, success depended on support from the forest products industry, but in the EU it was largely the importers who supported the legislation, apparently to improve their image, whereas as in the US domestic producers support import bans at least in part to protect themselves from low cost imports.

In addition to revealing that similar groups in different countries view policies differently, discussion brought forward examples that make clear that interest "groups" are not homogeneous groups, suggesting that emerging issues such as climate change and bioenergy, in particular, might divide environmental interests and timber interests differently than in the past. For example, environmental organizations focused on biodiversity may see bioenergy development differently than those focused on climate change and renewable energy.

A-34 Forestry Education Serving Science and Practice

Organizers: *Piotr Paschalis-Jakubovicz (Warsaw University of Life Sciences, Poland), Siegfried Lewark (University of Freiburg, Germany), & Yemi Adeyeye (IFSA/Bangor University, UK)*

Moderator: *Piotr Paschalis-Jakubovicz*

The activities of IUFRO and the International Forestry Students' Association (IFSA) as organizations highlighting the importance of forestry education in a changing world were introduced to the audience, followed by eight presentations discussing experiences and insights on forestry education worldwide. They were focusing on the development of new education strategies for improving higher forestry education, including new approaches to distance education, technology and didactic of e-learning, movement toward Open Education Resources (OER), and the growing role of universities in continuing education.

Key findings:

- Greater effort is needed toward improving the understanding and interest of high school students to increase undergraduate enrollment in undergraduate natural resources programs.
- Young leadership programs and other forms of development capacities are needed to enhance the transition of students into professional careers.
- Problems faced in forestry education such as financing, aging, new standards, separation from modern practices, and limited opportunities to exchange knowledge were discussed. These problems were highlighted by presenters referring to the current situation in Africa and Russia.
- It has been questioned if the skills, knowledge, and learning outcomes of a university degree coincide with the needs of future employers.
- Modernization and other improvements in forestry education were highlighted as urgent needs.
- Presenter and participants agreed on the need for adjusting forestry education and making forestry more attractive to young people, stakeholders, and professionals, but also for university teachers, and students. All of them have to act jointly and work together.
- A stronger collaboration related to education in the field of forestry was suggested as a future Joint IUFRO/IFSA Task Force.

A-35 The Social Education of Foresters

Organizers: *Lisa Hansen (IFSA/University of British Columbia, Canada) & Louise Fortmann (University of California at Berkeley, USA)*

Moderator: *Siegfried Lewark (University of Freiburg, Germany)*

This technical session outlined the importance of social science education for foresters, where the problems lie, what are the barriers to change, how to break these barriers, providing successful examples of the integration of social sciences into forestry curricula. It placed particular emphasis on the changes in learning outcomes that are needed to meet the needs of tomorrow's foresters, and examined how these changes might best be accommodated within forestry curricula.

Key findings and discussion points:

- A sound understanding of social sciences including (but not limited to) gender issues, property rights, cultural history, local institutions, economic systems, and social networks are important for foresters and natural resource management professionals as management, business, and policy development is more likely to succeed smoothly, with due consideration of social needs prior to implementation.
- Many forestry professionals today are lacking sufficient training in public consultation techniques and tools for holding effective community meetings/focus groups that are necessary (in some cases by law) or to effectively implement new landscape management plans (i.e., landscape restoration, fire management, land use management zoning for agricultural practices). Young resource management professionals should have these soft skills in community organizing, meeting facilitation, communications, qualitative data management, and analysis. Many of these skills are learned on the job, rather than in post-secondary institutions. The social sciences offer a variety of tools and technologies for studying humans and their relationship to the

environment and natural resources. These basic concepts should be taught to forestry and natural resource management students.

- Social scientists within forestry faculties/schools are generally under-represented worldwide and many social foresters are severely challenged to find work within forestry schools. However, there are some significant regional and institutional differences.
- There are significant differences in what faculty members expect students to know, what students expect to learn, and what employers expect from prospective employees. Education programs should be to clarify and bridge the gaps between these differences.
- Change is difficult and is possible if faculty members begin to support the idea that change is needed. Transformation requires a sense of urgency; pressure needs to be created by senior institutional staff, employers, and students alike.
- While some universities would be challenged to hire sufficient new faculty to modify education programs, gaps could be filled through online courses offered at institutions in a collaborative manner, whereby students could receive equivalent credit for these courses at their home institutions.

A-36 From Data to Knowledge, Geospatial Tools and Information Access

Organizers: *Carla Heister (Yale University, USA), Dave Vanderzanden (US Forest Service), Gillian Petrokofsky (Oxford University, UK) & Kevin Megown (US Forest Service)*

Moderator: *Carla Heister (USA)*

Data and information function both as components within the research process and as derived products from the research process. How data and information are organized, discovered, and made available for use was the theme of this session.

Key findings:

- The National Forest Information System for Greece will provide authoritative data by 2020.
- Librarians give research teams a strong component for information discovery.
- The Remote Sensing Applications Center (USFS) serves GIS data to both the research and public communities.
- GIS model development distills many layers of GIS to produce an information-rich product.
- Latin American land cover change data as developed by the Terra-I project is very accurate as validated by groundtruthing.
- The Landscape Change Monitoring System (USFS) provides land cover and land use data for the US
- The interactive Forest Atlas of the United States was released at IUFRO.
- Evidence Based Forestry will provide the best science so that strong expert opinion can work to meet societal needs.

A-37 Knowledge Exchange and Communication of Forest Research for Human and Community Well-Being

Organizers: *Cynthia Miner (US Forest Service), Jurij Begus (Slovenia Forest Service), Guy Smith (NRCan – Canadian Wood Fibre Centre), & Alejandra Real (National Forestry Corporation, Chile)*

Moderators: *Cynthia Miner & James Johnson (USA)*

Regardless of the domain of knowledge, from biophysical to socioeconomic, knowledge exchange and communication ultimately determine the effective application of research and subsequent benefits to humankind. This session focused on processes used to communicate and implement research findings in policies, programs, and practices for maintaining and enhancing human health and community well-being. Research findings, case studies, and program examples examined the human dimensions of sharing and using knowledge. Eight oral and seven poster presentations were followed by a panel session with rich discussion and reflection.

Key findings:

- Asymmetrical relations existed between regional and national reporters during coverage of COP10. National level reporters were less informed and more conflict oriented in Japan.
- The stakeholder interface in climate change adaption research resulted in change to forest management strategies and concrete recommendations and was enhanced by embedding local knowledge with scientific information in a case study from Sweden.
- Experts and novices view images differently regarding their perceptions of biodiversity in Sweden.
- European forest pedagogy provided a basis for developing an effective children's education program in Slovakia.
- The Forestry Research Institute of Nigeria has made significant impact on the well-being of neighboring communities including job creation and increase in income.
- Training for the forestry sector in Guyana resulted in better cooperation between local populations and people working in the forestry sector.
- Systematic, evidence-based review of key issues for family forest owners in the US highlighted issues of forest management planning, riparian management, climate change, invasive species, and intergenerational planning, which was the highest expressed concern.
- Homeowners generally had accurate perceptions of the risk their homes face from wildfire and took action primarily in response to information from their local fire departments versus other information sources including neighbors and forest-related agencies in a US study.

Challenges identified during the panel discussion:

- The real needs of people and the particular communities they form need to be understood in communications and knowledge exchange. Most of the world's people remain closely tied to the communities in which they live.
- The pace of change in how people get information impacts how extension and communication specialists reach targeted audiences. The power is in the networks that our devices are able to access and use. There is rapid movement toward open data and on-line sharing

of information – particularly maps and related spatial data – and of applications for manipulating data from many sources to address particular questions and needs.

- New technologies offer ways to better engage many audiences and need to be explored in communicating research. Today's youth, quick and ready to access networks and download and use apps, will grow up expecting to have access to useable information from varied sources.
- Science policy integration was a common theme as was the need for collaboration among various stakeholders. When communicating research findings especially to policy and decision makers, it is useful to present a broader picture by means of synthesis reports together with policy briefs in a non-technical language.

A-38 How to Make Forest Science Available for All? Publishers', Editors', and Authors' Challenges

Organizers: *Pekka Nygren (Finnish Society of Forest Science) & Eeva Korpilahti (Finnish Forest Research Institute)*

Moderator: *Annika Kangas (Finland)*

The eight presentations included in this session dealt with the problems of publishing scientific knowledge from different perspectives. The talks covered the development of journals, publications, and submissions; benefits and drawbacks of open access publishing as well as electronic and traditional publishing; and possibilities to promote either interesting papers from the journal's perspective or from the author's perspective, and the problems of disseminating the scientific results to the end users.

Key findings:

- The number of submissions has grown exponentially during the last 10 years, and the number of journals and published papers has doubled in that time. It means that the number of review reports needed has also increased exponentially. The rejection rates have also increased, and the result of this is that same papers are reviewed several times in several journals.
- Open access publications are very important, especially in the developing countries. There is a danger, however, that the availability of the publications will be a more important factor in what publications are actually read and cited than the quality of the research.
- The articles can be promoted in several ways, either by the journal or by the authors. For instance the journal may ask reviewers to develop their reviews to commentaries that are also reviewed and published with open access. The authors may promote their work for instance on Facebook and Twitter. The promoted works do get more downloads and citations than average papers. This increases the visibility of science, but there is also a danger that what gets cited is not the best research but the most actively promoted research.
- Electronic publishing means that there is a danger that the publications will vanish if the journals are not published anymore. The publishers need to arrange the archiving of the science, as libraries do not necessarily do that to electronic publications in the same way as for paper publications.
- As the number of publications and journals keeps rising, and some of the publications may have dubious quality, it will be more and more difficult for the end users to find relevant and reliable information from among the publications. It will be more and more important to publish also short syntheses of the publications that are based on reliable science.

Forest Biodiversity and Ecosystem Services

B-01 The Future of Ecosystem Services from Forests

Organizers: *William Nikolakis & John Innes (University of British Columbia, Canada)*

Moderator: *John Innes*

This session examined progress in the development of payments for forest ecosystem services. Papers covered the range of options, from regulatory to market-based approaches. In some cases, cash payments are being made for the provision of ecosystem services. In others, the mandates of government organizations have been changed to recognize the value of ecosystem services but without actually generating cash payments. A number of good examples now exist, such as water rights in Australia, water and ecotourism in Vietnam, and various forms of mitigation banking, but it is evident that a "one size fits all" approach is inappropriate. Even within a country, there may be major differences in the costs and threats associated with ecosystem services, raising the possibility of negative opportunity costs in some areas. Sorting out these problems is an urgent priority as forests and the many services that they provide continue to be grossly undervalued, resulting in their conversion to other forms of land use.

Key findings:

- Market failures are leading to the wasteful consumption of ecosystems.
- Many systems of payments for ecosystem services are now operational around the world, and many of the earlier problems have been resolved.
- Care is needed in academic studies of ecosystem services, since many factors can affect the responses of participants in, for example, choice experiments.
- As services become better priced, conflicts may arise because some more traditional uses may no longer be competitive.
- There is a need for credible conditionality.
- Various models exist, such as the DEFRA offsetting model. These can be used to gain good ideas of offsets.
- Even when there are no cash transactions, the concept of ecosystem services can be important in helping people change the way they think about ecosystems, enabling them to better grasp the range of services that ecosystems can provide, and the trade-offs between these.

B-02 Urban Forest Diversity and Ecosystem Services

Organizers: *David Nowak (US Forest Service) & Wesley Kocher (International Society of Arboriculture, USA)*

Moderator: *David Nowak*

Urban trees and forests provide numerous ecosystem services and substantial value to the majority of the people in the world and these services are critical to maintaining the health and well-being of the

urban environment and its human population. These services and values are directly dependent upon the urban forest structure and species composition/diversity within urban areas. However, due to several factors, the vegetation composition within urban areas is changing, which will impact the ecosystem services provided to current and future generations. As relatively little is known on urban tree species diversity and its impact on ecosystem services, this session will provide the latest research on species diversity in cities across the globe, ecosystem services provided by urban trees, how the urban forest composition and species diversity affects various ecosystem services and values, and how the urban forest composition and species diversity are and likely will change in the future. Information provided by this session can be used to help guide future research and policies related to sustaining critical ecosystem services provided by urban trees and forests.

Key findings:

- Urban forest values in the United States related to air pollution removal, carbon sequestration and avoided energy use and associated emissions is estimated at over $15 billion per year.
- Urban tree species richness and diversity is often higher than in rural forests.
- Urban forests and associated species diversity are likely to change due to development, climate change, insects/diseases and invasive species.
- β Diversity of tree species among cities is still high and mainly affected by climates, distances, and established times.
- Some of the most common urban tree species globally are black locust, cherry plum, weeping willow, and ginkgo.
- Park planting in cities in the mid- to late 1880s significantly affected species diversity.
- Development density, distance from development, and land ownership impact forest attributes.
- Species diversity and richness in the Chicago region is highest on residential land.
- Species diversity and richness in Baton Rouge, Louisiana, is highest on residential land.
- Ozone uptake by urban trees on a per leaf area basis are greatest for elm spp., live oak, and American basswood.
- Photosynthesis of three species under flooding had an increased trend when the CO2 level elevated, but the rates were lower than that of the control.
- Among three species, in general, live oak was least affected by flood treatments and sawtooth oak was most affected.
- There is a growing body of literature on the impacts of urban forests and nature in metropolitan areas on human health and wellness.

B-03 Providing Ecosystem Services Under Climate Change: Community of Practice of Forest Decision Support Systems

Organizers: *Harald Vacik (University of Natural Resources and Life Sciences, Austria), Jose Borges & Jordi Garcia-Gonzalo (Technical University of Lisbon, Portugal), & Lujsk-Ola Eriksson (Swedish University of Agricultural Sciences)*

Moderators: *Harald Vacik & Jose Borges*

The session explored how Decision Support Systems (DSS) are currently designed and applied for a sustained provision of ecosystem services under climate change, ranging from examples in the US and Europe, focusing on different contexts. Presenters provided an overview about the different models, methods, and techniques applied to support decision-making under changing environmental conditions and the challenges they have to tackle in tailoring the DSS to the needs of the decision makers. The network of 120 experts from 26 countries in Africa, America, Asia, and Europe provides a large repository of lessons learned for the design of DSS, which is shared via the Community of Practice of Forest Decision Support Systems.

Key findings:

- There is a strong need for DSS to consider growth models and ecosystem models that can address changing environmental conditions, including biotic and abiotic disturbance agents, and allow evaluations of multiple ecosystem services.
- DSS should provide frameworks that allow consideration of uncertainties in decision-making and provide possibilities for risk evaluation.
- There is a strong need to include decision makers and DSS users in the design of the DSS from the very beginning in order to meet their demands.
- DSS increases transparency of decision-making processes, supports formal evaluation of decision alternatives, and allows inclusion of various stakeholders and actors in decision-making.
- There is a dilemma in addressing all aspects of the complex decision-making contexts in forest management while still trying to design simple applications according to user demands.
- Members of the Community of Practice on Forest Decision Support Systems (www.forestdss.org) should share their expertise in applying models, methods, techniques, and frameworks for developing and applying DSSes to provide lessons learned.

B-04 Long-Term Forest Research on Forest Ecosystem Management

Organizers: *Hosang Kang (Seoul National University, Republic of Korea), Xingguo Han (Institute of Applied Ecology, Chinese Academy of Sciences), & Björn Hånell (Swedish University of Agricultural Sciences)*

Moderators: *Hosang Kang & Batkhuu Nyam-Osor (National University of Mongolia)*

This session provided a forum for scientists engaged in long-term interdisciplinary forest research to share their experiences and to promote cross-site research collaboration and networking to examine key research questions at larger scales.

Key findings and discussion points:

- Long-term investigations are needed to understand forest stand dynamics, thinning effect, appropriate harvest system, monitoring of biodiversity as a bioindicator for protected area management, and development of growth modeling for sustainable forest management.
- There are many long-term research networks at the regional level (e.g., in tropical forests, EU, LTER, Model Forest) and it is necessary share

their experiences, knowledge, and information through a global network on long-term forest research on forest ecosystem management.

- Working Party 1.01.13 "Long-term research on forest ecosystem management in Northeast Asia" will organize an international workshop and invite researchers from other regions to share current research activities and develop a global network. Further work in this field will benefit from involvement of colleagues in other IUFRO Divisions (e.g., Divisions 4 and 8).

B-05 The Benefits of Introducing the Ecosystem Service Concept in Forest Management and Planning at Different Spatial Scales

Organizers: *Sandra Luque (IRSTEA, France) & Christine Fürst (ZEF Uni Bonn, Germany)*

Moderators: *Sandra Luque & Christine Fürst*

This session examined how the distribution of ecosystem services and their monetary and non-monetary values can be influenced by changing scenarios (land use, climate) at different spatial scales, and the development of methodologies for mapping indicators that can be directly related to environmental policy assessments. The session aimed to provide a menu of scale dependent solutions to operationalize ecosystem services for application by decision makers at different policy levels, and for local and regional practitioners including land, water, and nature managers linked to forest activities at different levels of implementation.

Key questions and findings:

- How helpful is the concept of ES compared to the concepts of multifunctionality and sustainability? Are these complementary or are there major differences?
- Useful because it provides a broadened perspective while enabling actors with different backgrounds to exchange on values by: (a) solving the vagueness of the sustainability concept; (b) refining "languages" and being more specific; and (c) showing the dependence between (ecological) process outcomes and societal benefits.
- Qualitative and quantitative assessment approaches can easily be combined and support integration of highly different values (place-based, culturally specific, subjective perceptions).
- Less problematic than sustainability, ESes can be more objectively compared across different scales and consider trade-offs between expectations of different actors at different decision levels (non-exclusive) => services bundles that address multiple needs.
- Problems persist to define what is a good (sustainable) provision or consumption of a service; this is not possible without deep understanding of ecological processes.
- There is still a need to explain better the concept to policy/decision makers that might not understand non-market and cultural value systems.

What are major requests to adapt or improve and introduce the ES concept in multi-scale decision processes? What role can forestry overtake and how can we learn from 200 years of SFM for the benefit of today's and future societies?

- Need to combine spatial modeling and spatial approaches with stakeholders, knowledge and analysis; the latter should include rating and valuing exercises to integrate contextual cultural perspectives (mapping as a key instrument).
- Aspects of socio-ecological vulnerability and land system resilience need to be included.
- Different temporal and spatial scales need to be considered.
- Acceptance that even ES–based assessments do not deliver singular "best solutions," but an array of options to adapt or change land use and management.

Can payments for ecosystem services (PES) provide a substantially new and successful instrument to enhance SFM especially in small-scale (private) forests? What can we learn from success and failure examples? What additional instruments (governance) would we need?

- PES does not solve the problem of responsibilities for ecosystems and the question of who should pay needs to be answered.
- Capacity building and awareness rising at different scales were identified as very important; such activities should involve the active participation of both the providers and users of ecosystem services to define appropriate compensation options.
- Costs and compensation needs are greatly scale dependent; therefore, general price for one ESS is not overall transferrable.
- Positive example is ecotourism where demanders and beneficiaries experience mutual benefit by creating a market model or common ground based on ESes.

B-06 Research and Management Implications of the Economics of Ecosystem Services

Organizers: *Donald Hodges (University of Tennessee, USA), Donald Grebner (Mississippi State University, USA), & Runsheng Yin (Michigan State University, USA)*

Moderators: *Donald Hodges & Donald Grebner*

This two-part session included presentations focused on research and management related to the economic and accounting aspects of ecosystem services, including the effects on management decisions.

Key findings:

- Compensation of socio-environment benefits can lead to an obvious improvement of the rents and socioeconomic and structural conditions of local communities.
- Methods of measuring the socioeconomic importance of ecosystems services depend on data availability as well as matching the appropriate data to the right ecosystem service.
- Evaluating the effects of forest management strategies on human communities and landscapes requires a multi-criteria methodology and input from multiple stakeholders for effective decision-making.
- Although the value of biodiversity protection often assumes independence of geographical and political jurisdiction, recent research suggests otherwise. The willingness to pay for biodiversity protection as a public good depends on nationality and distance scales.
- Emphasis should be on bringing ecologists and economists together to

more effectively make management decisions. Using economic tools such as a production possibilities frontier can achieve consensus.

- Public stakeholders are able to bear higher opportunity costs than private landowners and provide greater ecological benefits.
- To manage forests for ecosystem services, a multifaceted approach that measures people's preferences toward different services is necessary. Discrete choice models are useful tools to address these issues.
- In some locations, historical land use issues create barriers for potential afforested lands.
- Sequestering forest carbon is a viable economic activity in countries such as Brazil.
- Revenue generation flows from ecosystem services has been lacking in developing countries due to both legal and illegal logging.

B-07 Silvicultural Practices to Facilitate Forest Restoration

Organizers: *Byung Bae Park (Chungnam National University, Republic of Korea), Palle Madsen (University of Copenhagen, Denmark), & Bryan Finegan (CATIE, Costa Rica)*

Moderator: *Palle Madsen*

Historically, a wide variety of forest regeneration methods originating from silvicultural practices have been used for the restoration efforts depending on site conditions management goals. However, silviculture and forest restoration – particularly afforestation – are usually viewed as separate situations with different sets of methods and practices to facilitate the survival and growth of the regeneration – artificial as well as natural regeneration. This two-part session examined current research and practical experiences on silvicultural methods (ranging from regeneration establishment to harvesting systems) used to facilitate forest restoration and management to better respond and adapt to challenges across site conditions and climatic zones and with a view to climate change. It included a total of 16 oral presentations as well as a guided poster tour across those of the 21 posters covering these topics based on research in both temperate and tropical regions.

Key topics discussed included:

- Terminology overview as well as identification of relevant strategies, methods and techniques.
- Restoration and establishment of desired forest and forest landscape structures.
- Regeneration techniques – direct seeding, planting, and natural regeneration.
- Use of nurse crops and pioneer species to restore forest conditions and facilitate late-successional species.
- Restoration or reintroduction of native species.
- Restoring fire regimes to reduce fire hazards and support biodiversity;
- Disease-management.
- Restoration to support biodiversity by various silvicultural systems and thinning regimes.

B-08 Forest Regeneration: Challenges and Prospects

Organizer: *Magnus Löf (Swedish University of Agricultural Sciences)*

Moderator: *Magnus Löf*

Regeneration is a key to perpetuating and improving our forests, and for forest restoration the tree regeneration phase offers the best opportunity to change tree species and ecosystem structure. This session included nine presentations of inspirational research from six continents.

Key findings:

- Spot-wise fire can be used as an effective site preparation method for some Eucalyptus species.
- Browsing and grazing strongly affects the outcome of regeneration at many places.
- Conversion of planted conifers to native broadleaves (rehabilitation) does not only occur in Europe, but nowadays also in other countries; e.g., Japan.
- Restoration and regeneration after stand-replacement fire may have the benefit of leaving the dead trees, logs, etc. rather than cleaning up the site and then regenerating it, which also costs more.
- For many tree species to be used during forest restoration, we lack general knowledge about their regeneration requirements, patterns, and processes.

B-09 What Future for Tropical Silviculture?

Organizers: *Robert Nasi (CIFOR, Indonesia) & Plinio Sist (CIRAD, France)*

Moderators: *Robert Nasi & Plinio Sist*

This session presented experimental data on the sustainability of selective logging and plantation forest management in the tropics, with an emphasis on the impact of tropical silviculture on biodiversity, biomass production, and ecological processes of natural and planted forests. The presentations were very diverse and covered the three continents where tropical forests are found. They included studies on a variety of harvesting systems and their impacts on timber volume reconstitution and environmental services such as carbon storage and biodiversity.

Key findings:

- Currently, about 400 million hectares of tropical moist forests worldwide are designated as production forests, about a quarter of which are managed by rural communities and indigenous peoples. There is now clear evidence that, with current logging practices, timber volumes will decline after the first harvest unless the pool of species harvested is expanded or the minimum cutting diameter is reduced.
- We are seeing a gradual impoverishment of forest resources inside forests that were selectively logged 30 to 40 years ago. In these forests, the volume of timber extracted over the first cutting cycle was mostly from large trees that grew over several centuries in the absence of strong anthropological pressures. Today, in many forests likely to be logged for the second felling cycle, that volume has not been reconstituted and, in many cases, the young trees expected to make up the next harvest are largely lacking in numbers as no silvicultural treatments have been undertaken.

- Tropical forest management was long dominated by logging companies that managed large concessions. However, it is estimated that approximately 800 million people in rural areas worldwide obtain important contributions to their incomes through extraction of timber and other forest products.
- The involvement of different actors in the management of natural tropical forest is undoubtedly one of the key issues in promoting large-scale SFM and preserving forests from degradation and conversion in the future. The so-called community-based forest management (CBFM) must therefore be developed to contribute more actively to the forestry sector than in the past, when logging companies were the main supplier of timber.
- Because of the increasing role of rural population in forest management, multiple-use forest management systems conciliating timber harvesting and non-timber forest products are likely to increase in the future. The examples of Brazilian nuts in Brazil and Peru presented in the session suggest that logging is compatible with the production of Brazil nuts and, through canopy opening created by felling, it can even stimulate the regeneration of this tree.
- Plantation in degraded deforested land can be an alternative for wood production while releasing the pressure on natural forest. However, forest plantations alone are not likely to solve the problem of deforestation nor replace highquality timber production provided by natural forests.

B-10 How Does Biodiversity Help to Manage High-Value Timber Species, and Vice-Versa?

Organizers: *Sheila Ward (Mahogany for the Future, Puerto Rico/USA), Emmanuel Opuni-Frimpong (Forest Research Institute of Ghana), & Nicholas Brokaw (University of Puerto Rico, USA)*

Moderators: *Nicholas Brokaw & Emmanuel Opuni-Frimpong*

Increasing demands for both production of timber and biodiversity conservation create conflict in the provision of these ecological services. This session aimed to explore how biodiversity can positively impact management of high-value timber species (e.g., protection from pests and pathogens) and, conversely, how management for high-value species helps conserve biodiversity (e.g., how planted forests can conserve biodiversity).

Presenters in this session covered both tropical and temperate species and hailed from Belgium, Costa Rica, Czech Republic, Germany, Ghana, Indonesia, Japan, Sweden, Nigeria, the Republic of Korea, and Switzerland.

Key findings:

- A species-diverse forest can be compatible with producing quality timber (quantitative analysis of forest stands over Europe, and in the Czech Republic).
- Multispecies plantings of rare valuable species in patches are useful for both forest restoration and timber production (disappearing indigenous species in Cameroon).
- Valuable timber species themselves can be the biodiversity in need of conservation (Sorbus in Europe, Cedrela montana in Ecuador, African mahoganies in Ghana).
- Focused management can promote biological and structural diversity as well as valuable species (single-tree management in Japan, clustered oak plantings in Germany).
- Restoration of productive forests could promote both biodiversity and valuable timbers (broadleaf species in Sweden).
- Plantations can provide refuge for some biodiversity (Gmelina arborea in Nigeria and Swietenia macrophylla in the Philippines).
- Interactions with biodiversity can be very complex (specialist moth herbivore probably reduces the density of S. macrophylla in Amazonia, promoting a more diverse forest composition).
- Mixed plantations may result in better growth of valuable species than in monocultures (Khaya grandifoliola in Ghana).
- Management for both biodiversity and timber production may require a mixture of stands with management practices focused on different ends (Congo basin).
- However, our understanding of how to manage for positive synergy between high-value timbers and biodiversity has a long way to go.

B-11 Forest Management for Wildlife Conservation

Organizers: *Thomas Rooney (Wright State University, USA) & Nobuhiro Akashi (Hokkaido Research Organization, Japan)*

Moderator: *Thomas Rooney*

This session featured recent studies from around the world that highlighted the importance of forest management for wildlife conservation, an increasingly important issue in research and for managers

This session covered forest management for wildlife in the broadest sense. Wildlife included deer, bats, beetles, reindeer, bees, and birds. Some researchers examined how forest stand development affected wildlife, and others looked at how some wildlife (white-tailed and sika deer) in turn could affect stand development. Forest management is better informed and ultimately improved when wildlife needs are explicitly incorporated into management plans.

B-12 Forest Management in Montane Communities

Organizers: *Pil Sun Park (Seoul National University, Republic of Korea), Raffaele Cavalli (University of Padua, Italy), Roberto Tognetti (University of Molise, Italy), & Karl Stampfer (University of Natural Resources and Life Sciences, Austria)*

Moderator: *Pil Sun Park & Raffaele Cavalli*

The session dealt with scientific findings on the structure, function of mountain forest ecosystems and engineering operations and management activities in mountain forests.

Key findings:

- Governance of mountain forests of diverse European countries was reviewed and the development of integrated multifunctional governance was found to be necessary across the region.
- Mountain forests are closely connected to lives of local people inside or near them. More research and information transfer should be conducted

on mountain forests to conserve, use, and protect the region as well as improve the life of people in it.

- Mountain forests become more important in the role of providing services and goods. Technologies for forest management and forest engineering in mountain forests such as logging systems have been developed to fit to the local characteristics. Meanwhile, technology transfer and adaptation of the technology to the field are key issues in mountain forest management, especially in developing countries.

B-13 Oak Regeneration to Maintain Biodiversity Around the World

Organizers: *Kurt Gottschalk, Brian Lockhart (US Forest Service), Aytekin Ertas (Istanbul University, Turkey), & Eduard Hochbichler (University of Natural Resources and Life Sciences, Austria)*

Moderator: *Kurt Gottschalk*

This session provided summaries of the importance of oak for biodiversity and ecosystem services and of oak regeneration issues and solutions in several regions of the world. The session started with a review of the large diversity within oaks around the world and then a summary of the importance of oaks for maintaining biodiversity. Specific papers then addressed the need to maintain oak forests in protected areas in Sweden, a review of oak direct seeding in the USA and Europe, the use of prescribed fire as a silvicultural treatment to sustain oak forests, large-scale regeneration patterns and issues in Spain, the use of nest and cluster planting to foster oak in Germany, the light environment of gaps to develop oak regeneration in China, and the biodiversity of leaf minors and gall insects on oak in Hungary.

Key findings:

- Oak forests around the world share many commonalities while also having regional and local site differences.
- One commonality is their importance in supporting biodiversity.
- Oak forests in many areas provide important social values in addition to their biological values.
- Land use changes due to humans have changed disturbance patterns such that they no longer support oak regeneration in areas dominated by oak forests.
- Silvicultural treatments that mimic natural disturbances can be used to encourage natural regeneration.
- Grazing and other human disturbances can hinder regeneration.
- Planting and direct seeding are viable alternatives for obtaining oak regeneration in some regions.
- Better information on oak genetics and systematics is needed to help understand the ecological and silvicultural processes needed for oak management.
- Long-term research on regeneration treatments are needed in many regions of the world.

B-14 Ecosystem Services Provided by Planted Forests

Organizers: *Peter Freer-Smith (Forest Research, UK), Eckehard Brockerhoff (Scion, New Zealand), & Jean-Michel Carnus (National Institute for Environmental and Agricultural Science and Research, France)*

Moderator: *Peter Freer-Smith*

This session focused on new research from around the world on the range of ecosystem services provided by planted forests, the valuation of ecosystem services, and their relevance to forest management and policy. Presentations were made by nine speakers from France, Germany, Ireland, Japan, Brazil, UK, Portugal, New Zealand, and the Unites States.

The first presentation covered the conclusions of the 3rd International Congress on Planted Forests held at Estoril, Portugal, in 2013. The next three papers covered individual ecosystem services (ES) – productivity, provision of habitat, and pollination services. Three papers then considered the evaluation and delivery of ES at the landscape scale, with the last of these also introducing some examples of commercial sponsorship of ES delivery. The eighth paper considered economic valuation of ES and the last looked at managing forests worldwide for provision of ESes. Together these presentations covered a wide geographical range and a comprehensive consideration of valuation of ecosystem services and their relevance to forest management and policy.

Key findings and knowledge gaps:

- The session showed that progress is being made on the valuation of ESes, in management approaches and planning to optimize their delivery from forestry.
- The presentations provided strong evidence of the mechanistic link between productivity and the delivery of other ESes; for example, high tree species diversity and good adaptive management will deliver high productivity, higher biodiversity, high resilience against abiotic and biotic risks, better conservation, and higher recreational value.
- The ES approach is clearly a conceptual advance on sustainable forest management achieved via Forest Certification schemes. The approach allows us to consider cost sharing, forest planning, and land use to achieve optimal benefits in forestry. The ESes paradigm fits well with the promotion of planted forests and resonates with stakeholders. Planted forests have a strong role to play in the delivery of landscape scale and multisectoral provision of ESes.
- However, significant knowledge gaps exist in the quantification of ESes and the approach is not yet having sufficient impact on forest policy and land use decisions. Progress needs to be made in applying the ES concept so that it influences land use planners and policy makers across sectors – the ability of the ES approach to achieve better cross-sectoral solutions is critical.

B-15 Forest Ecosystem Services Contributing to Agriculture

Organizers: *Kimiko Okabe (Forestry and Forest Products Research Institute, Japan) & Ian Thompson (NRCan-Canadian Forest Service)*

Moderators: *Kimiko Okabe & Ian Thompson*

This session examined the role of forests in sustaining agricultural livelihoods and the role of landscape management planning to address the social and economic drivers of deforestation in agricultural landscapes and optimize provision of forest ecosystem services to agricultural communities.

Key findings:

- Forests are important for agriculture in a number of respects, including their physical importance such as shade trees, providing nutrition as well as detoxification of soil and water around agricultural area, and providing pollinators and natural enemies.
- Quantification of relevant distance between forests and farmlands and sizes of forests required to obtain forest ecosystem services from forests could be different in regions but are not yet well known.

B-16 Contribution of Genetics and Genomics to Conservation and Sustainable Management of Forests Under Changing Environmental Conditions

Organizers: *Om Rajora (University of New Brunswick, Canada) & Wickneswari Ratnam (Universiti Kebangsaan, Malaysia)*

Moderator: *Om Rajora*

This session explored the impacts of and future directions for forest genetics and genomics research on the genetic improvement, conservation, and sustainable management of forest genetic resources and understanding adaptation in forest trees and their responses to climate and environmental change. There were two sessions. The presentations spanned over structural, functional, and population genomics; population, conservation, evolutionary, and quantitative genetics; cytogenetics; and genetic improvement aspects of forest trees.

Key findings:

- Climate and environment changes are subjecting our forests to significant stresses, and climate change is creating a mismatch between locally adapted populations and their environments. It is, therefore, essential to understand the genetic/genomic basis of local adaptation, responses, and adaptation of forest trees to these changing climate and environmental conditions. Genomics research and technologies in conjunction with phenotypic, eco-physiological and climate data provide powerful tools and opportunities to understandthe genetic/genomic basis of local adaptation (e.g., along different temperature and moisture gradients), responses and adaptation of forest trees to changing climate and environmental conditions, and designing assisted gene flow strategies to track changing climate conditions, thus assisting conservation and sustainable management of forest resources.
- A large number of genes involved in many molecular functions and biological processes are expressed differentially in response to climate change conditions in black spruce. Several genes showed adaptive response to sulfate air pollution in red spruce. This work assisted in understanding the responses and adaptation of spruce to changing climate and environment conditions.
- Tree species are ideal candidates for "assisted gene flow," the movement of pre-adapted individuals within species ranges, for reforestation or restoration to track climate change, as shown in lodgepole pine and interior spruce by genomics studies.
- Functional genome-wide variation was identified in loblolly pine breeding populations phenotyped previously for many adaptive traits using SNP genotyping and genotyping-by-sequencing. This work has significance in understanding local adaptation, and conservation and tree breeding.
- A study of range-wide molecular and chemical variation of medicinally important and endangered African species Prunus africana, assisted in understanding its genetic differentiation and phylogeography, and provided information for designing conservation strategies. Understanding fine-scale spatial genetic structure and past and current gene dispersal could assist to develop appropriate seed sourcing and tree stand management strategies in this species.
- Ponderosa pine exhibits complicated patterns of morphological and genetic variation. A range-wide study using nuclear and mitochondrial genetic markers provided surprising insights into its evolutionary history and phylogeography, which is of conservation and management importance.
- Precipitation and/or maximum annual temperature gradients were shown to be the key environmental factors affecting growth productivity of forest trees.
- There is a need for educational materials that can be used by non-specialists to increase the knowledge and awareness of the value of integrating genetic considerations into conservation and sustainable management of trees and forests. Bioversity International has developed thematic training modules to fill this gap.
- Karyological studies in Picea species demonstrated the occurrence of B chromosomes is common in several species, and B chromosomes may have a role in adaptation of species and populations.
- A DNA markers-based timber tracking system has been developed for Koompassia malaccensis in Malaysia. (Lee). Such a system could be developed and used for a wide variety of tree species.
- Trembling aspen in the western US is genetically distinct from that in the rest of its range, and a large portion of it is triploid, including many of the largest clones. Genetic evidence indicates that seed-based reproduction is important, which could increase the adaptive potential of this species.
- Provenance and progeny tests of Eucalyptus robusta in Madagascar showed that the wood volume could be doubled by selecting the best provenance for a specific site.
- Site characteristics that explain variation in Douglas-fir productivity, stem form, and adaptability could be identified by progeny tests.

At the end of the session, through a lively discussion, it was concluded that genetic and genomics research and applications can contribute significantly to breeding, genetic improvement, conservation, and sustainable management of forest resources, especially under changing climate and environmental conditions.

B-17 Salamanders: World Icons of Aquatic Biodiversity in Forests

Organizer: *Deanna Olson (US Forest Service)*

Moderator: *Deanna Olson*

Almost 70% of world amphibians have associations with forests and woodlands. In particular, salamanders are iconic symbols of forest biodiversity, including the giant salamanders of Asia and America, which

attain sizes measured in meters; the fire salamanders of Europe, known to emerge from ancient people's fires due to their associations with down wood; the newts, which proudly swanker along the forest floor in broad daylight due to their toxic skin, rendering them immune to predators; the pond-breeding mole salamanders, for which inter-pond connectivity is of paramount importance for their persistence; and the woodland salamanders, which are nocturnal and fossorial, lending a mystery to their existence. Their notoriety in world lore is now being trumped by our increasing understanding of the myriad forest ecosystem services they provide, and the multiple threats they face. This session focused on highlighting these ecosystem services, forest salamander habitat requirements, and the complex array of stressors affecting these animals.

A novel ecosystem service of woodland salamander presented by Hart Welsh (US Forest Service, California) was their functional role in mediating carbon retention in the forest-floor leaf litter via predator-prey interactions.

Forest habitat relationships were presented by:

- Kirsten Hecht in her assessment of streams in protected and unprotected forests as habitat for hellbender salamanders.
- Jessica Homyack, who focused on the use of down-wood microhabitats by terrestrial species.
- Wesley Staats, who used LiDAR to understand forest macrohabitat suitability.
- Valorie Titus, who focused on the ramifications of pond habitat fragmentation for mole salamanders in Long Island, New York.

Key threats were addressed by:

- Deanna Olson, who found reduced densities of stream-associated salamanders in areas managed by narrow stream-riparian buffers with upland forest thinning;
- Max Nickerson, who provided a comprehensive long-term study of composite threats of recreation, degraded water quality, siltation and embedded substrates, and novel predators to Ozark hellbender populations in Missouri, USA.

B-18 Ecology and Dynamics of Dead Wood – Dependent Species at Multiple Trophic Levels – Promoting Natural Pest Control in Managed Forests or Increasing Hazards?

Organizers: *Stephen Pawson (Scion, New Zealand), Kimiko Okabe (Forestry and Forest Products Research Institute, Japan), & Antoine Brin (University of Toulouse, France)*

Moderators: *Kimiko Okabe & Michael Ulyshen (US Forest Service)*

This session discussed the full spectrum of saproxylic species, highlighting the functional importance of dead wood across multiple trophic levels within managed forest ecosystems.

Key findings:

- Generally, more insects depend on dead plant materials than on living plants, hence a constant supply of deadwood is essential to maintain biodiversity.
- Comparisons of organisms exploiting deadwood in managed versus unmanaged forests revealed the importance of natural disturbance regimes to maintain diversity of deadwood organisms.
- Responses of organisms at each trophic level are different though the reasons for this are unknown.
- Excessive exclusion of deadwood from an ecosystem induces local species extinction.
- Forest management practices including clear-cut and retention should be planned at the landscape level.

B-19 Forests, Roots and Soil Carbon

Organizers: *Cindy Prescott (University of British Columbia, Canada), Douglas Godbold (University of Natural Resources and Life Sciences, Austria), Heljä-Sisko Helmisaari (University of Helsinki, Finland), & Shalom Daniel Addo-Danso (FORIG, Ghana, & University of British Columbia, Canada)*

Moderator: *Cindy Prescott*

Long-neglected in ecological studies, roots (and their microbial associates) are now recognized as key determinants of carbon sequestration in forest soils. This session presented new insights on root contributions to soil C, particularly linked to forest management, climate change, biodiversity, and ecosystem services.

Key findings:

- Tree species affect soil carbon pools through both below- and aboveground litter inputs.
- Fine roots need to be redefined based on their order and/or function. A simple division into absorbing and transport roots was recommended based on physical traits of fine roots.
- On some soils, particularly tropical soils, roots can grow very deeply and can be found at depths of over 12 m. Sampling layers need to be site-specific.
- In some soils, more that 50% of total soil C and ca. 70 of total Mg is below 1 m soil depth.

Discussion points:

- Land use and plant species (e.g., conifers/broadleaves) during history affect current soil carbon pools.
- Belowground data is often neglected even in ecosystem-level process studies.
- When soil is sampled for carbon stores, roots may be included or excluded, causing inconsistencies and errors in estimates.
- Climate change seems to increase belowground production and litter and may cause roots to grow deeper.
- Belowground studies are methodologically challenging due to the heterogeneity of the soil environment: statistical representativeness/ sampling possibilities.
- Root data from different species and sites is needed for more accurate carbon models, but funding often favors just modeling.
- Crop tree roots such as eucalyptus in the tropics have been poorly studied.
- Root data is a key knowledge gap for C modeling.

Important knowledge gaps highlighted during the session:

- Carbon allocation to roots and mycorrhizas (and mycorrhizal mycelia)

and their drivers, too few estimates exist on species and sites for biome-level estimates.
- Relationship between fungal species diversity and root processes.
- Rhizodeposition/root exudates and root respiration carbon fluxes.
- Coarse root and buried wood inputs and decomposition rates.
- Nutrient and carbon retranslocation within the root system.
- Understory species roots.
- Management impacts on tree roots: importance for aboveground growth.

B-20 Radioactive Contamination in Forest Ecosystems and Safe Uses of Forest Products

Organizers: *Masamichi Takahashi (Forestry and Forest Products Research Institute, Japan), Frédéric Coppin (Institut de Radioprotection et de Sûreté Nucléaire, France), & George Shaw (Nottingham University, UK)*

Moderators: *George Shaw & Frédéric Coppin*

This session reviewed and presented current research on the impacts and long-term dynamics of radioactive fallout on forest ecosystems and management strategies for rehabilitation of affected forest ecosystems.

Key findings:

- Forests are an important interface between atmosphere and soil with a potential effect on global element cycling,
- A key research question is to what extent are forests a possible sink for radionuclides or a vector for further recirculation?
- A large part of cesium (Cs) for tree-root uptake comes from recycling, which is influenced by the initial interception of deposition and subsequent absorption by foliage.
- Tree uptake of the total deposition inventory is actually very low – 14% of exchangeable pool, 1% of total deposition.
- Due to the Cs dynamics in forest ecosystems, Cs is expected to remain in the system for a long time.
- In Fukushima, Cs was measured in wood in 2011, so absorption must have occurred immediately after deposition.
- There was an increase of Cs in heartwood in Japanese cedar from 2011 to 2013.
- Detailed measurements of internal contamination of trees has shown gradual transfer from sapwood to heartwood since 2011 and also significant early differences in vertical distribution of Cs in Japanese cedar, though equilibrium distribution throughout the trees is now being approached.
- Cs in soil O layer decreased from 2011-2012, then stabilized in 2013.
- External dose calculations show that the relative distribution of Cs between soil and tree canopy is important in controlling the dose rates, especially 1 m above the soil surface.
- Transfer of Cs from tree to soil explains the decrease in dose rate measured by airborne surveys over the Fukushima prefecture.
- Clean-up around house and farmland is taking place in the Fukushima area, but decontamination of forest is controversial.
- Longer-term management of the Chernobyl Exclusion Zone is being undertaken which involves thinning of some forest stands to reduce fire risk and also management of some areas as wildlife reserves.
- Calculations of worst-case risks of forest fires indicates a relatively low impact on human health, though control of this risk is desirable.
- The Fukushima accident provides perhaps our best opportunity to collect complete data sets on Cs cycling in forests, including the early phase of contamination for which data are lacking after the Chernobyl accident.

Forests and Climate Change

C-01 Climate Change: A Driver for Land- Use Change and Adaptive Forest Management on Six Continents

Organizer: *J.P. Skovsgaard (Swedish University of Agricultural Sciences), Jean-Michel Carnus (National Institute for Environmental and Agricultural Science and Research, France), Ronald E. McRoberts (US Forest Service), Tod Ramsfield (NRCan-Canadian Forest Service)*

Moderator: *J.P. Skovsgaard*

Presenting examples from around the world, this session contrasted impacts of climate change on land-use and adaptive forest management. The examples included large-scale scenario modeling for Europe as well as detailed examples from North America, South America, Africa, and Asia. In addition to natural-science issues the session featured a presentation focusing on the framework for socioeconomic and policy issues of climate change for forests and forestry in Asia, using India and other countries in this region as examples.

Three issues were identified during the discussion as key components to consider carefully in further research:

- Ensuring realistic and relevant scenarios for forestry practice (for example, in terms of species and management practices);
- Ensuring the statistical validity of assumptions (for example by specifying the error/variability associated with future scenarios);
- Ensuring a relevant policy framework/social context for future scenarios (for example, by including or specifying legal restrictions [actual or anticipated] as well as traditional beliefs or management practices that may influence future developments).

C-02 From Understanding Drivers to Gaining Leverage at the Tropical Forest Margins: 20 Years of ASB Partnership

Organizers: *Peter Akong Minang & Elizabeth Kahurani (World Agroforestry Centre, Kenya)*

Moderator: *Peter Akong Minang*

This session discussed the evolution of theories and approaches to addressing the complex drivers of deforestation and forest degradation and the experiences of the ASB Partnership in order to draw lessons and define questions for further research.

Theory 1 – land sparing: The initial theory that shifting cultivation was responsible for deforestation and that the problem could be tackled

through agricultural intensification (land sparing) was a bit naïve and too simplistic. As agriculture became more profitable, more land would be cleared to maximize on the profits.

Shifting cultivation in some cases does not cause deforestation but stable forest degradation.

- In Mexico, shifting cultivation does not cause deforestation but does degrade the forest and reduces carbon stocks. In fact, the practice is operating successfully and sustainably in the region, with two years' cultivation and 5-10 years' fallow time. There is a need to explore viable options to control degradation and promote restoration.
- In the Amazon Basin, Brazil, and in the Congo Basin, Cameroon, swiddens systems is an acceptable use of the land when conditions are stable, but the systems become degraded with shorter fallow periods and forest encroachment due to pressures such as high population.
- Ecosystem services potentially spared through agricultural intensification can be quantified and valued to establish a business case for policy makers.
- In Uganda, quantitative data and valuation figures make a business case for the land-sparing paradigm. But this can only work with efforts to have integrated policies, create awareness among rural populations on gaining profits from intensification, provide crop diversification, and address rapid population growth.

Theory 2 – land sharing via fair and efficient incentives: Agriculture/forest trade-off practices can be addressed locally, but ensuring watershed functions, for example, requires conservation of forest mosaics at a landscape scale. Fair and efficient reward-incentives-based mechanisms and co-investment are needed, taking into consideration trade-off between public and private benefits. Knowing these costs can help to frame policy.

- In Indonesia, a case study showed that auctions can be used in payment for ecosystem services as an efficient alternative to identify opportunity cost but does not guarantee compliance. Factors for successful implementation include access to information by farmers, identification of constraints to compliance, and balance between sanctions and incentives.

Theory 3 – landscape approaches: Currently, a landscape-scale alternative to REDD+ being tested is co-investment in environmental services through reducing emissions from all land uses (REALU).

- Spatially explicit data from various contexts in Indonesia shows that a very specific understanding of drivers of deforestation and recovery of tree cover is needed as they vary from context to context. Specific leverage points can be identified by understanding this interconnectedness and variation amongst the drivers.

C-03 Understanding the Relationships among Biodiversity, Carbon, and People for REDD+ Forests: The Importance of Environmental and Social Safeguards

Organizers: *Ian Thompson (NRCan-Canadian Forest Service), Kimiko Okabe (Forestry and Forest Products Research Institute, Japan), Jae Soo Bae (Korea Forest Research Institute, Republic of Korea), & John Parrotta (US Forest Service)*

Moderators: *Ian Thompson & Kimiko Okabe*

REDD+ is being designed as a payment for forest ecological services scheme to recover forests as a climate mitigation mechanism. REDD+ can also deliver a number of ecological services, if proper safeguards are in place, including protection of biodiversity and enhancing ecosystem services other than just carbon. Further, projects implemented in areas with high poverty rates and complex social dynamics, and where local populations are particularly vulnerable to social and physical change, can cause problems unless done with careful planning. These latter two aspects require safeguards for environmental and social protection. Recently an IUFRO expert panel completed work on understanding the important relationships that exist among biodiversity, carbon storage, and people in REDD+ planning. This report highlighted the importance of understanding the mechanisms by which biodiversity is involved in carbon sequestration and storage in forests and the important role that REDD+ can play in the future for recovering and conserving forest biodiversity while maximizing the carbon storage service of forests. The purposes of this session are 1. To relate the important outcomes from the GFEP report; 2. To evaluate the results of the report toward the formulation of environmental safeguards that could help direct objectives from REDD+ projects; 3. To summarize the state of knowledge and explore common themes emerging from research in areas with high poverty rates and complex social dynamics (socioeconomic safeguards); and 4. To present a number of case studies on how social and environmental safeguards are being used or applied.

Key findings:

- Biodiversity needs to be recognized for its contributions to essential forest functions when designing REDD+ projects.
- Social safeguards are essential and must be designed locally.
- Governance is often complex and can make projects difficult to implement, but strong governance is essential for REDD+ to succeed.
- REDD+ safeguards are required to deal with all important social and environmental issues in tropical forests – biodiversity, social, and carbon – even when one of three is a focus.
- Analyzing local expectations/concerns, which are generally related to safeguards, is important for implementation of REDD+ projects.
- While REDD+ payment cannot cover the cost of REDD+ and REDD+ safeguards, PES-based approach could be appropriate in Nepal as well as in Costa Rica where application of safeguards seems to offer little incentive to local people.
- Maintaining local customary use of national parks established for REDD+ made an Indonesian REDD+ project successful.
- Incentives for local community were crucial for implementation of REDD+ projects in Ghana.
- REDD+ plus safeguards at the project level must be designed with local needs and conditions carefully considered.

C-04 Addressing the Drivers of Deforestation: Exploring Synergies between REDD+ and Forest Policy

Organizers: *Michael Obersteiner (International Institute for Applied Systems Analysis, Austria), Gilberto Camara (National Institute for Space Research-INPE, Brazil), Martin Tadoum (The Central African Forestry*

Commission-COMIFAC, Cameroun), & Valarie Kapos (UNEP World Conservation Monitoring Centre, UK)

Moderator: *Michael Obersteiner*

This session considered the latest research on tropical deforestation and degradation drivers, public and private sector efforts addressing these, and the identification of effective future invention options based on forest and land-use policies. It included eight presentations reporting on research conducted in numerous countries in Latin America, Africa and tropical Asia.

C-05 Gender, Participation, and Climate Change

Organizers: *Bimbika Sijapati Basnett, Esther Mwangi (CIFOR, Indonesia), Peter Cronkleton (CIFOR, Peru), & Terry Sunderland (CIFOR, Indonesia)*

Moderator: *Bimbika Sijapati Basnett*

The literature on gender issues in climate change and forest governance is still in its infancy. Drawing on theoretical and empirical evidence from a wide range of countries and contexts, the seven presentations and ensuing discussions shed light on how to study gender issues in climate change, strengthen women's meaningful participation in decisions and benefits, improve policy targeting, and mitigate risks of climate change in forest-based communities. Some of the key topics of discussion included the following:

- How we can build on the rich history of feminist research on political participation and forest governance to inform current attempts to engender social and environmental safeguards in REDD+.
- Whether and to what extent decentralization strengthens women's resilience to climatic variability, drawing on evidence from Cameroon.
- Experiences with mainstreaming gender and social inclusion in REDD+ process in Nepal.
- Results of a global comparative study on the "Poverty Environment Nexus" that questioned some of the commonly held ideas on how men and women access, manage, and use different forest products.
- The gendered implications of multiple stressors such as HIV, climate variability, and other localized risks on livelihood in the Eastern Cape, South Africa.

C-06 Boreal at Risk: Integrative Science as a Strong Foundation for Public Policy Development

Organizers: *Deepa Pureswaran, Werner A. Kurz, Louis De Grandpré (NRCan-Canadian Forest Service), & Philip G. Comeau (University of Alberta, Canada)*

Moderator: *Deepa Pureswaran*

This session presented scientific findings and discussed policy implications of integrated research on global change and forest disturbances (fires, insects, and pathogens) affecting circumpolar boreal forest dynamics.

Key findings:

- The importance of applying scientific findings to public policy by bridging the gap between scientists and policy makers was highlighted.
- Climate change is exacerbating fire behavior in arid areas of the United States.
- Spruce budworm outbreaks are moving further north in the Canadian boreal forest as a result of climate warming.
- There is potential range expansion of gypsy moth further north.
- Southern pine beetle outbreaks are now occurring in more northern pine forests.
- Dead wood serves as microenvironments for numerous organisms and its accumulation is necessary for boreal forest sustenance. Management of dead wood requires careful thought by policy makers before removal in order to maintain ecosystem integrity.

C-07 Forests, Fire, and Climate Change Dynamics

Organizers: *Bill de Groot (NRCan-Canadian Forest Service), Ainuddin Nurrudin (Univesiti Putra, Malaysia), Susan Conard (International Boreal Forest Research Organization, USA), & Pieter van Lierop (UN-FAO, Italy)*

Moderator: *Bill de Groot*

Wildland fires burn several hundred million hectares of vegetation around the world every year. Recent research suggests a general increase in area burned and fire occurrence during the last few decades, but there is much global variability. Wildland fire regimes are primarily driven by climate/weather, fuels, ignition agents, and people. All of these factors are dynamic and their interactions create a mosaic of varying global fire regimes. Under a warmer future climate, fire management agencies will be challenged by fire weather conditions that could push current suppression capacity beyond a tipping point, resulting in a substantial increase in large fires and a corresponding increase in wildfires causing disastrous social, economic, and/or environmental impacts. Presentations in this session focused on the latest scientific understanding of climate change and future global fire regimes, feedback to the global carbon balance, expected human and environmental impacts, and potential management strategies to mitigate negative impacts.

Key findings:

- Climate change is already affecting fire regimes around the world and is projected to influence global fire activity for the remainder of this century.
- Climate change will have the greatest effect on fire regimes at northern latitudes, and future boreal fire impacts will be complex due to many inter-relationships between fire, permafrost, peatlands, albedo, and future forest composition, structure and distribution.
- Studies in Australian eucalypt forest ecosystems suggest increased CH4 uptake under changing climate conditions.
- Canadian research on future fire activity and wood supply indicate increasing vulnerability of Canadian boreal forest timber with climate change.
- Future fire danger will increase in some tropical forests, but there are a variety of adaptive fire management practices that can be implemented to reduce fire impacts in these forests that are largely fire-sensitive.
- Model simulations of future fire regimes in Europe demonstrate the potential to substantially reduce predicted future increases in area burned under climate change through the application of prescribed fire and improvements in active fire suppression.

- Climate change warming (rather than drying) was found to be responsible for future predicted increases in fire indices and area burned in the US Rockies, Southeast, northern Great Plains, and Southeast regions.
- Research in China indicated that current and future fire occurrence density was strongly related to human settlements and travel corridors, and landscape simulations suggested a substantial increase in broadleaf tree species coverage by the end of this century.

C-08 Managing Forests for Fire in a Changing Climate

Organizers: *Cristina Aponte, Helen Vickers, Thomas Fairman (University of Melbourne, Australia), & William Elliot (US Forest Service)*

Moderators: *Cristina Aponte & Helen Vickers*

The session offered an overview of the effects of wildfire on fire tolerant and sensitive forests and presented alternative fuels management practices and their impact on forest biodiversity, carbon, and hydrology. It brought together knowledge from around the globe including North America, Europe, Asia, and Australia.

Key presentation and discussion topics included: the importance of cross-collaboration and knowledge transfer, localized parameterization of fire behavior and ecosystem response models, and the key role of long-term studies.

C-09 Dendrochronology: Detecting and Modeling Climate Change and Fire Impacts

Organizer: *Pekka Saranpää (Finnish Forest Research Institute)*

Moderator: *Pekka Saranpää*

The purpose of the session was to examine dendrochronology as an indicator of climate change and disturbance events in forest ecosystems of different regions.

The session included five oral presentations and one poster. Speakers included experts from Russia, China, Brazil, Argentina, and the United States, with contrasting experiments and results on wood formation and tree ring analysis.

Key findings:

- Tree ring research is especially important to understand the effect of climate change and global warming on vegetation.
- Wood formation has optimum temperatures during growing season and thus different climate conditions result in changes in productivity and wood properties.
- Tree rings can be also used to reconstruct past climate conditions (known as paleoclimatology), species distribution, and dynamics.

C-10 Vegetation Zone Shifts in Response to Climate Change

Organizers: *Constance Millar (US Forest Service) & Pavel Cudlin (Global Change Research Centre, Academy of Sciences of the Czech Republic)*

Moderators: *Constance Millar & Pavel Cudlin*

Shifts in mountain vegetation zones are often considered adaptation measures of forest ecosystems to climate change. This session explored the capacities and obstacles to adaptation related to autecological and synecological characteristics of dominant tree species. To date, projections of vegetation shifts in response to future climate change have been assessed primarily through modeling. The aim of this session was to compare model results with critically assessed field and observation data; linking of regional and subject (branch) approaches will be applied. Regional case studies were presented from representative mountain regions including Paleoarctic (Alps, Carpathians, Pyrenees Mts.) and Nearctic (Rocky Mountains, Sierra Nevada, Cascade Mountains) ecozones.

Case studies were critically assessed regarding soil, climatic, and ecologic (life-history characteristics, plant competition) conditions in response to climate change, focusing on opportunities and barriers to adaptation. The session integrated knowledge about forest ecosystem response – vegetation zone shifts, including changes in mountain ecosystem services under climate change.

Key findings:

- Drift of vegetation zones is being documented at present in many mountain regions of the world.
- Shifts in vegetation zone generally exhibit adaptive response to climate change – exceptions include where distribution contractions occur more rapidly than when adaptive migration is possible, where substrates are inappropriate, or soil mycorrhizal associates are lacking.
- Tropical montane forests are in grave risk of biodiversity loss due to climate change.
- Rates of climate change are great enough that in many situations assisted migration is a likely adaptive management strategy.
- Modes of observed response include the modelled/expected consequence of upward or northern movement but also other responses, such as downward shifts, changes in aspect, and changes in vegetation structure, composition, and function without change in distribution.
- The concept of velocity of climate change is useful for describing and evaluating the likelihood of species displacement and risk/vulnerability to climate change.
- Mechanistic modeling and vulnerability assessments regarding range shifts are most useful when the vital regeneration phase is included.
- Maps displaying shifts in the suitable ranges of 215 tree species from around the world are now available, under two contrasting GCM forecasts. These have been calibrated to observed changes, which correspond well to the simulations.

C-11 Forest Resistance and Resilience in the Face of Natural Hazards

Organizers: *Alexia Stokes (National Institute for Environmental and Agricultural Science and Research, France), Frank Telewski (Michigan State University, USA), & Thierry Fourcaud (CIRAD, France)*

Moderators: *Alexia Stokes & Frank Telewski*

Natural hazards in forest environments are increasing significantly due

to anthropogenic pressure and a higher frequency of extreme weather conditions. It is thus urgent to find solutions for managing natural and urban forests so that their resilience to disturbances is increased against a background of climate change. Society also needs to shift from the maximum sustainable yield paradigm to an adapted forest management that builds ecological resilience through a holistic understanding of the ecological and physical processes involved. This session united researchers and practitioners to explore new concepts, models, and tools for improving natural and urban forest resilience. We examined resistance and resilience at different scales: tree individual, forest stand, and landscape, and asked how resistance and resilience can be integrated across these scales. We focused on two types of common hazards that disturb forest systems (i) geomorphologic; e.g., landslides, water and coastal erosion, and snow avalanches and (ii) weather; e.g., strong winds, snow, ice and rain storms, and extreme temperatures. The session included seven oral and five poster presentations.

Key findings:

- The terms resistance and resilience are difficult to understand and to apply in forest ecology.
- Belowground processes are still poorly understood and have not been adequately taken into consideration in models that deal with natural catastrophes; e.g., windthrow prediction models.
- It is difficult to restore a forest ecosystem because the initial state is often not defined and restoration can take hundreds to thousands of years, depending on the disturbance factor.
- Predictive models are proving helpful in determining vulnerability of certain forests or portions of forests to natural hazards such as wind or landslides.
- Climate change is impacting forest composition and regeneration after disturbance due to natural abiotic events (drought, wind, fire).

C-12 Quantifying Uncertainty in Forest Measurements and Models: Approaches and Applications

Organizers: *George Gertner (University of Illinois, USA), Bogdan Strimbu (Louisiana Tech University, USA), David Paré (NRCan-Canadian Forest Service), & Peter Clinton (Scion, New Zealand)*

Moderators: *George Gertner & David Paré*

This session presented approaches to analyze uncertainties in forest measurements and models with applications of uncertainties in above- and belowground estimates of forest biomass, carbon, and nutrient pools and fluxes, and other ecosystem attributes. Sixteen oral presentations in the two-part session addressed sources of uncertainty in forest ecosystem studies, including natural spatial and temporal variation, measurement error, model uncertainty, and model selection error. In addition, there were more than 30 posters on this theme.

Key findings:

- Quantifying uncertainty was shown to be important in establishing the significance of findings, making predictions with known confidence, and guiding investments in research and monitoring. Uncertainties were shown to influence monitoring designs and affected management and policy decisions.
- The importance of spatial variation in detecting change over time in soil stores and measurement error in forest inventory due to identifying or classifying trees, measuring diameters, determining whether trees are living or dead, in or out of a plot, etc., were illustrated.
- Uncertainty both within and across models was shown to be important in biomass estimation and climate predictions.
- In general it was shown that uncertainty/errors would occur in most forest-based studies whether assessed or not. For this, it was recommended that uncertainty should always be assessed and reported.

C-13 Modeling and Simulation Systems

Organizer: *Grant Domke (US Forest Service)*

Moderator: *Grant Domke*

This session examined applications of large-scale models and simulation systems for forest planning and management and for assessing the potential of climate change and mitigation strategies.

Key findings:

- Introduction of novel species and genotypes may be required if ecosystems services derived from forests are to be maintained in the future.
- New methods to incorporate spatially explicit datasets into models such as the Carbon Budget Model of the Canadian Forest Service can be used to integrate fine-scale forest disturbance information into forest carbon accounting.
- Economic models have utility in studying gains and losses in forest carbon with respect to national reference levels set for EU countries.
- Individual-based models may be used to study alternative forest management scenarios in tropical forest environments and provide visualizations useful to forest managers.
- Process-based models, such as the 3PG model, are gaining popularity over empirical models to make projections of forest dynamics.

C-14 Forest Biomass and Carbon Inventory on Successive Occasions

Organizers: *Bianca Eskelson (Oregon State University, USA), Cris Brack (Australian National University), & Teresa Fonseca (University of Trás-os-Montes e Alto Douro, Portugal)*

Moderator: *Bianca Eskelson*

Speakers in this session discussed national successive inventory designs that integrate factors such as biomass and carbon as well as greenhouse gas emissions. The challenges that arise when dealing with remeasurements were discussed.

Key findings:

- Repeated measurements of ground plots are needed to have unbiased biomass and carbon estimates.
- Securing budgets for continuous remeasurement of ground inventory plots is one of the greatest challenges.
- Changes in sampling design over successive forest inventories have to

be accounted for when analyzing the temporal development of forest structure attributes to ensure correct interpretation of the obtained results.

- Uncertainty estimates for emissions and sinks from land use and land-use change of forests should be presented.
- There are three types of uncertainties in carbon budget models: (1) model inputs, (2) model parameters, and (3) model structure.
- Earth observation data provide ancillary information that can support sampling procedures (e.g., for stratification) and improve accuracy.
- Tracking land use change is critical and may pose challenges.
- Re-examination of land-use classification and detection of land-use change with the support of ancillary information can mitigate gross errors due to changes in definitions and procedures.
- Inevitable changes in definitions and procedures can lead to gross errors in quantifying forest carbon flux when measurements from successive inventories are used.
- Natural disturbance and management events need to be tracked and their effects need to be quantified.
- Forest disturbance attribute maps across the United States derived from Landsat time series present new analysis opportunities and tools for mapping many forest attributes through time.
- Challenges of quantifying carbon flux of some aboveground forest biomass pools remain (e.g., dead wood, understory vegetation).
- Technical advances in estimating forest C pools (both above- and belowground) are needed to improve climate change monitoring.
- The efficiency of deadwood inventory can be tremendously increased by selecting an appropriate sampling technique and sample size allocation, when integrated into an existing forest inventory with two-phase sampling for stratification.
- A long rotation management cycle (80 years) might be preferable over a short rotation (40 years) with regard to the carbon balance in a wood life cycle, as presented for a Japanese softwood species, depending on their use.

C-15 Monitoring Soil Carbon Stocks and Dynamics at Variable Spatial Scales

Organizer: *Robert Jandl (Research and Training Centre for Forests, Natural Hazards and Landscape, Austria)*

Moderator: *Robert Jandl*

The session explored challenges of evaluation changes in total soil carbon stocks and its components in planted and natural forests.

Key findings:

- A wide variety of soil carbon simulation models are used. All have their strengths and weaknesses.
- Climate manipulation experiments and case studies are required in order to constrain modeling results.
- Climate change is perceived as an important driver in changes in soil carbon pools. However, unwise forms of land management, either due to ignorance or lack of governance, lead to site degradation manifesting itself as declining soil carbon pools.
- Multipurpose forms of forest management are scientifically evaluated and available for practical forest management in different climate zones that increase the size of the soil carbon pool. No specific publications are planned.

C-16 Remote Sensing in Carbon Balance Evaluation and Monitoring

Organizers: *Tomasz Zawila-Niedzwiecki (General Directorate of the State Forests, Poland), Mathias Schardt (Joanneum Research, Austria), & Radomir Balazy (Forest Research Institute [IBL], Poland)*

Moderator: *Tomasz Zawila-Niedzwiecki*

The session explored innovative methods for carbon assessment based on airborne or satellite remote sensing data. Presenters concentrated their interventions on the use of satellite (optical and LiDAR) data in carbon mapping, as well as evaluation of biomass and carbon stock (also in connection to socioeconomic indicators). Method for EU-wide mapping of growing stock/biomass via satellites was also described. Validation, accuracy, and precision of classifications were deeply discussed.

Eleven posters exhibited in the general poster session were related to this session. They presented examples of specific applications of optical and radar remote sensing from different geographic locations.

All together these presentations provided a good overview of the use of aerial- and satellite-based remotely sensed methods of biomass and carbon monitoring. While the session also considered modeling issues, this is an area of work that requires further development through integration with data from ground samples and other ground-based methods.

C-17 New Developments in the Use of Remote Sensing and National Forest Inventories for Estimation and Mapping

Organizers: *Gregory Reams (US Forest Service), & Kenneth MacDicken (UN-FAO, Italy)*

Moderator: *Temesgen Hailemarian (Oregon State University, USA)*

The session brought together researchers, scientists, practitioners, and managers with common interests to exchange ideas related to the use of remotely sensed data and national forest inventories to meet monitoring, verification, and reporting needs. This session presented and discussed the latest knowledge in developing methods and in using remote sensing and national forest inventories for estimation and mapping.

Six oral and three poster presentations addressed some of the challenges and opportunities in using remotely sensed data and national forest inventories to meet monitoring, verification, and reporting needs. The discussion in the session focused on ways to provide statistics at the national level to international reporting (e.g., global forest resources assessment) in a timely and consistent manner. In doing so, most speakers identified extent of forest areas, biological diversity, forest health and productivity (e.g., tree species group, volume and biomass), human dimensions and ownership, protection status, and institutional infrastructure and support as critical variables to improve forest monitoring and verification globally.

Key findings:

- Remotely sensed data and national forest inventories were shown to offer unprecedented opportunities to support sustainable forest management through global forest resource assessment and monitoring.
- LiDAR presents an opportunity to augment data, quantify forest attributes, handle missing data, and tackle emerging challenges efficiently and consistently across the globe. The current global forest biomass survey has some potential to improve forest resource assessment globally.
- Woven into various presentations was the importance of crowdsourcing and online platforms to improve estimation and mapping of land cover and biomass globally.
- Across presentations it was articulated that monitoring floor and vegetation cover in national forest inventory data is important for biomass estimation and climate predictions. The importance of spatial variation in detecting change over time in soil and vegetation were illustrated.
- In general it was shown that a new data infrastructure would help to move forest inventory and monitoring efforts toward a common continental framework. For this, it was recommended that forest resource assessment be assessed at ecoregion scale that goes beyond national scale statistics.

C-18 Using Multisource Remotely Sensed Data and Nearest-Neighbor Techniques to Improve Inference for Natural Resource Applications

Organizer: *Temesgen Hailemariam (Oregon State University, USA)*

Moderator: *Temesgen Hailemariam*

This session presented and discussed the latest knowledge in using multisource remotely sensed data and nearest-neighbor methods to improve inference for natural resource applications. Six oral presentations in the session showed and discussed how multisource remotely sensed data and nearest-neighbor techniques offer unprecedented opportunities to augment data, quantify forest attributes, handle missing data, and tackle emerging challenges.

Key findings:

- Presentations showed that sustainable forest management decisions are rarely based on single objectives, and hence, strategic and operational forest assessments require spatially explicit information to support timber production, fire hazard mitigation, biodiversity, and carbon balance goals.
- Woven in various presentations, the importance of remotely sensed data in improving biomass estimation and climate predictions was demonstrated. Speakers demonstrated that nearest-neighbor methods and parametric prediction methods are viable vehicles in providing timely, accurate, and precise information.
- In general it was shown that remote sensing is needed to assure spatially comprehensive data and to create wall-to-wall forest landscapes.
- Speakers asserted that multisource remotely sensed data provide a large number of variables. Hence, careful selection of variables and evaluation of their contributions are critical in linking ground and remotely sensed data.

C-19 Implementation of Silvicultural Treatments and Their Effects into Forest Growth Models

Organizers: *Margarida Tomé (Technical University of Lisbon, Portugal) & J.P. Skovsgaard (Swedish University of Agricultural Sciences)*

Moderators: *Margarida Tomé & J.P. Skovsgaard*

The implementation of silvicultural treatments and their effects into forest growth models were exemplified by a range of speakers from North America, Europe, and Australia. The session included reviews of the historical development of growth models and their links with inventory data and procedures. Considering contemporary developments the attention focused mainly on the incorporation of spatial patterns and spatio-temporal ecological and eco-physiological processes into operational models for stand-based predictions and projections. The session demonstrated interesting state-of-the-art overviews and examples.

- James Arney reviewed the historical development of forest growth models and their links with inventory data and procedures, contrasting mainly whole-stand and individual tree models, based on The Forest Projection System developed for forest types in the western USA.
- Teresa Fonseca presented the procedure for implementation of thinnings in individual-tree and size-class models for Maritime pine in Portugal, based mainly on various types of stand density indices. Fonseca specifically emphasized the development from stand-table projections to contemporary spatially-explicit model predictions. As part of the review Fonseca presented various approaches to quantifying thinning operations and their impacts on forest growth.
- Based on a brief review of the silvicultural practices for black spruce in Canada and specifically the options for uneven-aged management practices, Arthur Groot presented a growth model concept based on the light capture by individual trees (as alternative to competition-driven models). The model was calibrated based on yield tables.
- Valentine Lafond presented algorithms for incorporating classical selection system practices into growth models, for example based on accurate reflections of stand structure and stand structure changes. The model core was classical forest mensuration and regeneration variables, but with an outlook to biodiversity, deadwood and other ecosystem variables. A question from the audience was how stem quality could be included in the model.
- Cristiane Lemos presented an update of the 3-PG model to incorporate soil fertility in modeling the growth of eucalypt plantations in Brazil. The update was based on 130 twin-pairs of plots, one with and one without fertilization. Calcium and potassium were identified as limiting factors.
- Phil Polglase presented results from a P fertilizer trial in Monterey pine on sandy soil in New South Wales, Australia, focusing on soil carbon and the C/N ratio. Based on the difference in soil and litter C (between control and fertilized) to MAI (SI) PG modelled and explained the build-up of soil and litter C due to P fertilizer.
- Nick Smith presented a model for the regeneration (growth and survival) of Douglas fir with two-aged or variable retention silviculture in Pacific temperate rain forests on Vancouver Island, Canada. The model incorporated various explanatory variables.

C-20 National Forest Sector Greenhouse Gas Inventories Following IPCC Guidance and Guidelines: Requirements, Methods, and National Examples

Organizers: *Werner A. Kurz (NRCan-Canadian Forest Service), Gregory Reams (US Forest Service), & Thelma Krug (National Institute for Space Research-INPE, Brazil)*

Moderators: *Werner A. Kurz & Gregory Reams*

This session provided an overview of the state of the science for national greenhouse gas (GHG) inventories in the forest sector. Presentations addressed the requirements for GHG reporting under the methodological guidelines of the Intergovernmental Panel on Climate Change (IPCC), challenges and experiences with implementation of these guidelines, and country-specific experiences from Australia, Canada, the European Union, Mexico, Russia, and the United States The session included 8 oral presentations and 9 poster presentations.

Key findings:

- Starting in 2015 the 2006 IPCC Guidelines for GHG reporting in the LULUCF sector have to be followed by all countries reporting to the United Nations Framework Convention on Climate Change. Countries that report for the second commitment period of the Kyoto Protocol have to also follow the 2013 IPCC KP Supplement.
- Definitions of forest based on land cover or land use can result in discrepancies in reported estimates of carbon stock changes and resulting net emissions.
- Several presentations emphasized the importance and utility of an integrated modeling framework to support the compilation of relevant data (inventories, growth and yield, activity data), data analysis including uncertainty analysis, and the identification of areas in which uncertainties can be reduced.
- Presentations from Australia, Mexico, and Canada outlined the use models to estimate regional and national-scale estimates of past GHG emissions and to develop estimates of future GHG emissions under various climate change mitigation and REDD+ scenarios.
- Developing consistent estimates of GHG emissions for 28 member states of the EU is challenging. A comparison of GHG emission estimates derived from a methodologically consistent Tier 3 model (CBM-CFS3) to those reported by EU member states assisted the identification of possible methodological problems.
- Requirements to report carbon stock changes and emissions associated with harvested wood products are being met with new tools developed by several countries following the 2013 IPCC Kyoto Protocol Supplement.

C-21 Complying with the IPCC Good Practice Guidance for Tropical Carbon Stock Inventories

Organizer: *Ronald E. McRoberts (US Forest Service)*

Moderator: *John Coulston (US Forest Service)*

The session addressed methods for complying with the IPCC Good Practice Guidance criteria: (i) neither over- nor under-estimation (bias), and (ii) uncertainties are reduced as far as is practicable (precision).

Key findings:

- Despite the relatively little emphasis accorded to the stock-change method, for countries with large area forest inventories, it is probably the most useful, accurate, and precise method available. Further, most countries that are currently developing monitoring, reporting, and verification (MRV) systems plan to extend them to full national forest inventories.
- Maps are not truth, and estimates based on pixel counting can deviate substantially from true values. Further, map accuracy assessments do not provide information on the quality of estimates or parameters of populations that the maps only inaccurately depict. Thus, statistical techniques for adjusting for bias and assessing uncertainty are necessary.
- Airborne laser scanning data are extremely useful for enhancing remote sensing-based assessment of below-canopy forest attributes such as biomass and carbon. However, data acquisition is currently too expensive for large-area estimation unless the Lidar data are acquired via sampling.
- Model-based inference does not require probability samples, and therefore merits consideration for application in remote and inaccessible tropical forests and even regions such as Siberia and interior Alaska.

C-22 Advances in Forest Carbon Measurements and Monitoring for Building REDD+ MRV Systems

Organizers: *Yasumasa Hirata (Forestry and Forest Products Research Institute, Japan) & Andrew Lister (US Forest Service)*

Moderators: *Yasumasa Hirata & Andrew Lister*

This session served as a forum to exchange scientific knowledge on forest carbon measurement and monitoring for building the REDD+ monitoring, reporting, and validation (MRV) systems. Eight talks were presented on topics related to the development and implementation of MRV systems, carbon measurement strategies, carbon budget models, and various remote-sensing and field-based measurement technologies.

Key findings and knowledge gaps:

- High-resolution data like LiDAR multispectral data were found to be very useful in quantifying carbon. For larger-area phenomena, coarse- or moderate-resolution satellite data were appropriate. There were many different satellite change detection options presented for monitoring fire, for example.
- Carbon budget models were being used, at least in Mexico, and generating data for these from multiple input sources was a challenge.
- Quantification of belowground biomass was found to be important, and sampling and field methods for doing this in a standardized way were presented (for Tanzania)
- Colombia has a very well-designed, integrated system that combines inventory data, remote sensing, research plots, and a national monitoring strategy to develop a baseline and present results in a logical, transparent way.
- LiDAR sampling was being used in China – linking LiDAR information to ground plots to generate carbon maps.
- One gap that was identified was the quantification of uncertainty using

IPCC guidelines – for example, remote sensing products are quite useful for generating estimates, but it is hard to quantify their uncertainty using principles from probabilistic sampling theory, as described in the IPCC guidelines.

C-23 Forest Management for Adaptation to Climate Change

Organizers: *Rodney Keenan (The University of Melbourne, Australia), Carina Keskitalo (Umea University, Sweden), Kalame Fobissie (WWF Central Africa, Cameroon), & Guangyu Wang (University of British Columbia, Canada)*

Moderator: *Rodney Keenan*

This session focused on options for adaptation to climate change in forest management from ecological, social, economic, and policy perspectives including decision tools for adaptation to climate change and best practice case studies in building adaptive capacity from tropical, temperate, and boreal biomes. The aim was to encourage dialogue between researchers and practitioners.

Key findings:

- Forest owners and managers are becoming increasingly aware of the risks of climate change for forests and forest-dependent communities. Adaptation options need to be considered in the context of other changes and threats to forests, communities, and industries.
- Strong local leadership and organizational commitment, enabling policies or legislation, and financial resources are important in supporting adaptation to climate change in forest management. However, forest managers, owners, and forest-dependent communities are taking autonomous actions to address current and perceived future risks.
- Adaptation measures need to be tailored to local conditions. Community-based approaches including local knowledge can support local adaptation, and there are a range of options to support adaptation in planted forests.
- Owners and managers need support to "make sense" of climate science, to support better informed decisions, and to consider trade-offs between different values or services in a changing climate.
- Communication and education programs can have a significant impact on understanding, confidence, and willingness to take action to address the risks of climate change among forest owners and managers.
- Adapting to climate change is a social learning process. Networks, partnerships, and dialogue between forest owners and managers, and researchers (from many disciplines) are required to develop a common understanding of climate-related risks and potential management options.

C-24 Adaptive Forest Management Under Climate Change – Networking from Local to Global Scales in the Temperate Zones

Organizers: *Andreas Bolte (Thünen Institute of Forest Ecosystems, Germany), John Stanturf (US Forest Service), & Palle Madsen (University of Copenhagen, Denmark)*

Moderator: *John Stanturf*

The oral presentations and the posters of the session addressed either methods for identifying forest vulnerability to climate change (CC) impacts in the temperate zones or ways to assist forest adaptation to adverse effects of CC.

Key findings:

- Andreas Bolte presented pathways for concerted actions to (future) adaptation of forests to CC focused mainly on increasing resistance and adaptive capacity (resilience) to CC impacts and including both active and passive adaptive management measures. International networking addresses the sharing of data (meta-analyses), harmonized studies, and monitoring (standard protocols) as well as exchange of staff and expertise.
- Peter Hobson presented a novel methodological approach to assess the microclimatic functioning of forests with varying structures and management intensities. The results pointed out the importance of multi-structural and mixed forests as well as the quantity of coarse woody debris (CWD) for the microclimatic balancing of heat extremes.
- Three presenters reported on the emerging role of Douglas fir (Df) and its provenances in the adaptive forest management in Central Europe. Miriam Isaac-Renton showed results of a European-wide climatic envelope modeling and its validation for different Df provenances from Northern America that are already used in Europe. It turned out that there might be a distinct spatial mismatch of current use and future suitability of Df provenances in Western and Central Europe that has to be considered in adaptive forest management (AFM).
- Regional scale analyses of Douglas fir provenances trials presented by Silvio Schüler confirmed the above mentioned mismatch of current use and future suitability of Df. Based on regional analyses and modeling of the future viability and productivity in Austria. Recommendation for the future use of CC-adapted Df provenances are given to forest practitioners, tree nurseries, and decision makers. The important potential of Douglas fir, and also of other North American tree species like red oak and grand fir for the (future) adaptive forest management in Poland, was stressed by Michał Zasada. In particular to maintain forest productivity and forest adaptability, he advocated both for increased research and an increased use of these introduced tree species in forestry and AFM.
- Palle Madsen's presentation stressed the importance of refugial populations and their high adaptive potential for considerations in AFM. Based on examples for silver fir with adaptive refugial populations in Calabria (Italy) and for Oriental beech in northern Iran, he recommended increasing studies on the use of their potentials in transplanting trials and assisted migration.
- Andreas Rigling highlighted results of an irrigation and thinning field experiment in drought-impacted Scots pine stands in the Valais (Switzerland) showing significant positive responses of the stands to irrigation and heavy thinning. The derived models of site suitability of Scots pine and alternative species are used for decision support for forest management.
- Somid Saha (on behalf of Julia Sohn) presented results of a literature meta-analysis of thinning experiments in order to increase resistance and resilience of tree stands to drought events. Thinning can increase both the resistance and resilience in stands with coniferous species. For broad-leaved species there are indications for positive effects on resistance, but less on resilience potential.

- The presentation by Ruben Delgado dealt with detection of local adaptation in adult stands in different provenances. Using a "virtual transplanting" approach by comparing the climate at the origin of a provenance with this close to other provenance areas. The results suggested that this could be a promising method for the evaluation of assisted migration needs.
- Several posters on the ecophysiological responses of tree species to CC, monitoring and nature conservation activities, and adaptive management strategies as well as the role of single species for adaptation completed the session.
- In a final discussion round, the need for further increased collaboration on AFM on international scale was identified. This mainly applies the exchange of data and common experiments and analyses on provenances. The interdisciplinary collaboration with forest genetics specialists shall be increased.

C-25 Forest Management Options to Tackle Climate Change

Organizers: *Hubert Hasenauer (University of Natural Resources and Life Sciences, Austria), Frits G. Mohren (University of Wageningen, Netherlands), & Jean-Luc Peyron (Ecofor, France)*

Moderator: *Hubert Hasenauer*

The session discussed forest management strategies for mitigating potential climate change effects, including adaptation options, carbon sequestration issues, fossil fuel substitution potentials, and life cycle assessment strategies.

Presentation topics and key findings:

- Hubert Hasenhauer presented MODIS (moderate resolution imaging spectroradiometer) as a tool for estimating productivity potentials on large scales provided that forest management is taken into account.
- Daniel Plugge, on behalf of Michael Köhl, presented a model evaluating forest carbon mitigation potentials through forest management, forest adaptation, and timber utilization, demonstrating that management has a high impact on carbon stock.
- Bart Muys discussed the concept of carbon neutrality and its limitations compared to full accounting methods. He then presented a life cycle analysis approach which can be made time and space explicit, thus likely to be very efficient for increasing the mitigation potential of forests.
- Gert-Jan Nabuurs discussed carbon sink saturation in European forest biomass, and formulated recommendations in order to maintain some carbon sink.
- Anatoly Shvidenko presented research results indicating that Russian forests are at a tipping point due to climate change, with potential emissions coming from warming permafrost and the huge risk of wildfires. He argued that adaptation is urgently needed which will require elaboration of models to support decision-making.
- Ellen Soldal presented a combination of models (forest growth, management optimization, and life-cycle analysis) in order to optimize the mitigation of climate change (including greenhouse gas and albedo effects).
- Jean-Luc Peyron illustrated the synergies and trade-offs between adaptation to climate change and mitigation of climate change and insisted on the need to develop an integrated approach, despite the difficulties in estimating parameters.

All these presentations were very complementary: they discussed carbon sequestration, carbon substitution (from life-cycle analysis), the albedo effect, the consequences of risks due to climate change, and, consequently, the need for adaptation. Consequences of adaptation or mitigation measures for sustainable forest management should also be taken into account.

C-26 Forest Owners and Climate Change Adaptation

Organizers: *Robert Jandl (Research and Training Centre for Forests, Natural Hazards and Landscape, Austria), Ulrike Pröbstl (University of Natural Resources and Life Sciences, Austria), Anatoly Shvidenko (International Institute of Applied System Analysis, Austria), & Sandra Luque (National Institute for Environmental and Agricultural Science and Research, France)*

Moderator: *Robert Jandl*

The session discussed the consequence of a changing structure of forest land owners under the conditions of climate change for development and implementation of appropriate forest management measures and risk management.

Key findings:

- Absentee-forest owners are common in all countries where forests are privately owned. The typical size of the respective forest holdings varies greatly.
- Absentee-forest owners have a limited perception of climate change effects, as other closely related topics such as fluctuations in the timber market, invasive species, and natural disasters receive equal or more attention.
- Absentee-forest owners are open to adaptive forest management for a variety of reasons. However, the controversy among experts and insufficiently concise suggestions are weak incentives to modify forest management strategies.
- Elaborate schemes such as participating in carbon trading markets that call for long-term commitments of the forest owners are not attractive.

C-27 Sustainable Management of Spruce Dominated Ecosystems in Response to Climate Change

Organizers: *Phil Comeau (University of Alberta, Canada), Bill Mason (Forest Research, UK), & Ulf Johannson Björn Hånell (Swedish University of Agricultural Sciences)*

Moderator: *Phil Comeau*

Spruce species are important in the world's northern, mountain, and temperate forests. While their wood is valued for many uses such as lumber, pulp, and energy, spruce forests also provide a broad range of ecosystem services including recreation, watershed protection, carbon sequestration, biodiversity, and habitat. While moderately shade tolerant, spruces have low tolerance to drought, high temperatures, and fire, which may become greater problems with climate change. In addition, warming

climate may increase insect and disease risks. Consequently, climate change is likely to result in shifts in the distribution of spruce species across the northern hemisphere during the current century. The session included 6 volunteer presentations followed by discussion.

Key findings:

- In moist climates or environments, spruce responds favorably to temperature increases.
- Spruce survival and growth can be compromised on drought-prone sites, although once well established, spruce are capable of adapting to drought.
- Since climate change may lead to maladaptation of local provenances, seed transfer guidelines need to enable seed transfer and guidelines to decision-making related to assisted migration of provenances and species are required. Laura Gray illustrated this with an example of work underway by her team in Alberta.
- Thinning may increase stand recovery following drought, but may not increase drought resistance except immediately following thinning.
- The use of alternative species, including Douglas fir, was presented and discussed.
- Continuous cover forestry that creates group mosaic and other structures was identified as having potential as a tool for climate change adaptation on appropriate sites.
- Traditions and lack of demonstrated alternatives were identified as key barriers to forest managers applying this knowledge in responding to climate change.
- Ongoing research and establishment of long-term demonstrations are needed as a basis for supporting adaptive management of spruce ecosystems.

C-28 Tropical Forest Wetlands, Climate, and Land-use Change: Adaptation and Mitigation Opportunities

Organizers: *Richard Birdsey, Randall Kolka (US Forest Service), Daniel Murdiyarso (CIFOR, Indonesia), & Boone Kauffman (Oregon State University, USA)*

Moderator: *Richard Birdsey*

The objective of this session was to provide policy makers with credible scientific information needed to make sound decisions regarding the role of tropical wetlands in climate change adaptation and mitigation strategies. Presentations reviewed recent research on (1) greenhouse gas emissions from intact wetland forests and sites that have undergone land cover change; (2) carbon stocks of representative tropical forested wetlands of the world and associated land uses; (3) progress in the development of ecosystem C dynamics modeling tools suitable for tropical wetlands and to scale-up measurements to landscape, province, or country scales utilizing remote sensing approaches; (4) roles of tropical wetlands in climate change adaptation and potential scenarios for their inclusion in climate change strategies; and (5) activities to facilitate capacity building and outreach as an integral part of all research and technical transfer activities.

Key findings:

- Tropical wetlands provide a disproportionate number of important ecosystem services including protection from storms (e.g., tsunamis, wave action), nursery, and feeding areas for fish, habitat for many rare and endangered species, and food, fiber, and fuel for human populations.
- Carbon-rich mangroves and peatlands are high priorities in climate change adaptation and mitigation strategies throughout the world. High rates of plant growth coupled with anoxic, water-logged soils in mangrove forests, and peatlands result in these ecosystems having enormous C stocks and being significant C sinks.
- Tropical wetland ecosystems threatened by the highest rates of deforestation and degradation resulting in significant GHG emissions. These ecosystems may assist in mitigating climate change if emissions may be avoided by protecting and restoring long-term storage of C.
- Comparing data from intact and disturbed tropical wetlands allows estimation of emissions that could be avoided in mitigation programs to reduce deforestation and degradation. These data are essential to meet the Measurement, Reporting, and Verification (MRV) standards necessary for participation in C markets and mitigation programs.
- Most tropical countries do not have sufficient information to include wetlands in their national reporting to the United Nations or to develop plans for avoiding greenhouse emissions from wetland protection and restoration.
- The USAID-sponsored SWAMP program has conducted training workshops and field surveys of tropical peatlands and mangroves in many countries. The data that has been collected and reported are making significant contributions to quantifying C stocks in both intact and disturbed systems.

C-29 Desertification, Land Degradation, and Drought

Organizer: *Hoduck Kang (Dongguk University, Republic of Korea)*

Moderator: *Hoduck Kang*

This session will focus on desertification, land degradation, and drought in arid or semi-arid areas with presentations of recent research, operational experiences, and lessons learned on rehabilitation of degraded lands and combating desertification.

Seven speakers gave presentations on assessments and rehabilitation strategies to combat desertification based on projects and research studies as well as capacity building programs in several countries in Asia, Europe, and Africa. Asia Khamzina presented rehabilitation through forestry in degraded land in irrigated croplands of Central Asia. Munkhnasan Lamchin and Claudia Listopad introduced research on estimation and mapping of degradation using LANDSAT Imagery in Mongolia and LiDAR-derived structural diversity indices for management ecosystem in desert. Batkhuu Nyan-Osor introduced physiological aspects in an afforestation site in dry steppe of Mongolia, and Oumarou Ouedraogo introduced ecological approaches of land use gradient on wood vegetation in West Africa. V.P. Tewari introduced strategies to improve degraded arid land in India, and Qiaoling Yan introduced some effects of shelter forests and water factors on desertification processes in China.

After completing their presentations, participants from the floor engaged in a valuable discussion on their research and experiences to combat desertification in their countries. The session was very productive and fruitful to develop relevant strategies and to advance technologies to combat desertification on local, regional, and global levels.

C-30 Novel Ecosystems and Intervention: Adaptation to Climate Change

Organizers: *John Stanturf (US Forest Service) & Palle Madsen (University of Copenhagen, Denmark)*

Moderator: *Palle Madsen*

The session explored current perspectives on restoring forests under the simultaneous pressures of land-use change, trade globalization, and climate change. The eight speakers provided an overview of the concepts of novelty and how novel ecosystems arise, as well as some theoretical and adaptive practical responses.

Key findings:

- Temporal time-scale is often not specified but is critical to understanding novelty and "unprecedented" disturbances.
- At the evolutionary time-scale, such as paleoclimatic shifts, nothing is novel.
- Novel spruce ecosystems from altered fire regimes in Fennoscandia are now regarded as "natural" and of high conservation value.
- Drivers such as climate change have indirect effects as well as direct effects on forests; for example, ungulates are affected by altered climate effects on vegetation as they in turn alter vegetation.
- Efforts to restore extirpated species such as *Castenea dentata* must address both the constraints posed by altered climate on deployment of disease-resistant varieties, as well as the ecological effects of introducing these varieties into altered ecosystems.
- Adaptive management responses explored varied from theoretical suggestions to operational practices.
- Assisted migration of species in response to altered climate is a controversial approach to maintaining species and ecosystems.
- Multi-aged forest structures (distinct from even-aged) are an approach to risk reduction and adaptation most appropriate for large forest areas that are not strictly managed for production (e.g., plantations) or for conservation (parks and protected areas).
- Forest management in western Canada is already responding to climate change by expanding seed zones and, in effect, practicing assisted population migration. There are signs of a move toward shorter rotations to reduce risk by shortening the exposure of forests.
- In the lively discussion, the cautionary point was raised, whether such proactive alterations might not damage existing forest ecosystems and whether it would be better to let "nature" take its course.

Forest and Water Interactions

D-01 Long-Term Watershed Studies: What We Have Learned About Eco-Hydrological Functioning

Organizers: *Shirong Liu (Chinese Academy of Forestry) & Xiaohua Wei (University of British Columbia, Canada)*

Moderators: *Shirong Liu & Xiaohua Wei*

Forests play an important role in regulating water supply and water quality, and many other ecosystem services. This session highlighted the importance of long-term watershed studies under emerging environmental impacts such as human disturbances and climate change, and shares the latest knowledge about eco-hydrological functioning of forests from different geographical regions.

Key findings and discussion points:

- Although there is a general understanding drawn from numerous small watershed studies that forest change can generate pronounced effects on annual runoff, the interactions between forest and many other hydrological variables still lack consistent conclusions among different types of forests, climate, and management regimes.
- In comparison to a wealth of small watershed studies, large watershed studies are very limited and inconsistent interactions between forest and water in large watershed have been reported even for annual runoff, not to mention floods and low flows.
- Reforestation or afforestation, and forest logging can significantly alter flow regimes in terms of magnitude and timing of high flows and low flows. Climate change associated disturbances (logging, fire, and pest) are also likely to have impacts on watershed hydrology at different scales.
- There is a clear need to explore new approaches to assess forest and water relations, and ecosystem services at large watersheds or landscapes, in order to develop sustainable watershed management strategies.

D-02 Conceptual Frames and Research Strategies for Integrated Studies of Adaptation to Drought

Organizers: *Philippe Rozenberg (National Institute for Environmental and Agricultural Science and Research, France), Anne Griebel & Gregor Sanders (University of Melbourne, Australia)*

Moderator: *Anne Griebel*

This two-part session focused on: 1) ecophysiological studies aiming at understanding the adaptive value of xylem and leaf function, including approaches linking xylem traits such as hydraulic capacitance and parameters of hydraulic vulnerability across climatic gradients; 2) genetic studies aimed at estimating the potential for genetic adaptation to climate change in experimental trials as well as in natural populations; 3) investigating how specific functional traits may be fixed or adaptive within a species and related to climatic distribution more broadly; and 4) dendroecological studies aiming at retrospectively investigating tree responses to climate change.

Fifteen oral presentations based on reviews and recent studies of novel and applied research were included in the session related to drought responses and adaptation. These were studied within a number of disciplines: ecophysiology, dendroecology, remote sensing and genetics. Some studies were integrated at the genus level (multi-species studies of eucalypts), genetic level (clone and provenance studies of eucalypts,

lodgepole pine and radiata pine) or bioclimatic/environmental level (multisite studies of lodgepole pine and eucalypts). Studies employed drought treatments (piñon pine, juniper, radiata pine, and eucalypts) and inter-annual variation of response to drought by direct and retrospective approaches (oak, eucalypts, Siberian pine and fir). In addition there was one multi-generation study on radiata pine, and age effects were indirectly represented by height gradients of Douglas fir.

Physiological studies of response to drought were presented at different levels, including: hydraulic vulnerability of leaf and branch xylem with reference also to carbon depletion and starvation. Several studies discussed interspecific variation in functional drought adaptation by comparing seasonal and controlled (water-exclusion or water-deficit) conditions. There was evidence of common plasticity in seasonal adaptation to declining water potential between eucalyptus species from different climatic zones. Other studies suggested within-species variation for drought-resistance strategies (lodgepole pine). In addition, fast natural selection (micro evolution) was apparent in drought resistance in radiata pine.

In ecosystems, genus, and species, evidence of variation in drought resistance strategies were related to different levels and components of hydraulic vulnerability from leaves to xylem, with variable relative weights. These levels also varied with environment: between growing season, between sites, and between fertilization treatments.

Reliable proxies or methodological improvement for the measurement of some physiological traits including resistance to cavitation (hydraulic vulnerability or hydraulic capacitance) and stomatal regulation of water potential should be investigated to develop large-scale studies involving many species and replicates and for better comparison of results from independent studies.

D-03 Land Use/Land Cover Change and Hydroecology: Consequences at Variable Spatial Scales

Organizers: *Latif Kalin (Auburn University, USA), Yusuf Serengil (Istanbul University, Turkey), & Xiaohua Wei (University of British Columbia, Canada)*

Moderator: *Latif Kalin*

This session included eight speakers who focused on hydrologic and ecologic issues in watershed at various spatial scales, as affected by spatial mosaic of land use (and associated water use and management practices) and multiple stress factors such as urbanization, climate change, and air pollution.

Key findings and knowledge gaps:

- Forest to urban change in watersheds draining to headwater wetlands can have significant negative impacts on the functioning of these wetlands. Wetlands downstream of urban watersheds had low organic matter and more invasive species.
- Results from a study in Africa showed that forests can actually increase groundwater recharge. The study showed that there is an optimal forest density, beyond which recharge decreases.
- Beetle infestation can have serious impact on water cycle, with impacts apparent 2-3 years after the outbreak. They also impact the carbon cycle. Study conducted in Wyoming showed that forests can become from carbon sink to carbon neutral after the outbreak. The study also showed that sublimation from snow can play a much bigger role than previously thought and existing models are not handling sublimation well.
- A study conducted in Missouri comparing forested and agricultural floodplains concluded that forested flood plains can have significant water storage capacities and help mitigate large floods.
- A large watershed (>3000 km2) study in China showed that increased forest cover can increase low flows (Q<Q5%) by as much as 30%. However, another study also in China in an even larger watershed showed mixed effects with no statistical meaningful results. These and other studies show that the forest-water relationship is very complex and varies with climatic characteristics, watershed size and location, etc.
- A study in Georgia, USA, showed that nutrient loads increase when a watershed changes from forested to urban. The study then explored the link between West Nile Virus carrying Culex mosquitoes and various nutrient levels. They showed that mosquitoes can breed in very low nutrient levels too (larvae feeds on bacteria, which need N, P, and other nutrients).
- Results from a study conducted in Turkey showed the linkage between channel erosion and watershed land use/cover. Channels with urban watersheds had deeper channels.

D-04 Hydroecological Studies in the Mediterranean Region

Organizers: *Yusuf Serengil (Istanbul University, Turkey), Xiaohua Wei (University of British Columbia, Canada), & Ferhat Gokbulak (Istanbul University, Turkey)*

Moderator: *Yusuf Serengil*

The objective of this session was to evaluate long- and short-term studies in the Mediterranean region on hydrology-ecosystems interaction to better understand the effects of anthropogenic stressors in the region, which is highly vulnerable to the impacts of climate change according to the latest IPCC Assessment Reports. The forests and related ecosystems in the region are expected to face prolonged dry periods, increased risk of wildfires, and related socioeconomic stress factors. The scope of the session was limited with forests and concentrated on hydroecology. A very important output of the session was to underline the need to transfer scientific outputs into management strategies.

Presentation topics and key findings:

- A study comparing wood production with hydrological parameters concluded that a management objective toward water production and adaptation to climate change might be more sustainable than traditional timber production approach.
- A study focused on hydrological modeling to compare complex models with more basic practical models concluded that simpler models can also yield precise results.
- The importance of different forest management approaches toward water production objective was discussed in one presentation, emphasizing the importance of extending the results of the study to a broader scale using remote sensing tools. Other two papers from

experimental watersheds in Turkey discussed the impacts of different management options including various intensity thinning treatments.

D-05 Managing Forests and Forest Uses to Protect and Provide Clean Water

Organizers: *Richard Harper (Murdoch University, Australia) & Jean-Michel Carnus (INRA, France)*

Moderators: *Richard Harper & Jean-Michel Carnus*

This two-part session examined the linkages between forests and forest watershed management and water quality for rural and urban water users and consumers. New research was presented by 11 speakers from Sweden, Australia, United States, Malaysia, Costa Rica, Burkina Faso, and Thailand; as part of the session, nine posters were also presented from Brazil, Canada, Indonesia, Mexico, Poland, Sweden, and the United States.

The morning session presentations focused on quantitative aspects and the afternoon session on qualitative aspects. Two morning presentations covered the impacts of forest management intensification on the sustainability of forest soils and water, and on water flows. Other presentations evaluated restoration options and tools for soil and water protection following fire, as well as co-benefits and trade-offs between forest carbon sequestration and water protection services. The afternoon papers covered the interactions between forest management and water quality and underlined the importance of forests for water quality. Water quality encompassed a range of variables including nutrients, pathogens, and other contaminants. Presentations examined both specific case studies and also new approaches to management and planning, including involving local communities. Together these presentations covered a very large range of biomes and provided a comprehensive consideration of linkages between forest management and planning and the provision of water in quantity and quality. Results from this session were communicated to the Forests and Waterside event organized by FAO during the congress on Thursday, 9 October.

Key findings and knowledge gaps:

- The session showed that progress is being made on the assessment of water-related environmental services provided by forests (water quality protection, water supply) and how management and planning can optimize their delivery from forestry. Several presentations described digital platforms that utilize an array of data sets that will provide the basis for better water management planning.
- The importance of considering water values in the context of other management issues (e.g., timber production, carbon mitigation, rural livelihoods, biodiversity protection) was drawn out by several speakers. Environmental services may provide the basis for such an integrated approach; however, whether a market-based or regulatory approach is most efficient requires more investigation.

D-06 Role of Disturbance in Maintaining and Stimulating Aquatic Biological Diversity in Temperate Forest Ecosystems

Organizer: *Robert Danehy (National Council for Air and Stream Improvement, USA)*

Moderators: *Robert Danehy & R.D. Moore (University of British Columbia, Canada)*

In this session we focused on disturbance to aquatic systems and how they impact biological diversity. Natural disturbances, fire and debris flows, and anthropogenic, clear-cut logging were compared and contrasted. We discussed how understanding the extent of these disturbance impacts the relationship between disturbance severity and recovery period for aquatic communities, as well as possible recovery trajectories required to properly evaluate aquatic biological diversity. Within a landscape subject to periodic forest disturbance in the riparian zone, stream channels are expected to exhibit a range of states associated with responses to disturbance that occurred at different times in the past. Therefore, management targets should be based on considerations of the frequency distribution of these states across a landscape rather than a single reference state.

In the specific case of forest fires, standing dead trees in the riparian zone provide shade and a source of in-stream wood, both of which are critical to maintaining aquatic biodiversity in many landscapes. It is clear that we need a better understanding of interactions between fluvial processes and riparian forest dynamics and how these vary across and among landscapes to support the development of new approaches to riparian management. That knowledge helps forest managers have a better understanding of the consequences of disturbance in the aquatic ecosystems of forested watersheds.

Key Findings:

- Disturbance effects vary across and within landscapes, and the range of biotic responses are determined by new habitat conditions.
- Scale, both temporal and spatial, is important in understanding underlying drivers of every forested ecosystem.
- Across disturbance types, responses vary due to the extent and severity of the disturbance.
- Since disturbance is an integral ecosystem component, emulating those effects in managed landscapes could assist in conservation planning for aquatic biodiversity. In particular, the common practice of reserving buffers along water bodies may need to be reconsidered in some landscapes, particularly in the boreal forest.

D-07 Impacts of Forest Roads on Water Resources and Aquatic Habitat

Organizers: *Charles Luce (US Forest Service) & Artemio Cerdà (University of València, Spain)*

Moderators: *Charles Luce & Carlos E. Ramos Scharrón (University of Texas at Austin, USA)*

Presentations from the US, Brazil, and the Caribbean highlighted measurements and modeling techniques to assess erosion from forest roads as well as their impacts on aquatic ecosystems. The first two presentations gave measurements and calculations of sediment inputs to water bodies and related those inputs to conditions in both stream and marine environments. Specific impacts to trout and coral ecosystems were identified. These two presentations were followed by two papers discussing plot and road segment scale analyses of sediment production related to road design, surfacing, and precipitation characteristics. The session was finished with two papers discussing connections between

roads and stream environments as related to road location and design factors.

Posters displayed after the oral presentation complemented the oral presentations with new results from the US, Asia, and the Caribbean showing effects of mitigation techniques, including decommissioning, road to trail conversions, rolling grades, and road standards. Most showed substantial capacity to control sediment through careful road design or complete road removal. The paper on trails noted similar concerns about the linear design of trails as those of roads, including the capacity to intercept and concentrate water to create gullies and landslides.

Key findings:

- Almost all authors documented the importance of road surfacing, ditch condition, and climate on road surface erosion. These results all highlighted the utility of mitigation techniques in reducing road erosion.
- Two authors demonstrated empirical relationships between road erosion and impacts to marine and aquatic ecosystems, highlighting the importance of mitigation techniques for protecting ecosystems.
- Most of the authors presented results on connectivity of the roads to streams. In particular the impact of distance between the stream and drainage points from the road was described as a key control on sediment delivery from the road.
- Road decommissioning is an increasingly common approach to mitigate road impacts after their use in timber harvest. Most analyses showed substantial improvement from decommissioning, although some caveats about design and implementation of projects were noted.

D-08 Sustaining Riparian Biodiversity and Ecosystem Services in a Changing Climate

Organizers: *Kathleen Dwire (US Forest Service), Michael Pollock (National Oceanic and Atmospheric Administration, USA), & Chris Frissell (University of Montana, USA)*

Moderator: *Kathleen Dwire*

This session focused on changing approaches to management of riparian forests to assure maintenance of biological diversity and ecosystem services in the context of climate change. The potential impacts of altered flow regimes, increased frequency and severity of fire, shifting precipitation regimes, and increased demands for freshwater were discussed for several riparian forest types and different riparian-dependent species.

Key findings and discussion points:

- Management of riparian forests continues to evolve, depending on regional conservation priorities, riparian forest types, competing uses of floodplain areas, and potential fire risk.
- In the Pacific Northwest, riparian management approaches are largely designed to protect water quality, salmonid habitat, and avian habitat for sensitive vertebrate species, and mandated by the (US) Northwest Forest Plan. The effectiveness of these management approaches is now being examined, particularly in regards to amphibian habitat. Although fixed-width riparian buffers have proven to be effective in headwater streams, additional questions have been raised about potential impacts of climate change.
- In larger rivers, fluvial disturbance is critical in maintaining a diverse mosaic of riparian community types and a wide range of native species. This key interaction between physical processes and riparian biodiversity has been appreciated for some time; however, maintaining beneficial fluvial disturbance while delivering expected ecosystem services can sometimes conflict, and has become more challenging.
- The role of fire and fuels management in riparian management is increasingly recognized as more data and information has become available. Recent insect outbreaks (mountain pine beetle, spruce beetle) in the Western US have also impacted riparian forests, contributing to streamside fuel loads and generating new discussions about active riparian management.
- Stream and riparian restoration efforts continue to advance. The integration of natural processes, use of native riparian species, and control of herbivory have become more standard.
- Important knowledge gaps:
- Recent advances in the fire ecology of riparian forests has highlighted the data gaps regarding fuel loads, fuel moisture levels, and fire history of many riparian forest types.
- Fixed-width riparian buffers have proven to be effective in headwater streams, but additional research is needed to improve predictions of the impacts of climate change.
- The impacts of climate change on natural disturbance regimes, stream flows, and riparian forest dynamics remain important knowledge gaps and research priorities.

D-09 Ecology and Management of Coastal Forests and Mangroves

Organizer: *Ariel E. Lugo (US Forest Service)*

Moderator: *Ariel E. Lugo*

This session discussed current research on mangroves and other coastal forest ecosystems, including their importance as habitat for marine and estuarine biodiversity and provision of other ecosystem services.

All five papers were interesting and provided novel information about mangroves.

- Tanushree Biswas demonstrated the importance of temporal analysis of satellite images to assess changes in mangrove status through an innovative Z-Score index.
- Seca Gandaseca and Nelson Manguiat Pampolina presented changes in vegetation structure and composition through mangrove forests in Malaysaia and the Philippines, respectively.
- Md Mizanur Rahman predicted losses of the Nypa palm populations in the Sundarbans as a result of sea level rise, loss of freshwater inputs, and consequent increases in salinity throughout the region. Freshwater wetlands in the region are disappearing.
- Emmanuel Suka made a passionate presentation about the social and ecological problems in the coastal region of Cameroon. He called for the establishment of a number of new agencies to help deal with the plight of people and forests in this part of the world.

All papers elicited questions and discussion from the audience.

Forest Biomass and Bioenergy

E-01 Sustainable Biomass for Energy and Industrial Raw Materials

Organizers: *Viktor Bruckman (Commission for Interdisciplinary Ecological Studies, Austrian Academy of Sciences), Sanjeev Kumar Chauhan (Punjab Agricultural University, India) & Robert Jandl (Federal Research and Training Centre for Forests, Natural Hazards and Landscape, Austria)*

Moderators: *Viktor Bruckman*

This two-part session aimed to disseminate state-of-the-art knowledge of sustainable woody biomass production from common woodland management systems, such as conventional forestry, short rotation forestry, and agroforestry with a focus on sustainability in context of changing climate, carbon sequestration and trading, and social benefits. The first session focused on biomass potentials, while the second considered valuation of bioenergy systems

Biomass cultivation and utilization are key steps on the way to a bioeconomy. Our economy is carbon-based from which most of it is of fossil origin. Since fossil resources are finite and the release of fossil carbon into the atmosphere contributes largely to climate change, science has the responsibility to react and develop potential renewable resources. However, biomass cultivation goes along with land use change that may have a great impact on the environment. Where it has a great impact on hydrology in certain dry regions, it could have large impacts on carbon stocks or biodiversity in other regions, just to name a few examples. Therefore, sustainable practices are needed in order to maintain ecological services that are inevitable for human well-being.

The discussions revealed that the necessary steps to develop sustainable biomass resources are very diverse and region-specific. There is a general consensus that we need incentives; however, while in some cases they need to be top-down (governmental regulations and incentives), it was shown that bottom-up models work very well in suburban forests of Japan, for instance. However, current developments toward more intensive cultivation approaches were seen critically, as soils are considered as a non-renewable resource. Therefore, sustaining soils is a crucial issue for forest and woodland management, which again points out the need for regional approaches. It was further stressed that wood is a valuable product with a wide range of different applications, from traditional use as construction material to more recent and sophisticated utilizations as feedstock for industrial processes and development of composite materials. Consequently, the utilization of biomass as a source for energy should be at the end of a cascade use. In this context, it was mentioned that the efficiency plays a crucial role. The recent trend in a number of industrialized countries toward small-scale, household-based wood stoves must be critically evaluated, both in terms of efficiency and especially air pollution.

The last presentation in our session represented an excellent metaphor of what can be the future worldwide: In Myanmar, rural people rely on a thorny invasive species. It badly injures local people and livestock, yet they accept all the pain and injuries to utilize it as it is a source of energy – because there is simple no alternative left. We have to prevent the world's population suffering from pain for the sake of raw materials and energy, and therefore develop sustainable resources and shift toward a green economy as long as we still have the chance. Research has a key role in this agenda.

E-02 Environmental Impacts of Intensive Management of Forest Soils for Timber and Bioenergy Production.

Organizers: *Deborah Page-Dumroese (US Forest Service), Peter Clinton (Scion, New Zealand), Liisa Ukonmaanaho (Finnish Forest Research Institute), & Hailong Wang (Zhejiang Agricultural and Forestry University, China)*

Moderators: *Peter Clinton & Liisa Ukonmaanaho*

The goal of this session was to address a range of biogeochemical and environmental consequences of timber harvesting or bioenergy production; topics will include intensive forest soil uses such as cultivation, fertilization, herbicide, nutrient removals in biomass, acidification, leaching of DOC, replacement of soil nutrients via deposition and weathering, and alterations associated with the application of biochar.

Twelve presentations provided an overview of current research focused on the environmental impacts of intensive management of forest soils. Four of the presentations were by PhD students reporting on their research studies.

- Leena Finer described differences in nutrient removals due to stem-only or whole-tree harvesting of different species and highlighted that nutrient removals were species dependent and inclusion of roots while leaving branches and needles behind could reduce overall nutrient removals.
- Nicolas Clarke described new trials designed to examine short- and long-term impacts of harvesting biomass residues for bioenergy comparing whole-tree and stem-only harvesting treatments. These types of studies are essential across a range of forest ecosystems so as to show the range in potential responses.
- Matt Vadeboncoeur presented various scenarios around the ability of soils beneath hardwood stands to provide nutrients, particularly Ca, over varying time periods. The results from these scenarios suggested that weathering rates were not well understood but clearly will determine long-term nutrient supplies for these soils and forest types.
- Stanley Sochacki presented details of a novel study using trees to alter the hydrology of sal-prone soils in western Australia. Although the proposed system achieved its stated objective, the lack of demand for biomass for bioenergy in the area highlighted that wide uptake of the proposed method might not be achieved.
- Juan Carlos Gimenez illustrated how hydrological constraints could be included in harvest scheduling models. This is an exciting area of research that can be further strengthened by incorporating multi-criteria decision-making processes into the analysis so that community aspirations around the various environmental constraints can be included in decision-making.
- Martina Cambi highlighted the need to recognize soil type in planning harvesting operations and to consider potential for compaction and the ability of soils to recover from this form of physical disturbance. The data presented show that recovery had occurred in this case. Such a result is interesting to note.
- Tom Fox described large improvements in productivity that have been achieved over large areas in the southeastern United States. The presentation highlighted the role of effective engagement with the forest industry and how this can have a wide-ranging impact over a long

period of time to result in very significant improvements in forest management.

- Peter Clinton pointed out that there is the need to identify the extent of the productivity gap for forests. Manipulation of forest soil offers many possible options for increasing the productivity and value of mid-rotation stands. One way to do this is to increase the sophistication of fertilizer use in forestry and to bring it into line with state-of-the-art fertilizer technology.
- Arnis Jurevics and Lilli Kaarakka both described impacts of stump harvesting in boreal forests and the resulting changes in soil carbon pools. This is an important issue because stump harvesting could have a negative impact on the soil C pool by removing slowly decomposing biomass and also disrupting N cycling.
- Robert Fleming presented results of a global meta-analysis. He pointed out that a range of field trials have been carried out in various parts of the world to assess the environmental impacts of intensive biomass removals. He used meta-analyses to test the hypotheses that tree growth response to intensity of biomass removals is dependent on factors such as tree species, ecosystem type, climate, site index, soil properties, and surficial and bedrock geology. Results indicated that site-specific information should be used to determine the extent of change during biomass removal.
- Martha Henao presented on the productivity of plantations of *Gmelina arborea* in Colombian tropical dry forest that are lower than in other South American countries. Results showed that sodium may be negatively affecting plant development because of a negative relationship with exchangeable sodium and tree volume.

E-03 Evaluation of Environmental Impacts of Production and Use of Wood Products and Wood Energy

Organizers: *Richard Bergman (US Forest Service) & Adam Taylor (University of Tennessee, USA)*

Moderator: *Richard Bergman*

All products including wood building and wood energy products have environmental impacts. Because of the large carbon flows associated with forestry and wood products, net greenhouse gas (GHGs) emissions and the resulting effects on climate change are important to understand from the forest and forest product perspective. Two important notes in this context are that global climate change is primarily being driven by the burning of fossil fuels while the building sector consumes about 40% of all fossil fuels. Using products with lower net GHG emissions would reduce global warming impact. Life-cycle analysis (LCA) has become a useful method to evaluate building and energy products and associated GHG emissions tied to climate change. Using LCA approaches provides insight into critical environmental impacts including GWP from cradle-to-grave for wood products and wood energy and demonstrates greener products. In addition, dynamic LCA approaches have shown that timing of GHG emissions has a substantial impact on the radiative-forcing impacts leading to climate change.

Key findings:

- Emerging bio energy products from thermochemical conversion may not have a better environmental performance than established energy products such as wood electricity unless associated co-products such as biochar are sequestered in soils are considered in LCA. Therefore, higher-value products such as chemicals ought to be considered for production.
- When discussing alternative forest management practices in the context of LCA, ensure that a functional unit (same services provided) for the alternative systems evaluated for comparison is included.
- LCA is good at providing environmental impacts for a region but ought to include localized effects as much as possible in relation to population centers.
- Environmental performance of wood cascading can be counter-intuitive. Product systems based on cascaded post-consumer wood showed only marginal environmental benefits in LCA compared to products based on fresh wood. Because biomass production is not credited in LCAs, the conservation of biomass over many product cycles in cascading does not document as high of benefits as in other material systems. Additional metrics need to be implemented in the evaluation to better address the environmental effects of wood cascading.
- Soil carbon flows ought to be considered in LCA as data becomes available. Use LCA to estimate life cycle carbon flows in relation to the belowground as well as the aboveground carbon pools.
- Include dynamic LCA approaches in dealing with carbon in wood products over its whole life cycle.
- Forest management can be developed to produce more energy biomass without reducing the timber produced while increasing the substitution possibilities of forest biomass. However, to define more precisely the role of forests in climate change mitigation there is a need for assessing the net CO2 exchange of the ecosystem-technosystem-atmosphere continuum. Forest-based production systems should be compared with corresponding fossil-based systems by means of LCA.

E-04 Forest Biomass Supply Chains: Practice, Economics, and Carbon Balance

Organizers: *Woodam Chung (Oregon State University, USA), Nate Anderson (US Forest Service), & Gustaf Egnel (Swedish University of Agricultural Sciences)*

Moderator: *Nate Anderson*

This two-part session covered a wide range of forest biomass supply chain studies from around the world; topics include feedstock production, operations research, conversion technologies, logistics management, economics, and carbon balance associated with forest biomass utilization. The second session considered case studies from Africa, Europe, and the Americas, which discussed the economic, social, and environmental aspects of forest biomass used for household heating, cooking, charcoal production, and other domestic end-use applications.

The presentations ranged from global and international economics and public policy research, to regional and facility-scale supply chain assessments and engineering, to community-based social science survey research. Countries represented included Denmark, US, Finland, Japan, Guatemala, UK, Costa Rica, Cameroon, Nigeria, Iran, and Canada. The session moderator presented a summary of these technical sessions in the sub-plenary session SP-14 Energy from trees: technology, opportunities, and challenges.

Key findings:

- Biomass sourcing potential is closely related to supply chain cost and price, which is strongly influenced by policies and incentives, especially subsidies and feed in tariffs.
- Even modest subsidies in a few EU countries would substantially increase use of wood for energy, but the economic efficiency of such subsidies should be considered by policy makers, especially when it comes to possible impacts on the wood products sector.
- Spatial analysis of supply potentials is preferable to uniform co-firing targets for all facilities when it comes to biomass co-firing with coal.
- Sustainability is not an intrinsic quality of biomass energy, but related to management variables.
- For many forest biomass bioenergy scenarios, greenhouse gas reductions are larger than emissions, resulting in net negative flux and potential climate benefits. However, flux is closely tied to fossil fuel displacement, and also to the source of feedstock and associated management practices.
- Co-location of bioenergy facilities with plantation-grown biomass feedstock is favorable, but in general the economics of facility construction and operation more strongly influence financial viability than feedstock supply variables in these systems.
- Studies in UK and Africa show that fuelwood consumption can be an overlooked and significant component of local and regional economies, especially in rural areas.
- Even communities with relatively low percent forest cover can be highly dependent on local forest resources for heating and cooking.
- Residues from agricultural and agroforestry systems may be underutilized for heating and cooking as a result of both economic factors and public policies restricting access.
- A variety of state-of-the art tools exists to inform supply chain management, especially when it comes to logistics.

E-05 Global and Regional Deployment of Biomass & CCS (BECCS): Reconciling Top-Down and Bottom-Up Approaches and REDD+BECCS Nexus

Organizers: *Florian Kraxner (International Institute for Applied Systems Analysis, Austria), Sabine Fuss (Mercator Research Institute on Global Commons and Climate Change, Germany), Ruben Lubowski (Environmental Defense Fund, USA), Nathalie Walker (National Wildlife Federation, USA)*

Moderators: *Florian Kraxner & Sabine Fuss*

This session discussed the latest research on combining bioenergy with carbon capture and storage (BECCS), its important potential co-benefits, and its risks (e.g., the conservation of biodiversity), and to identify possible (funding) synergies and challenges from the REDD+/BECCS nexus.

The new IPCC report (AR5) says we can still limit global mean temperature rise to <2 °C, but in order to do so, all options must be put on the table. The majority of the stabilization scenarios, which are consistent with limiting global warming to below 2° C, exhibit strong reliance on negative emissions (presentation by Sabine Fuss), in particular through combining bioenergy with carbon capture and storage (BECCS) (presentation by Estushi Kato). However, the champion solution of BECCS is still surrounded by lots of uncertainties, most notably concerning the potential of sustainable biomass to deliver carbon-neutral bioenergy (presentation by Dmitry Shchepashchenko). Country case studies were supposed to shed more light on economic potentials in a geographically explicit way (presentation by Manahan Saragih and Florian Kraxner). At the same time we will need natural sinks for mitigation. In particular, forest-sector-only models in AR5 find that 0.3-13.9 Pg CO2/yr could be sequestered by forests, and this mainly through reducing deforestation (REDD+). However, while REDD+ projects have started to deliver, private sector interest in buying REDD+ credits has never been lower than today. In the face of uncertainty, we might not be able to afford to squander the forest option and so interim funding proposals have been developed (presentation by Ruben Lubowski and Alexander Golub). Bringing REDD+ and BECCS together, there appear to be conflicts, but the session was intended to also identify complementarities, where an integrated strategy could lead to an enhancement of both in their pursuit of mitigation. Finally, it is not only important to study REDD+BECCS in an integrated way, but also to look at those two from a systems perspective, i.e. respecting scarcities of water, fertilizer, and land and competition with other (also non-climate) objectives such as food security and biodiversity conservation (presentation by Florian Kraxner).

Key findings, discussion points, and important knowledge gaps:

- Without the right data (and there are huge discrepancies between existing biomass maps/products), any REDD+ and/or bioenergy strategy will be difficult to plan and realize. Data sharing and efforts like the biomass GEO-wiki are needed to overcome this.
- It is important to understand uncertainties and make them transparent, but we also have to be careful how to communicate them to decision makers, so as not to discourage action.
- Team up with REDD+ efforts to certify sustainability of biomass feedstock for BECCS (because if bioenergy is not carbon-neutral, we cannot achieve negative emissions by definition and concept).
- Integrated REDD+BECCS strategy to help raise private sector finance by introducing broader scope for economic benefit.
- BECCS could benefit from aligning with REDD+ in terms of public acceptance (both bioenergy and CCS are unpopular in different countries).
- REDD+ to buy time for more BECCS research and scaling it up. Options sales (maybe combined with price guarantees by the World Bank, philanthropic funds, or governments) could help raise the finance to save the forest option until 2020 (when an agreement might come into force) or even later. In absence of a climate agreement currently, we need to think about how to provide incentives to preserve the option to use forests for reasonably priced mitigation later on.
- Both REDD+ and BECCS are needed to achieve climate stabilization. There are important trade-offs and tensions in terms of resource scarcity (e.g., increased water use for intensified agriculture) and also with other (non-climate) objectives such as food security, which require careful study.

E-06 Emerging Technologies for Forest Resource Assessment and Genetic Improvement

Organizers: *Xiping Wang (US Forest Service), Jianxiong Lu (Chinese Academy of Forestry), Kyu-Suk Kang (Korea Forest Research Institute, Republic of Korea), & Marco Marchetti (Italian Academy of Forest Sciences)*

Moderators: *Xiping Wang & Kyu-Suk Kang*

This session focused on the most recent advances in non-destructive and precision-based technologies and strategies for assessing wood quality of forest resources and selecting clones for genetic improvement of future plantations. Seven speakers from Australia, Brazil, Republic of Korea, United States, Japan, and Germany delivered excellent presentations on this cross-discipline theme.

Discussion topics and key findings:

- Traditional phenotypic measurements for properties such as density, stiffness, pulp yield, calorific value, etc., are often destructive, expensive, and time-consuming, which limits their utility. Rapid, non-destructive technologies are being used on standing trees to classify hybridization, or provide multiple phenotypic properties, in breeding trials in Australia and SE Asia in order to select next-generation germplasm.
- New studies have shown that acoustic wave technology can be used in field to assess the effects of thinning and bio-solids fertilization on wood quality and differentiate eucalyptus clones in terms of tree's resistance to wind. More studies are needed to better understand how stand variables (age, stand condition, silvicultural treatment) affect acoustic wave propagation in trees so that accurate prediction models can be developed for practical use.
- Poplar clones in short rotation coppice (SRC) under the treatment of slurry composting and bio-filtration liquid fertilizer (SCBLF) showed significant improvement in survival rate, average number of shoot, average of leaf area, and annual average of aboveground biomass production.
- Laser technologies providing high-quality three-dimensional structural data of trees are emerging as automatic and non-destructive tools for forestry monitoring, operation, and inventory work. Two different terrestrial Lidar sensors (RIEGL VZ400 and SICK LMS511) have been demonstrated to accurately and efficiently estimate forest biomass in tropical forest.
- X-ray computed tomography (CT) is increasingly introduced in industrial practice to optimize the value yield in sawmilling and wood material industry. Now algorithms for automated species detection and detailed assessment of value-determining features have been developed for many softwood species. Many of them work in real-time during industrial roundwood processing at speeds up to 120 m per min.
- The extractives loading modeled by near infrared reflectance (NIR) spectroscopy was found to correspond with lower lesion severity. This relationship may play a role in genetic separation for improved forest health. More work is underway to further test the hypothesis that lesion severity can be reduced through increased extractives loading across different sites and genetic sources.

E-07 Genomics and Biotechnology for Improvement of Woody Energy Crops

Organizer: *Carl Douglas (University of British Columbia, Canada)*

Moderator: *Carl Douglas*

This session presented current research on optimizing woody biomass plantations for bioenergy, natural variation in bioenergy and biomass traits, genetic and genomic approaches to tree domestication for bioenergy uses, and biotechnology for bioenergy biomass optimization. Five oral presentations were given by colleagues from Canada, the United States, Sweden, and Finland.

E-08 Biobased Products and Bioenergy

Organizers: *Jianchun Jiang, Fuxiang Chu (Chinese Academy of Forestry), Dominique Lachenal (Grenoble INP-Pagora, France), & Jingxin Wang (West Virginia University, USA)*

Moderators: *Dominique Lachenal & Jianchun Jiang*

This session featured current scientific developments on techniques for converting biomass into useful products and energy. They refer to gasification, pyrolysis, torrefaction, and extraction of the main wood components: cellulose, lignin, hemicellulose, extractives and their use to produce higher value chemicals, polymers, and materials. Fourteen oral presentations were included in this two-part session.

Key findings and important knowledge gaps:

- The current methods and logistics used to harvest and transport renewable energy feedstocks are in general unable to deliver these feedstocks at a price at which they can compete with traditional fossil fuels for energy production.
- High yields of oil (>70%) can be obtained by fast pyrolysis of biomass but unsuitable properties (mostly linked to the presence of oxygen atoms) make its direct use improbable. Catalytic upgrading such as hydrogenation using nanocatalyst may offer a solution to provide green transportation fuels.
- Gasification of biomass to produce commercial liquid transportation fuel is today handicapped by the high investment cost and poor final yield (10-15% based on carbon).
- Production of cellulose for textiles and polymers (acetate) applications requires heavy investment and efficient purification steps. The use of ionic liquids looks like a very promising approach to simplify the whole process and is applicable directly on a regular paper pulp.
- Hemicelluloses from lignocellulosic biomass might be an attractive feedstock for the development of sugar chemistry, in order to produce bioproducts and bio-based materials. As an example, production of bio-based surface-active agents from non-food sugar sources looks particularly desirable.
- Autohydrolysis of wood chips is today a satisfactory way to obtain sugar syrup, which is appropriate for bioethanol and surface active agents (APG type) production.
- Lignin has unfortunately a very complicated chemical structure and inappropriate molecular properties for the production of high-value bioproducts and biopolymers. A potential use is in the adhesive sector (phenol formaldehyde resins). But even for this application, kraft lignin has to be modified to increase its reactivity. Phenolation is one attractive modification.
- Fatty acids are already extracted from wood and commercially available. This operation is generally linked to the production of cellulose in pulp mills. Analytical techniques for their complete characterization are in progress.
- The session revealed interest in greater communication between biorefinery researchers and those in the pulp and cellulose community.

Because of its size and its expertise, the cellulose industry will inevitably be a key actor in the development of new biorefinery operations.

Forests and Forest Products for a Greener Future

F-01 Innovation in the Forest Sector: Maximizing the Sector's Competitiveness

Organizers: *Eric Hansen (Oregon State University, USA), Erlend Nybakk (Norwegian Forest and Landscape Institute), Lyndall Bull (Australian National University), & Gerhard Weiss (University of Natural Resources and Life Sciences, Austria)*

Moderator: *Rajat Panwar (University of British Columbia, Canada)*

Global forest-based industries face significant hurdles to maintaining competitiveness in the face of a dynamic competitive environment. The potential increased competitiveness through innovation has driven interest in industry, academia, and policy makers. Policy makers the world round are developing mechanisms to promote and facilitate innovation in the forest sector. The session included presentation on: the efficiency frontier based on forest ownership type, tendencies of environmentally conscious forest owners, value chain innovation, sawmill optimization, architect awareness of cross-laminated timber, innovation diffusion of biorefinery products, and factors influencing architect's specification of certified wood.

Key findings:

- In Spain's forest sector, productivity is more labor than investment driven, public ownership is less efficient than private ownership, and environmental and recreational uses are drivers for increased efficiency.
- In Finland, environmentally conscious forest owners emphasize more the multiple benefits of forests. Women, older people, and more educated people are more likely to be environmentally conscious owners. There is a need for more diverse and in-depth cooperation among stakeholders.
- In Finland research and development projects, customer projects teach and motivate researchers and the wood products value chain is not well understood. More collaboration is needed.
- In the US, approximately two-thirds of architects are unfamiliar with cross-laminated timber as a building system. Those architects who are familiar with the technology are favorable to its use.
- From research in Sweden, forest companies must transition to be better at innovation/product development. Forest companies are not accustomed to working with entrepreneurial companies. There is a need to establish an identity for composite wood products that is as favorable as the identity that solid wood products possess.
- In the US, homebuilders that have constructed green-certified homes are more aware of certified wood. On average, builders perceive certification with a price premium. Younger builders are more likely to use FSC-certified wood.

F-02 The Interface Between Quantitative Forest Sector Modeling and Policy Analysis: What Can Be Improved?

Organizers: *Birger Solberg (Norwegian University of Life Sciences), Daniela Kleinschmit (Swedish University of Agriculture Sciences), & Clark C. Binkley (International Forestry Investment Advisors, USA)*

Moderator: *Birger Solberg*

The session explored the strength and weaknesses of using forest sector models in policy analyses, recent methodological improvements and pending needs in forest sector modeling, and the scope for improvement in the interface between policy analysis research and forest sector modeling.

Key questions and findings:

- From the perspective of policy analysis: What are weak and strong points in using forest sector models in policy analyses? The strong points are that this will secure consistency between markets and policies and integration of economics in the policy analyses. The weakest point is that model assumptions could be too far from reality and that the models are complicated to understand for policy researchers not familiar with economics.
- From the perspective of forest sector modeling: what major methodological improvements have occurred lately in forest sector modeling, and where are further improvements most needed? Here the following points came forward: (a) more differentiated timber supply assumptions have been incorporated in some models, but more of this is needed: (b) the need for better demand studies is great; and (c) attempts are being made to incorporate risks but this is proving difficult.
- How to improve the interface between policy analyses and forest sector modeling? The most important thing is for these two groups of researchers to work together in the same research project, with close contact from the beginning. There is a much room for improvement in this.

F-03 Contributions of Business and Marketing to a Greener Future

Organizers: *Eric Hansen (Oregon State University, USA), Tom Hammett (Virginia Tech, USA), & Birger Solberg (Norwegian University of Life Sciences)*

Moderator: *Richard Vlosky (Louisiana State University, USA)*

The interaction between society and forests is highly influenced by business and marketing practices throughout the value chains that process and transport forest-based products from forest to consumer. Environmental marketing, ecolabeling, supply chain optimization, and design for environment are examples of current practices that can contribute to a greener future. The session also covered issues of digital versus print media, consumer perceptions of furniture, furniture ecodesign, community forestry business models, forest certification, ecosystem services, biomass, and corporate responsibility.

Key findings:

- All LCAs found in the literature found digital media to be preferable to paper. LCAs are not robust enough to deal with differences in systems. Future use of E-readers are expected to increase significantly – digital media is increasing across the board. Environmental values have little influence over media consumption. Consumers may be disconnected from media footprints. LCA is ill-equipped to compare paper to digital media.
- IKEA is a sort of metaphor for furniture among Finnish and German

young adults – it is the top of mind for them when thinking of furniture – even though they were critical of quality. Consumers give special value to used pieces of furniture – personal bond. German consumers were skeptical of ecolabels. Maturing consumers move toward being more ecological and eliminating the "cheaper" furniture. Consumers are looking for furniture with a story.

- Nordic designers' integration of ecological criteria in their work concerned material and process optimization perspectives and end use and recycling of furniture. Designers focused more on earlier stages of life cycle than later.
- Community forest enterprises face important challenges: no guarantee of tenure, lack of legal assistance and financial risk management skills, ability to maintain market relationship, pests, diseases, and climate change. Some important success factors are: product value proposition, some government support and promotion, experienced business leadership, and facilitation. Future success can be facilitated by: leadership and business skills, strategy based on value chain understanding, proper policies, and business development services. If the forest pays, the forest stays.
- Better data is needed to predict the on-the-ground progress with forest certification. With that data, models can be created to determine, for example, if future certification can help avoid deforestation and what can be learned from the experience in the North? There is a need for integrated assessment/modeling approaches.
- Private sector engagement is emerging for environmental services. Absence of regulatory framework, newness, and lack of experience lead to higher transaction costs. Current policies, tools, or practices focus on risks, but not on business opportunities.
- Biomass product features in Europe are defined by EU standards. Personal selling is the most used promotion tool. For customers, delivery consistency, quality, and price are the most important issues.
- Decline in financial performance leads to higher decline in community initiatives than environmental initiatives. Organization decline does not have a uniform effect on CSR initiatives. Initiatives integrated with a firm's strategy and core functions are more resilient to exogenous shocks.

F-04 Greening Society and Non-Wood Forest Product Commercialization: Assessing the Environmental, Economic, and Social Trade-Offs

Organizers: *Luis Fontes (Technical University of Lisbon, Portugal), Jenny Wong (Wild Resources Ltd, UK), Robert Mavsar (European Forest Institute, Finland), & Marla Emery (US Forest Service)*

Moderators: *Robert Mavsar & Marla Emery*

This session explored trade-offs inherent in the sustainable provision of NWFPs and the possible consequences of globalization of demand for new products and services on the environment and on forest-dependent communities.

Key findings:

- North American indigenous people are not universally opposed to commercialization of NWFP, but subsistence and cultural survival are first priority.
- The European Non-Wood Forest Product Network offers an enlarged opportunity to share and increase knowledge to promote sustainable forest management on NWFP.
- Dry forests of Ethiopia are important sources of gum and resins for trade and local and international markets, but only a small portion of the potential production is used. There is a need to develop pro-poor value chains.
- International trade of NWFP appears to be growing, but is still dominated by a relatively small number of countries.
- Despite the great market potential for products based on Quassia amara, there are obstacles to be overcome that require better of the species ecology, policy and institutional barriers, and access to credit and the international markets.

F-05 Gender and Forestry Value Chains

Organizers: *Herry Purnomo, Bimbika Sijapati Basnett (CIFOR, Indonesia), Sola Phosiso (CIFOR, Kenya), & Pablo Pacheco (CIFOR, Indonesia)*

Moderators: *Herry Purnomo & Bimbika Sijapati Basnett*

Drawing on research carried out on a wide range of forest value chains from charcoal and teak to bushmeat and wild vegetables, this session shed light on the role of women in forest value chains in the face of forest loss and a range of uncertainties generated by ever-increasing demands for food, timber, and ecosystem services in a globalized world.

Presentation topics and key findings:

- Fiona Paumgarten presented "Opportunities for enhancing poor women's socioeconomic empowerment in the value chains of three African non-timber forest products," discussing gum arabic from Burkina Faso, gum olibanum from Ethiopia, and honey from Zambia – three non-timber forest products (NTFPs) from Africa's dry forests with international value chains. The results show that women are involved in various stages of the chains; however, their roles are often poorly recognized due to their involvement in the informal sector, their role as part-time employees, and their tendency to carry out NTFP-based activities at home in conjunction with household responsibilities. Herry Purnomo's presentation "Gender, value-added chains, and certification in the furniture industry" concluded that although women play an important role in the value chains their power was weak, and they perceived green certification as a must. Specific training activities were recommended to improve women participation.
- Sola Phosiso shared findings on "Women and charcoal value chains in Eastern and Southern Africa." Wood fuel is the main energy source for most people in sub-Saharan Africa, a substantial part of which is supplied as charcoal. The preliminary assessments have shown that the players in the middle of the value chain benefit more than those at the two ends. These stages are mostly dominated by men.
- Edward D. Wiafe shared findings on "Afadjato Mountain Ecosystem in Ghana," where most women contributed to the development of the resources to ensure their sustainable utilization through harvesting of many resources ranging from food and materials to amenities. Though men generally did not prevent the women from harvesting the resources from the mountain, some of the men competed with the women by harvesting resources that were meant traditionally for women or assisted other women. The women mentioned some constraints in the

course of utilizing the resources such as difficulty in climbing, lack of environmental management personnel, and lack of public education.

Discussion summary:

- Several participants asked questions regarding the gum and honey businesses in Africa, particularly how the role of women can be improved. Other participants clarified the effect of certification on women's roles in the Jepara furniture industry in Indonesia as well as how the relative power of women in different value chain connectivity. Wood fuel in Eastern and Southern Africa interested participants in many ways including its sustainability as well as women roles. The struggling of women in Afadjato Mountain, Ghana, generated much discussion.
- From the discussion we can learn lessons about the important role of women in every stage of product creation, selling, and use. However, value added from the products is not fairly obtained and enjoyed by women for many various reasons. Women are also not able to participate in meetings and fora due to their family duties; e.g., taking care of education and food for their children. Carol Colfer, who moderated the discussion, mentioned the need to deepen and move forward from existing findings to get more insights from gender studies to improve the role of women in forestry value chains.

F-06 Impact of Forest Certification on Sustainable Forest Management

Organizers: *Wenming Lu (Chinese Academy of Forestry), Robert L. Deal (US Forest Service), & John Innes (University of British Columbia, Canada)*

Moderators: *Wenming Lu & Robert Deal*

This session assessed different aspects of forest certification, including impacts on forest management and timber markets, effects for forest workers and communities affected by certified forest management, quality of certification audits, and governance and authority of certification schemes. The session included eight oral presentations plus four posters that were part of a separate facilitated poster symposium. The presentations included diverse perspectives on the role of forest certification from around the world and their potential for sustainable forest management. These included:

- Logging concessions and local governance in the Congo Basin and the connection between social legitimacy and the effectiveness of forest certification.
- Challenges of forest certification in China and the evolving changes in forest certification programs in China.
- Analysis of domestic forest certification programs in Korea's forestry and forest products industries.
- Chain of custody and FSC forest certification in Spain and Brazil.
- Implementation of sustainable forest management under different governance and socioeconomic conditions.
- Conservation impacts of forest management certification in different regions of the world.
- Evaluation of tropical forest management certification.
- Assessment of new methods for sustainable management practices in remote areas of the world.
- Sustainable development in an international framework and an overview of the impacts on forestry and forest products.
- The role of forest certification and sustainable forest management in British Columbia, Canada.
- Community forest management and deforestation rates in Brazilian biomes.
- Assessment of attitudes of forest industry companies toward forest certification in northwestern Russia.

The session provided a broad overview of the role of forest certification in many different regions of the world and how forest certification can assist in efforts to achieve sustainable forest management. Presenters provided case study examples and some of the opportunities and challenges of forest certification and some ideas for improving existing programs and their potential impact on sustainable forest management for different countries around the world.

F-07 Forest Governance and Legality of Timber: Challenges of Legality in Practice

Organizers: *Margaret Shannon (University of Freiburg, Germany), Wenming Lu (Chinese Academy of Forestry), Mersudin Avdibegovic (University of Sarajevo, Bosnia-Herzegovina), & Qiang Li (International Tropical Timber Organization, Japan)*

Moderators: *Margaret Shannon & Wenming Lu*

Effective governance for ensuring Forests and Forest Products for a Greener Future includes the capacity to reduce or eliminate illegal logging globally. Several countries have legislatively banned the importation of illegally harvested wood products, but effective implementation of these bans as well as identification of illegally harvested wood remains a significant global challenge. Nonetheless, these legal changes are creating a transnational legal regime for forest trade, affecting the business practices of exporters and importers, and raising issues of fairness between importing and exporting countries. This session critically examined the expectation that forest governance can be improved by strengthening institutional and legal requirements for timber legality within a transnational legal context and with emerging national systems for legality assurance.

Key findings:

- A challenge for importers and exporters is the transnational legal context for international timber legality and implementation of these new legal requirements within countries.
- The EU Timber Regulation and its requirements for due diligence and risk assessment by the first importer of wood products into the EU for potential illegality remains a challenge for understanding in other countries. The linkage between the EU FLEGT and its VPA process and the EU TR is unclear to some.
- Corruption in the forest sector poses a significant difficulty for some countries in ensuring the legality of timber and wood products exports. Changes in management practices at the forest enterprise level are necessary to address corruption.
- A feminist (critical) theory approach shows that what seems most neutral and objective is often oppressive. Thus, taking a critical look at

the implications of labeling some kinds of timber harvest as "legal" and others as 'illegal' is a complex normative political process that privileges some and punishes others.

- Posters presented during this session addressed the issue of the relationship of timber legality to expand demand in China for the re-importation of US wood products and how timber legality requirements are affecting the business practices of importers in the US.

F-08 Forest Resources Assessment for Non-Wood Forest Products

Organizers: *Marco Marchetti (University of Molise, Italy), James Chamberlain (US Forest Service), Pawel Staniszewski (Warsaw University of Life Sciences, Poland), & David Pettenella (University of Padua, Italy)*

Moderators: *Marco Marchetti & James Chamberlain*

This session explored the status and challenges of including non-wood forest products in national forest resource assessments. The technical session provided a forum for colleagues from around the world to assess the challenges of reporting on non-wood forest products.

Key findings:

- The Kenya Forest Research Institute has estimated yields of gum from two important trees, and using mapping techniques has projected potential production from two counties that could improve management.
- In Nigeria households prefer locally available NTFPs to those being imported from distant rural areas.
- The abundance and structure of a local tree in Hiern, Benin, was negatively impacted by harvesting and habitat changes.
- The challenges of tracking medicinal forest products can be overcome by building trust of local buyers in Appalachia, USA.
- In Austria, efforts are well developed to estimate the value of NTFPs to the nation's economy.

F-09 Sustaining Bamboo and Rattan Resources

Organizers: *Jinhe Fu (International Network for Bamboo and Rattan, China), Yan Yu (International Center for Bamboo and Rattan, State Forestry Administration of China), & Jinzhong Xie (Chinese Academy of Forestry)*

Moderators: *Jinhe Fu & Emmanuel Appiah-Kubi (Forestry Research Institute of Ghana)*

This session focused on basic and applied research surrounding the conservation and sustainable utilization of bamboo and rattan resources. Oral and poster presentations during this session considered the following topics, among others: bamboo as a new alternative to wood in the Philippines; guidelines for sustainable management and use of Guadua angustifolia in Costa Rica; bamboo as a sustainable biomass energy; competitive analysis of bamboo products in global markets; field performance of bamboo propagules produced through micropropagation; preparation and properties of microfibrillated cellulose (MFC) from bamboo processing residues; harnessing diversity of rattans and its benefits for the green economy and the environment; studies on chemical constituents and biological activities of bamboo leaf extracts; and effectiveness of forest tenure reform on the resource cultivation, and institutional innovation on livelihood development in bamboo areas in China and India.

Key findings:

- Bamboo and rattan are two most important NTFPs.
- Bamboo biomass energy is very important in Africa.
- Bamboo innovative utilization and land tenure reform are essential to sustain bamboo sector development.
- Rattan certification is an urgent need for sustaining natural rattan resource.
- International and domestic trade data of bamboo and rattan need further improvement.
- There is a need for networking of experts on standardization and other key topics related to the sustainable production and utilization of bamboo and rattan resources.

F-10 Precision Land-Use Management – State and Perspectives

Organizers: *Hans R. Heinimann (ETH Zurich, Switzerland) & Woodam Chung (Oregon State University, USA)*

Moderator: *Woodam Chung*

This technical session explored principles, technologies, and applications of precision land-use management. The precision land-use management is an emerging, engineering-driven concept based on the vision that future land-use management systems will be able to purposefully control and coordinate biological, technical, and administrative processes in real-time.

Key findings:

- Precision remote sensing data can provide an accurate forest inventory even for stands with high structural complexity and variability.
- Precision inventory data coupled with modern optimization techniques make it possible to develop harvesting plans at an individual-tree level.
- Various applications of high precision information include automatic delineation of harvest units, site suitability analysis for hardwood species plantation, development of precise forest operations models, and individual tree level decision-making.
- Precision data acquisition, analysis, and applications enable high-resolution planning, but effective ways of implementing such plans still need to be researched.

F-11 Forest Operations Engineering and Management – The Way Ahead

Organizers: *Hans R. Heinimann (ETH Zurich, Switzerland) & Woodam Chung (Oregon State University, USA)*

Moderators: *Hans R. Heinimann & Woodam Chung*

Forest Operations Engineering and Management scientifically contributes to umbrella disciplines, such as operations research, systems analysis, and road engineering, and has to consider region-specific terrain, stand, and socioeconomic conditions. This leads to a balancing act of bringing discipline- and region-specific knowledge and experience together to learn from each other and to jointly address the big issues ahead. The session sought to bring the perspectives from umbrella disciplines together with region-specific aspects of research and development, and at setting up an agenda of issues that should be addressed internationally in the next

IUFRO period. Presenters reported on main achievements, issues, and trends from regional (North America, Europe, Japan) and domain (systems analysis, pperations research) perspectives.

Key Findings

- Problem streams have been shifting from components of production systems (workers, machines, etc.) to analysis of whole production systems to supply network systems, which are complex networks of production systems, linking resources to customers.
- Research activities considerably spread across the above spectrum. Researchers that are linked to INFORMS and SSAFR are those who are pushing the frontiers of forest operations as a scientific discipline, addressing supply chain management (SCM) and enterprise resource planning (ERP) issues to improve the value-added, network efficiency, and network flexibility. A considerable amount of research, particularly in the area of bioenergy, is not problem- but mainly money-driven.
- Ergonomics, called "human factors" in North America, has been an important area of research as long as manual work was key in forestry production systems. Nowadays, we are facing a dichotomy: (1) regions with still labor-borne production systems, and (2) regions with highly mechanized systems. For the first, workload assessment and work safety will remain key issues, while for the second, cognitive ergonomics and macro-ergonomics are fields that have to be adapted from general ergonomics to forestry.
- The trend to study systems-of-systems (supply networks) requires new knowledge and skills that have to be included in forest operations engineering and management curricula. The most important fields are (1) OR methods and tools, (2) systems engineering concepts and tools, (3) control engineering basics, (4) aspects of complexity science, particularly complex network theory, and (5) data mining techniques to analyze huge data sets that were captures in whole supply chain systems.

As Ivar Samset, a former IUFRO president (1971–76) and forest operations scientist, wrote, the technical evolution is characterized by discontinuities, at which a paradigm shift occurs. Those changes can be shaped, and the so-called informal college (Samset, Sundberg, Steinlin, Silversides, Puitkisto) is a shining example of the past how this could be done. It would be worthwhile to set up such an informal college to move forest operations in the area of systems-of-systems.

F-12 Intensive or Ecosystem-Based Forest Management – Impact on Yield, Wood Quality, and Economic Return?

Organizers: *Pekka Saranpää (Finnish Forest Research Institute), Alexis Achim (Laval University, Canada), Robert Deal (US Forest Service), & John Moore (Scion, New Zealand)*

Moderators: *Pekka Saranpää & Alexis Achim*

Our challenge for the future is the understanding of the implications of various kinds of forest management on wood quality. Silvicultural planning and management needs to adapt to new demands and conditions by promoting the resistance of a forest to global change. This may involve actions that restore or sustain compositional, structural, and functional diversity in stands. We need more flexibility in management and capacity for forests to adapt to changing environmental conditions and also societal values. Conversion from even-aged forest management to uneven-aged mixed forest management is a response of forest owners and managers to forest damages connected with severe climate events, such as heavy wind/rain storms, drought-induced forest fires, and destruction by insects and the appearance of pathogenic fungi, which were previously less destructive or present over smaller areas. However, despite a willingness to adopt such systems there is limited experience in implementing them into practice or quantifying the outcomes in terms of the impact on timber quantity and quality and economic impacts across the value chain.

The seven oral presentations and six posters included in this session featured current research on these challenges, with an aim to enhance the resistance and resilience of managed forests to global change, while maintaining or improving productivity and profitability. Speakers included experts from USA, Canada, India, Germany, and Finland with contrasting experiments and experience on wood quality, modeling and economic evaluation.

Key findings:

- Complex stand structures and uneven-aged harvesting practices give a possibility for larger diversity in wood quality.
- Thinning must be adopted selectively to assure wood quality: large defected stems should be removed and valuable species should be left growing.
- Different management regimes does not directly affect wood properties or quality, but there is a need for better tools to evaluate the quality of logs and their suitability for various end-products.

F-13 Planted Forests: Meeting Future Global Forest Product Needs Sustainably

Organizers: *Dave Cown (Scion, New Zealand), Jean-Michel Carnus (National Institute for Environmental and Agricultural Science and Research, France), Tim Payn (Scion, New Zealand), & João Palma (Technical University of Lisbon, Portugal)*

Moderator: *Jean-Michel Carnus*

This session examined the growing importance of planted forests and the potential for intensified production without adversely affecting the wider environment, focusing on integrated or systems approaches recognizing the importance of interactions of all aspects of forest management. The session was a follow-up of the 3rd International Congress on Planted Forests, which was held at Estoril, Portugal, in 2013. New research was presented by 10 speakers from USA, Sweden, New Zealand, Netherlands, Australia, Tunisia, Japan, Portugal, and Chile.

The first four presentations covered research on main issues related to sustainability of planted forests and to their interactions with wider environment and socioeconomic context (landscape, governance, markets). The next three papers covered research conducted on productivity and management of planted forests in tropical, Mediterranean, and temperate environments. Two papers considered sustainability impact assessment of planted forests at national scales using modeling approach and indicator frameworks. The last paper reflected on the question of exotic tree species introduction in planted forests. Together those presentations covered multiple disciplines and a wide biogeographical

range, providing a comprehensive consideration of sustainable management of planted forests and of their potential role in meeting future market needs.

Key findings and knowledge gaps:

- Progress is being made on the question of sustainability of planted forests and on the development of tools for impact assessment. The presentations demonstrated the pertinence of sustainability frameworks to assess impacts of future scenarios of planted forests development.
- Retrospective approaches and evidence-based research showed mutual economic, social, and environmental benefits of planted forests for wood sector development and restoration of degraded landscapes. However, there is also evidence of inadequate governance arrangements for sustainable development of planted forests in some policy contexts. Further analytical research studies are needed to develop and strengthen governance frameworks and institutional support structures for the forestry sector and the associated ecosystem services in developing countries.
- Significant knowledge gaps exist on the question of sustainable intensification of planted forests for increased productivity and wood production to meet growing market demands in emerging bioeconomies and on interactions with other ecosystems and potential land-use conflict with other sectors, as limited land is available in many industrialized countries. In particular, further research is needed to better integrate our understanding of soils, water, nutrients, and tree physiology and genetics for sustainable management of forest plantations.

F-14 Forestry for Desired Wood Quality and Products from Underutilized Forest Species

Organizers: *Andrew Wong (Universiti Malaysia Sarawak, Malaysia) & Pekka Saranpää (Finnish Forest Research Institute)*

Moderators: *Robert Deal (US Forest Service) & Andrew Wong*

This session assessed different underutilized forest species from different regions of the world and their potential role as important species for producing high-quality wood and wood products.

The session included four oral presentations:

"Assessing wood quality and developing markets for landowners growing high-value native hardwoods in Hawaii." James Friday discussed Hawaii's forest and woodworking industries, largely based on harvest of old-growth stands of the native hardwood Acacia koa or koa, one of the most valuable woods in the world. Small private landowners are reforesting pastures with koa with the intention of harvesting timber. Today's market, however, is for old-growth lumber, not wood harvested from young or planted trees. Woodworkers' reactions to the young koa wood were mixed: some woodworkers valued the wood as highly as old-growth koa, others did not think it was usable for furniture. All agreed that a market for young koa does not exist now but should be developed.

"Mechanical characterization of Mexican Quercus species' wood by non-destructive means." Victor Avila Akerberg, on behalf of the absentee authors, stated that Mexico has a great diversity of species belonging to the Quercus genus, which have limited uses due to a lack of technological information, including mechanical characteristics. Sixty-seven specimens of Quercus spp. wood collected from the State of Michoacán, were tested by non-destructive methods: ultrasound, stress waves, and transversal vibration. The authors showed that non-destructive evaluation of wood is a quick and cost-efficient way to determine technological information that can aid in optimizing forest resource management.

"Indian sandalwood (Santalum album Linn.): an important bioresource of India and its scope of greening India." This paper by R. Sundararaj evaluated the role of emerging plantations of Indian sandalwood (Santalum album L.) outside of forests. This tree is synonymous with ancient Indian culture and gained importance as a source of scented heartwood and oil. It is a semi-root parasite and its successful regeneration requires suitable host plants and is distributed all over India. India is encouraging community and private entrepreneurs to cultivate S. album in agroforestry, farm forestry, and various agri-silvi-horticultural and mixed plantation systems based on the choice of tree growers. The authors assessed emerging mixed plantations of S. album, its role in greening India, and meeting the demand for sandal-based products.

"Higher value lesser know timber species from secondary tropical dry forests in Columbia." Angela Paredes mentioned that secondary tropical dry forests (TDF) resulting from anthropogenic disturbance frequently lack economic value and are continuously threatened by land-use change. These forests are relevant for production of goods and services although those characteristics are usually not recognized. A strategy for secondary forest conservation might be the production of valuable timber by utilization of suitable lesser-known species (LKS). This study evaluated the status of secondary TDF in northern Colombia and aimed to find options for their conservation based on LKS. Sixty-four tree species were identified from a forest inventory. The outcomes of the study indicated a pool of species in the secondary TDF suitable to provide high-quality timber and concluded that the use of LKS under sustainable management will increase the secondary forest value and thereby minimize the tendencies for land transformation.

F-15 Applications of Nanotechnology and Biotechnology in Forest Products Research

Organizers: *Jeff Morrell (Oregon State University, USA) & Andrew Wong (Universiti Malaysia Sarawak, Malaysia)*

Moderator: *Andrew Wong*

This session considered contributions from the fields of nanotechnology and biotechnology in the development of innovative forest products. Five oral presentations were presented:

- "Applying electrospinning technology to produce lignin fibers," by Feng-Cheng Chang (China-Taipei)
- "Effect of nanomaterials on the wearing resistance and hardness of water-based wood coating," by Ling Long (China)
- "Classification of agarwood quality by electronic nose technology," by Nor Azah Mohamad Ali (Malaysia)
- "Novel nanotechnology for forest and forest product protection," by Yadong Qi (USA)
- "Life cycle assessment of cellulose nanowhiskers prepared with ionic liquid," by Wei Xu (Germany)

F-16 Bio-based Composite and Engineered Products from Wood and Non-wood Forest Resources

Organizers: *Salim Hiziroglu (Oklahoma State University, USA) & Andrew Wong (Universiti Malaysia Sarawak, Malaysia)*

Moderator: *Salim Hiziroglu & Andrew Wong*

This session included topics on recent advances in the innovation, processing, and utilization of bio-based composites and engineered bio-based products from wood and non-wood forest resources linked to the efficient use of forest residues and plantation resources.

- Robert Erickson discussed the manufacturing of engineered wood composite poles from the point of technical aspects and cost analysis. Several questions related to raw material properties from the audience were asked.
- Yuliati Indrayani presented research on particleboard manufacture from natural and plantation red meranti wood. One question was asked regarding resin used for the experimental panel manufacture and density of the raw material.
- Brian Via covered liquefaction and pyrolysis of forest resources into bio oil.

In addition to oral presentations, four poster presenters gave short PowerPoint talks covering their research projects.

F-17 Recovery, Reuse, and Recycling of Wood Products for a Greener Future

Organizers: *Phil Araman (US Forest Service), Robert Bush, & Robert Smith (Virginia Tech, USA)*

Moderator: *Phil Araman*

Manufacturers of wood products do a great job of utilizing waste for energy, mulch and other products. For a greener future we need to recover, reuse, and recycle construction waste and end-of-use wood products. Use options are needed for construction waste generated during home construction, which represents a significant portion of landfill waste, estimated as 17% of the total waste stream. Additional disposal problems are created by people replacing treated wood decks and disposal of wood pallets that are considered waste. Green opportunities also exist in wood building deconstruction and demolition of old warehouses and other structures made from timbers. We will address these issues with green solutions that will save trees while keeping wood waste out of landfills. This session also addressed the spirit of the Congress title – Forests, Sustaining People -- The Role of Research while addressing the Forests and Forest Products for a Greener Future theme in the wood waste and end-of-use wood products areas.

Presentation and discussion topics:

- Home construction wood waste can be recycled into several potential products, keeping these materials out of burn piles and landfills.
- Local experience with the use of wood residues for various products from a sawmill in Cuba.
- Wood pallet production uses great quantities of wood each year in the Untied States We also learned that recovery, reuse, and recycling of pallets provide close to half of the pallets needed by industry in the United States, and this saves over 60 million trees from having to be cut down each year.
- Paper honeycomb panels and sustainability in Turkey.
- Green building stability of blocks produced from sawdust and sand in Africa.

F-18 Emerging Green and Sustainable Alternatives to Classical Wood Preservative to Protect Forest Products

Organizers: *Donatien Pascal Kamdem (Michigan State University, USA), Jöran Jermer (SP Technical Research Institute of Sweden), Andrew Wong (Universiti Malaysia Sarawak), & Nasko Terziev (Swedish University of Agricultural Sciences)*

Moderators: *Andrew Wong & Fatima Charrier-El Bouhtoury (IPREM/ Université de Pau et des Pays de l'Adour, France)*

The aim of this session was to explore recent research and technology used worldwide to improve stability and durability of wood products such as biological, chemical, and physical modification and test methodologies to evaluate and predict their in-service performance in different applications. The sessions included 4 oral presentations and seven in-session posters covering a wide range of topics related to wood natural durability, wood treatment and modification, and wood's preservative and protective agents.

Key issues discussed:

- There is still great interest in understanding natural durability, and research continues on the natural wood protection mechanism and involvement of extractables. A study carried out on stilbenes of Norway spruce aimed, inter alia, to determine their genetic variation, distribution, stability, and bioactivity.
- It is important to determine the durability classes of imported woods under the local-use condition because the degradation agents and the exposure conditions are very variable.
- Wood modification through acetylation or heat treatment can significantly enhance the wood properties but are difficult to implement on large quantities of whole logs, for example.
- Due to the environmental concerns and regulation, a huge amount of research has been and still is conducted, around the world, on natural bioactive components and the potential for exploitation as the basis for a “natural wood preservative.” However, because of their intrinsic properties, some components can pose risks to humans, animals, and the environment and thus the commercial implementation of this kind of biocidal product will not be possible.

Forest Health in a Changing World

G-01 Air Pollution as a Factor Affecting Global Forest Health

Organizers: *Algirdas Augustaitis (Aleksandras Stulginskis University, Lithuania), Andrzej Bytnerowicz (US Forest Service), & Robert Jandl*

(Research and Training Centre for Forests, Natural Hazards, and Landscape, Austria)

Moderators: *Algirdas Augustaitis & Andrzej Bytnerowicz*

The ecological integrity and the continued capacity of forests to provide goods and services are of increasing concern in the face of a long list of threats, including insect and disease infestation, fragmentation, catastrophic fire, invasive species, and the effects of climate change. Therefore the session focused on global impacts of air pollution and climate change on forest health and productivity related to the interactions between detected threats.

Borys Tkacz presented evidence that the outbreaks of native pests have killed trees on millions of acres in the western United States. Fires and severe droughts reinforced this negative effect. In the eastern United States, the combined effects of invasive forest pests, atmospheric deposition, and human development have changed the structure and composition of many forests. Steven McNulty claimed that the slow-growing, low-resource adapted trees will increase in future forests because these trees are predisposed to a lower risk of mortality than higher-resource acclimated trees.

Climate change results also in the complex and surprising interaction with nitrogen critical acid load exceedance in forests, which are expected to decrease by approximately 25% in the future in North America and Europe. Martin Lorenz presented evidence that under the future climatic conditions the share of ICP Forest monitoring plots acting as C sinks will be higher than the share of plots acting as C sources, which confirms recent more intensive tree growth than before. However, due to increasing drought, the health and sustainability of European beech is still at highest risk.

Rainer Matyssek claimed that under the pressures of climate change, daily drought does negatively affect the relative daily growth rate of European beech trees, although there was no significant daily effect induced by peak O3 influx and O3/drought interaction. The increase in temperatures is expected to have the potential of compensating, moderate drought effects on tree growth across Bavarian forests. Complex climate change and air pollution impacts on the Carpathian forests, especially Norway spruce and European beech, were presented by Andrzej Bytnerowicz. Increasing and highly variable temperatures, unpredictable precipitation patterns, prolonged droughts, and high frequency of strong winds are the most important climatic factors affecting forest growth in this region. Suggested science-based management strategies and their implementation should include increased presence of mixed forests that would allow increasing adaptation of the Carpathian forests to these changes. These recommendations were also supported by Robert Jandl, who reported that other forestry treatments like soil amelioration by liming and fertilization by P, K, Mg had no significant effect on forest stand productivity and recovery.

Algirdas Augustaitis reported that in Lithuania, forest air concentrations of SO2 and deposition of NH4+ are the key parameters explaining variability in pine defoliation. Increase in mean temperature inhibited negative effect of pollutants on pine defoliations as well as their stem increment. Therefore detected changes in meteorological parameters as well as acidifying compounds in the air and their deposition should only reinforce tree health recovery in the future. However, in China the distribution pattern of SO2 and acidity of precipitation remain unchanged. Notwithstanding this, He Shang from Chinese Academy of Forestry stated that the combined effect of climate change and CO2 fertilization would increase forest net primary production in all climate zones in that country.

Despite all the past and recent scientific efforts and international events, further research is needed to fully assess these complex and often unexpected environmental interactions and their integrated and synergetic effect on forest ecosystems across the world. Well-designed and long-term forest health monitoring and assessment efforts are critical.

Steven McNulty, USA, gives a presentation in the G-01 technical session

G-02 Ozone and Forest Health

Organizers: *Zhaozhong Feng (Chinese Academy of Sciences) & Elena Paoletti (National Research Council, Institute of Plant Protection, Italy)*

Moderators: *Zhaozhong Feng & Elena Paoletti*

This session was focused on the impacts of climate change on ground-level ozone formation and ozone damage to vegetation worldwide.

Key findings:

- Tropospheric ozone (O3) is a criteria pollutant that is formed by reactions among precursor molecules such as nitrogen oxides and volatile organic compounds.
- Ozone concentrations over the past few decades in North America have drastically decreased due to the implementation of strict control measures. Intercontinental transport of O3 from developing countries is contributing to higher concentrations on the west coast. Concentrations can be extremely variable in space and time, and still may exceed air quality standards.
- Ozone average concentrations in China and Europe are still rising, while a decrease in ozone peaks occurs in Europe as a result of successful control measures.
- What matters for plants, however, are not ozone concentrations in the air but how much ozone is taken up through their stomata. Measuring, monitoring, and modeling stomatal ozone uptake (or flux) by plants are thus critical for developing meaningful legislative standards for protection of forests and other plant ecosystems.
- Decreased levels of photosynthesis, complex interactions with pathogens, drought, nutrient deficiency, increased NO2 or CO2 concentrations, and a general decline in health were discussed in the session. Overall, it was stressed that plant genotype is an important driver of plant responses, and leaf mass per area was discussed as a potential index of ozone injury.
- Epidemiological approaches, where large-scale biological responses to ambient ozone uptake in the field are investigated, were suggested as a promising tool for assessing ozone impacts on real-world forests.

G-03 Critical Loads for Nutritional Nitrogen Deposition: Progress and Problems

Organizers: *Sarah Jovan, Andrzej Bytnerowicz, & Mark Fenn (US Forest Service)*

Moderators: *Sarah Jovan & Andrzej Bytnerowicz*

This session focused on the latest research in nitrogen (N) critical loads (CL) development and application. Critical loads describe pollutant loads associated with "harmful" effects to forests and other ecosystems, which are intended to guide air quality regulations. Nutrient-N CLs can be low, near background deposition levels for community changes in lichens, bryophytes, mycorrhizal fungi, and plant biodiversity impacts. This presents a challenge in setting appropriate CLs for areas already in exceedance of CLs for sensitive responders. Critical loads development includes varied approaches, ranging from manipulative experiments and empirical field studies to dynamic modeling. All approaches are challenged to characterize the complex effects of nutrient-N in an ecosystem and derive effective CLs that can be practically applied by policy makers and managers.

Key findings and discussion points:

- Throughfall measurements in dry holm oak forests in Spain largely underestimated N inputs. Nitrate loss in soil water was detected only during the periods of low biological activity in the winter period.
- Case studies were presented that demonstrate how CL science is used in setting policy and management decisions in US National Parks. The most protective CLs are based on changes in diatoms in alpine lakes.
- Dry N deposition is difficult to empirically determine and model. A GIS-based empirical inferential method was presented for making fine-scale estimates and evaluating CL exceedances in complex mountain terrain.
- New CLs for forests across the United States are determined using lichen communities. Most CLs are near background levels, although N tends to be elevated in the eastern United States and so are beyond the true lichen CL.
- Chemical thresholds for soils (e.g., base saturation, Ca/Al ratios) and surface waters (ANC or acid neutralizing capacity) have been established for acidification critical loads. Nitrogen as a nutrient CL can be established based on thresholds for plant diversity change or impacts on high-interest species. Thresholds for establishing nutrient N CL are less well-defined than for acidification CL.
- In the Polish-Saxon border region, N CL was projected to decrease with climate change, illustrating that climate change factors should be considered when projecting future CL exceedances.
- Motor vehicle emissions and livestock are a major contributor to N emissions as well as greenhouse gases. Reducing emissions would "kill two birds."

G-04 Emerging Invasive Forest Pathogens

Organizers: *Phil Cannon (US Forest Service), J.P. Skovsgaard (Swedish University of Agricultural Sciences), Ned Klopfenstein (US Forest Service), & Steve Woodward (University of Aberdeen, UK)*

Moderators: *Ned Klopfenstein & Phil Cannon*

Several invasive pathogens are currently spreading quickly in some forests of the world. In some cases, these pathogens are affecting large numbers of trees and causing great levels of dieback and angst to the owners of those trees. The session contained historical accounts of the sequences of introduced forest diseases into the forests of the United Kingdom and the White Pine forests of the eastern United States. In the case of the White Pine forests, there was also a brief summary of the control measures that were attempted to eradicate White Pine Blister Rust.

Other talks in this session focused on the following three diseases that are just now spreading very quickly: (1) Hymenoscyphus pseudoalbidus – causes dieback of ash trees in Europe and has been sweeping across that continent with dire and extensive impact; (2) the pitch canker (Fusarium circinatum) disease that is spreading around the world and is currently causing exceptionally high levels of mortality in northern Spain; and (3) the Puccinia psidii rust that is currently spreading to dozens of countries in the tropics and sub-tropics. Some strains of this rust were shown to be highly pathogenic on many tree species in the large family of the Myrtaceae.

G-05 Global Approaches to the Biological Control of Invasive Eucalyptus Pests

Organizers: *Simon Lawson (Queensland Department of Agriculture, Fisheries and Forestry, Australia), Toni Withers (Scion, New Zealand), & Helen Nahrung (University of the Sunshine Coast, Australia)*

Moderators: *Simon Lawson & Toni Withers*

The session focused on the biological control of eucalypt pests worldwide. It included updates on biological control programs for long-established pests, recent invasions, and on the selection and release of effective control agents,

Key findings, discussion points, and knowledge gaps:

- Australian-origin invasive eucalypt pests are continuing to move rapidly around the globe, threatening planted, urban, and amenity forests.
- Pathways of invasion have generally not been identified but were presumed by various speakers to include wind-assisted, natural dispersal, as well as many human-assisted or trade-assisted pathways such as through cut foliage, timber, or live plant trade.
- An international collaborative effort was considered to be required to coordinate biological control efforts globally.
- Only New Zealand, the country closest to Australia, has developed issues with hyper-parasitoids invading and disrupting otherwise successful biological control efforts.
- The major species of current concern are the gall wasps Leptocybe invasa and Ophelimus maskelli, the red gum psyllid Glycaspis brimblecombei, the bronze bug Thaumastocoris peregrinus and the eucalypt weevil Gonipterus species complex.
- New invasive pests continue to emerge, the most recent being the shell lerp Spondyliaspis sp.
- For some pests, gallers in particular, releases of more than one parasitoid may be required to achieve optimum control.
- Discovery of new biocontrol agents is required for some pests, while better climate/host matching is required for others.

G-06 Mechanisms of Tree Defense across Forest Insect Feeding Guilds: Can a Comparative Approach Help Predict Responses to Climate Change?

Organizers: *Barbara Bentz (US Forest Service) & Ken Raffa (University of Wisconsin, USA)*

Moderators: *Barbara Bentz & Ken Raffa*

Forests are among the most productive and ancient terrestrial biomes, which attest to their ability to resist a variety of biotic and abiotic stress agents. All tree species must expend some amount of energy to defend themselves from continual attacks by insect herbivores. Thus, tree defense is a unifying theme across all insect-tree systems throughout the world, and a bridging theme with frontier research in basic ecology and evolution. In native systems, a variety of sophisticated mechanisms have evolved to defend against local insects and pathogens. Invasive species, however, present trees with potentially novel stresses that may go beyond their capacity to respond. Tree defenses can also be significantly influenced by abiotic conditions, thereby directly and indirectly connecting climate change with insect population dynamics and insects' roles in forest ecosystem processes and services.

Exciting advances have been made recently in research on plant-insect interactions including the use of genomics and proteomics, application of plant defense theory to biological invasions and potential climate change effects, and the role of tritrophic and community interactions. Eight speakers from around the globe presented information on a diversity of insect feeding guilds attacking several host tree species with varied defense mechanisms. Their emphases ranged from biochemical to ecological, and from basic to applications for forest protection. Results suggest that multiple drivers, including temperature, CO2, forest structure, natural enemy communities, and evolutionary history, will differentially affect insects and their host plants.

G-07 Is Climatic Change Modifying the Characteristics of Insect Damage in Forests?

Organizers: *Francois Lieutier (University of Orleans, France), Timothy Paine (University of California, Riverside, USA), & Rodney Keenan (University of Melbourne, Australia)*

Moderator: *Timothy Paine*

Modifications of insect damage and risk in forests are crucial problems in the context of climate change, as well as in the context of forestry change that will necessarily accompany the climatic evolution. Some of these modifications are already occurring and known, while others may be foreseen.

This session provided an opportunity for exchange of information on these subjects by scientists involved in forestry, entomology and management. These problems were addressed at the level of forests in general but without forgetting the particularities of the different forest biomes (temperate, Mediterranean, boreal, and plantations). The session was structured in sections corresponding to these different forest types and in each section/biome, specific characteristics were considered: local modification of damage by already known indigenous pests, emerging indigenous pests, extending pests, and introduced pests. This structure by types was preceded by a general introduction on the effect of climate change on tree resistance mechanisms. A general conclusion was focused on possible consequences for management.

Key findings:

- Increasing temperatures in the higher latitudes may produce phenological asynchrony between insects and the preferred developmental stage of their host plants, reducing insect fitness.
- The asynchrony may be system-specific, and different host plant-herbivore interactions, including host plant defensive mechanisms, must be examined individually.
- Changes in insect voltanism may place plant systems at increased risk as an indirect impact of global climate change.
- Changes in precipitation patterns stemming from global climate change, including periods of prolonged drought, can result in favorable conditions that directly and indirectly precipitate outbreaks of insect herbivores that were previously held at low chronic population levels.
- Distributions of insects and their interactions with their host plants at low elevations and in the warmer end of their geographic range are being strongly influenced by increased temperatures, potentially resulting in range contractions.

G-08 Consequences of Changing Trophic Interactions on Forest Insect Population Dynamics

Organizers: *Aaron S. Weed, Carissa F. Aoki, & Nina K. Lany (Dartmouth College, USA)*

Moderator: *Aaron Weed*

Future land use, climate change, and nitrogen deposition may fundamentally alter interactions between forests and insect herbivores by affecting the strength and direction of feedback resulting from trophic interactions. Understanding how indirect effects may affect forest insect abundance is challenging but important for evaluating forest productivity and disturbance interactions into the future. Speakers in this session presented research describing how forest fragmentation, climate change, and leaf nitrogen affect species to community-level interactions that are in turn consequential for the population dynamics of forest pests.

Key findings:

- Community composition of forest insects and associated organisms are sensitive to abiotic and biotic factors via direct and indirect pathways.
- Species interactions are sensitive to changes in temperature. Warming temperatures not only influence forest insect abundance by affecting growth and development but also increase the foraging ability of natural enemies. Temperature effects on predator activity will also contribute to variation in herbivore survival over time.
- Variation in leaf nitrogen can have demonstrable effects on fluctuations of forest herbivore communities and the impact of natural enemies on forest pest abundance. Factors that influence leaf N (e.g., inter-annual variation in precipitation, fertilization, and N deposition) may influence inter-annual growth rate of forest insect populations and interactions with natural enemies.

- Species-specific responses of natural enemies to forest fragmentation result in scale-dependent regulation of forest pest population dynamics.

G-09 Ecology and Management of Invasive Wood-Boring Pests in a Changing World

Organizers: *Juan Carlos Corley (CONICET- INTA, Argentina), Massimo Faccoli (DAFNAE-Agripolis, Italy), Michael Smith (USDA-Agricultural Research Service, USA) & Brett Hurley (University of Pretoria, South Africa)*

Moderators: *Juan C. Corley & Massimo Faccoli*

This session focused on two specific groups of invasive insects, long horned beetles and wood wasps, which are causing significant damage to forest ecosystems worldwide. The session included eight oral presentations, three concerning alien invasive wood-boring beetles (mainly Longhorned beetles) and five dealing with wood wasps (Sirex spp.).

Key presentation and discussion topics:

- Invasive wood-boring pests may cause serious damage, directly and indirectly, to both natural and planted forests and landscapes.
- Both economic and ecological impacts of invasive wood-boring pests were presented and discussed in depth.
- The main techniques for dealing with monitoring, eradication, and control of the most harmful wood-boring species invading Europe, North America, South America, and Australia were presented and compared.
- New scientific collaborations among the session participants started with common research topics.

G-10 Multiple Risk Management in Planted Forests

Organizers: *Hervé Jactel (National Institute for Environmental and Agricultural Science and Research, France), Christophe Orazio (European Forest Institute, Finland), & John Moore (Scion, New Zealand)*

Moderator: *Christophe Orazio*

Forests in general have always been exposed to a range of biotic and abiotic hazards. However, natural disturbances and subsequent damage to forests seem to increase worldwide in a context of more extreme climatic events, changing land uses and landscapes. Planted forests are no exception and may even be more prone to pest and pathogen outbreaks because they are usually grown as monoculture. Their management and planning need to integrate multiple risks in order to improve overall resilience of planted forest systems to many threats and perennial supply of resources to wood-based sectors. The session therefore focused on interactions between biotic and abiotic hazards because this reflects the reality of risks in forest ecosystems, while the synergistic or cascading effects of multiple hazards remains insufficiently studied.

Key findings:

- Interactions between abiotic and biotic hazards are common in planted forests, operating in both directions. For example, drought stress can reduce the resistance of trees to pest infestations while root rot fungi can trigger lower resistance to wind damage.
- Interactions between different hazards of the same type also occur: heat waves increase planted forest vulnerability to fire, mistletoe and infestations are predisposing factors of bark beetle attacks.
- Interactions operate at different scales: through physiological trade-offs at the tree scale (e.g., energy allocation to growth or defenses), through the provision of substrate at the landscape scale (e.g., wind-felled trees used for breeding by bark beetles or dead trees serving as fuel for forest fires).
- Forest growth (tree scale) or forest dynamics (landscape scale) models emerge as highly relevant tools to analyze and predict the interactive effects of multiple hazards on forest damage.
- Adaptation of silvicultural practices in planted forests is the most promising way to prevent multiple risks.
- It is therefore necessary to raise awareness among forest managers about multiple risks in order to improve their preparedness.

These findings highlight the necessity to enhance the scientific collaboration between forest entomologists, pathologists, and modelers and also the cooperation between scientists in forest ecology and socioeconomics.

G-11 Societal Impacts of Invasive Forest Pathogens and Pests

Organizers: *Matteo Garbelotto (University of California at Berkeley, USA), Giles Hardy (Murdoch University, Australia) & Paolo Gonthier (University of Turin, Italy)*

Moderators: *Matteo Garbelotto & Giles Hardy*

The session aimed at understanding the consequences of emergent diseases, including changes in policy and regulations, shifts in native or contemporary culture, changes in habits, and effect on income of local people, while at the same time emphasizing the role that local communities and the mass media may have had to highlight the environmental, cultural, and economic consequences of these emergent diseases.

There is a need for greater attention to the social dimensions of tree health – and in particular a better understanding of the barriers and motivations of forest managers in adopting measures to manage diseases. Emerging findings from such a study relating to Dothistroma Needle Blight in the UK were presented in this session. Similarly, since their emergence over the last decade, the highly invasive pathogens Phytophthora ramorum and Chalara fraxinea now threaten the survival and productivity of UK trees and forests but pose different societal challenges dictated by their contrasting quarantine status, behavior, and host range. Both diseases have also heightened public awareness of the ecosystem destruction that can result from introduced non-native organisms, generating citizen science initiatives for the early detection or tracking of other new pests and pathogens.

Sudden oak death (SOD) is one of the best examples of how an introduced exotic disease can change the "face" and the structure of native woodlands. The disease, brought to forests by the ornamental industry, resulted in a costly and unprecedented regulation of the trade, with significant economic consequences. By killing large numbers of oaks and tanoaks (two keystone species), SOD has highlighted many aspects of how people and forests coexist and depend on one another. Oaks and tanoaks represent two important symbols of persistence and endurance in a changing

world, and their loss severed the centuries-old link between native people and the land and altered residential neighborhoods. The high visibility and public outcry over SOD resulted in expanded funding for research and the creation of one of the largest citizen science programs in the country.

Similarly the introduction of Phytophthora cinnamomi in Australia has led researchers to join forces with local communities to amplify awareness, to initiate restoration programs, to educate kids from a young age about the consequences of not doing anything, and about the scientifically proven ways to mitigate the disease. Often entire communities have come together to treat trees in order to save them.

In Europe, chestnut has in the past been a keystone species both ecologically and economically, providing an alternative income source for inhabitants of rural areas by producing a highly prized nut, valuable and durable wood, and tannins. Unfortunately the arrival of chestnut blight, ink disease, and now the gall wasp has reduced dramatically the productivity (both of fruits and timber) of chestnut orchards, often accelerating emigration from rural areas. The depopulation and the consequent abandonment of chestnut woodlands worsened the incidence and severity of both ink disease and chestnut blight.

In the Pacific, a vascular wilt disease, Fusarium oxysporum f. ssp. koae (FOXY) of Acacia koa (koa), Hawaii's iconic tree species, causes high rates of mortality, and koa is no longer adapted to much of its native range. Producing seeds or propagules with genetic resistance to FOXY is vital to successful koa reforestation and restoration and supporting the Hawaiian culture it sustains. At the same time the invasion by the plant Miconia calvescens has contributed to the loss of native forests, and in some areas increasing erosion, loss of wildlife, and a significant reduction in ecosystem services.

The impact of disease and insect pests in Colombian reforestation has limited the planting of some species. As a result, the government in alliance with the private forestry sector is implementing strong surveillance and management policies that contribute to the reduction of exotic diseases and insects.

The session provided an excellent oversight of the range of effects caused by the arrival of invasive organisms. There was a consensus on the need for forest pathologists to better understand how to study the societal impacts of forest diseases and to better communicate their science to the public and to the stakeholders.

G-12 The Co-evolution of Insects and Fungi That Form Symbiotic Relationships and Kill Forest Trees

Organizers: *Mee-Sook Kim (Kookmin University, Republic of Korea) & Philip Cannon (US Forest Service)*

Moderators: *Mee-Sook Kim & Phil Cannon*

In recent years there has been a surge in interest in tree mortality that was brought about by a certain symbiotic relationship between fungi and insects. In most of these relationships the involved insect brings the fungus to the tree, creates some kind of wound or gallery in the tree, and then cultivates the fungus (or fungi) so that it (they) will be available as a food source for the brood of that insect. Death to the tree can occur either because of the excessive tunneling brought about by the fungal-fed insects and/or as a result of the fungal hyphae extending out into the wood and causing vascular blockages. In some cases, the inadvertent dispersal of fungi and/or insects through international trade has led to new and exceptionally dangerous combinations of insects and fungi resulting in extensive losses of some forest tree species.

Symbiotic combinations that were reported on during this session included the fungal associates of the bark beetles infesting conifers in Mexico; the role of insects in spreading pitch canker; the spread of Fusarium fungi by the polyphagous shot hole borer (Euwallaceae spp.); the multiple different fungi that are associated with different ambrosia beetles in the Southeastern United States, where they cause bay laurel wilt; and in Korea and Japan where they cause oak wilt. Other combinations presented included a twig beetle Pityophthorus juglandis and Geosmithii morbida fungus, which can bring about the thousand canker disease of walnuts and the lethal combination of a Sirex wasp cultivating an Amylostereum fungus to kill conifers.

G-13 Modeling as a Tool for Improving the Knowledge on Forest Vulnerability and Risk Exposure in a Changing World

Organizers: *Alessandra De Marco (ENEA, Italy) & Salim Belyazid (Lund University, Sweden)*

Moderator: *Salim Belyazid*

Modeling approaches are emerging to develop coupled biogeochemical-ecological models, to predict the combined effect of climate change, air pollution and atmospheric deposition of pollutants on forest functioning and biodiversity. Significant alterations in future global land-use patterns are anticipated, both as a result of anthropogenic changes in land use and management and climate-driven changes in ecosystem distribution. These changes in land-use and land-cover patterns may have considerable impacts on the climate, both through modifying the physical properties of the land surface (biophysical effects) and by altering the absorption or emission of greenhouse gases and air pollutants (biogeochemical forcing). The projected temperature, precipitation, and changes in atmospheric CO2 concentrations may alter forest distribution, productivity, carbon storage, and GHG fluxes. Information about land ecosystem functions and processes is necessary to gain an understanding of the causes underlying such changes and, subsequently, to model the future effects of natural and anthropogenic stress factors (soil moisture, temperature, GHGs) on our forests and derive the adaptation potential of land ecosystems to climate change and air pollution effects. Air pollution and climate change effects on forest ecosystems constitute significant scientific research fields today. Reliable methods are needed to identify social and economic aspects of individual damages toward land ecosystems and to investigate and quantify the sensitivity to climate change and air pollution. Furthermore, it is important to determine how this will affect the economic revenues of forest products and ecosystem service provision.

The modeling approach will help bridge the knowledge gaps in different scientific domains (air pollution, atmospheric deposition, climate change, forest impacts in terms of growth, health, yield, distribution, and biodiversity loss) in order to: (1) translate environmental observations and predictions into future scenarios, including socioeconomic implications; (2) improve understanding of interaction between climate change, air

pollutants, and impacts on land ecosystems; (3) quantify the ecological responses under changing climate conditions on forest ecosystems; (4) reduce uncertainties of current climate predictions; (5) identify hot spot regions where action is needed; (6) provide risk maps for forests at the regional and local scale; (7) identify suitable actions to mitigate, adapt, and manage; and (8) propose adaptations and recommendations to forest ecosystem policy and management practices.

The session analyzed different modeling approaches to assess impacts of climate change and air pollution on many different targets linked to forest health; e.g., growth, beetle disturbance, ozone injury occurrence, and gross primary productivity. The following five papers were presented and discussed:

- "Combining large-scale simulation with economic models to investigate impacts of climate change on forests" (by Marc Hanewinkel)
- "Can modeled and measured data interact to evaluate forest health condition?" (by Elena Paoletti)
- "Impact of climate and site conditions on the growth-mortality relationship in European tree species" (by Lisa Hülsmann)
- "Predicting the spore infection depending on climate to model the Heterobasidion annosum dynamics in even-aged Pinus pinaster stand" (by Céline Meredieu)
- "Interactions among spruce beetle disturbance, climate change, and forest dynamics" (by Christian Temperli)

Key findings:

- Forest productivity and disturbances in Europe have increased in the past, and these trends may continue in the future.
- Studies of climate change impacts on forests usually only consider either the effects of changing productivity or disturbances. However, productivity and disturbances are intrinsically linked.
- Air pollution and climate change are still mostly treated as separate issues, and modeling approaches with different targets can be helpful in decreasing the uncertainties linked to impacts of both stressors on forests ecosystems.
- Model predictions shows that – depending on different realizations of three climate scenarios – by 2100, between 21% and 60% (mean: 34%) of European forest lands will be suitable only for a Mediterranean oak forest type with low economic returns for forest owners and the timber industry and reduced carbon sequestration.

G-14 Impact and Monitoring of Forest Pests and Pathogens in a Changing World

Organizers: *Maartje J. Klapwijk, Johanna Boberg (Swedish University of Agricultural Sciences), & Jolanda Roux (FABI/University of Pretoria, South Africa)*

Moderators: *Jolanda Roux & Jan Stenlid (Swedish University of Agricultural Sciences)*

This two-part session examined emerging pests and pathogens in relation to global change, the impact of these disturbance agents within the context of forest resilience, and possibilities to monitor for critical changes.

Presentation and discussion topics:

- Bernard Slippers discussed the role of humans in the movement of cryptic fungal species in the Botryosphaeriaceae as symptomless endophytes in living plants. This has resulted in the population diversity of some pathogens being equal to, or even higher than, that of related native pathogens in the same regions.
- Geoff Pegg summarized the arrival and impact of the Myrtle rust pathogen, Puccinia psidii in Australia. This disease has been called a potential environmental disaster in Australian ecosystems. It has already been detected on more than 200 native Australian Myrtaceous species, with fruit, flowers, leaves, and young shoots of susceptible plants being affected and plants being killed.
- Randall Morin approached the problem from a regional level showing that by using monitoring systems, mortality with large time lags after damage can be detected.
- Sandy Liebhold discussed different levels of invasibility because of propagule pressure and habitat variability. He proposed that more variable systems are more vulnerable but also better equipped to compensate for ecological impacts.
- Stephen Williams emphasized the importance of communication and of doing science that is more integrated in the community/general public.
- Anna-Maria Vettriano discussed a new approach to detect potential invasive fungal species by identifying unknown pathogens using sentinel nurseries.
- Paul Bosu discussed the challenges underlying forest-health monitoring in Ghana. Important to the success of the program was direct communication with, and education of, the smallholder owners and creating awareness at stakeholder level.
- Olle Anderbrant spoke about the characteristics that make a species an invasive/pest species, Hungarian spruce scale (Physokermes inopinatus).
- Sri Rahayu spoke about the damage that the rust fungus Uromycladium tepperianum causes in Malaysia and the potential effects of climate change on the spread and prevalence of the pathogen.
- Minna Lyytikäinen compared two monitoring methods for Ips typographus in Finland and concluded that both pheromone trapping and trap log piles gave similar results.
- Jolanda Roux discussed the use of 454 sequencing to show that the Eucalyptus stem canker pathogen Teratosphaeria zuluensis is present in Eucalyptus seeds and seed capsules. A number of other eucalypt pathogens were also detected. However, none were shown to be vertically transmitted.

The in-session poster presentations included studies on monitoring of pathogens and insects in different countries. These three-minute presentations created a dynamic atmosphere giving all presenters the opportunity to respond to questions from the audience.

G-15 Monitoring Emerging Threats to Forest Health in North America Across Regional to National Scales

Organizers: *Borys Tkacz (US Forest Service) & Kevin Potter (North Carolina State University, USA)*

Moderator: *Kevin Potter*

Forests possess substantial ecological and socioeconomic importance. Both their ecological integrity and their continued capacity to provide goods and services are of concern in the face of a long list of threats,

including insect and disease infestation, air pollution, fragmentation, catastrophic fire, invasive species, and the effects of climate change. Persistent forest health monitoring and assessment are critical given the potential impacts of these threats but are challenging across regional to national scales. This session presented examples of broad-scale forest health indicator data and cutting-edge methods for quantifying the status, change, and trends in indicators of forest health across regional to national scales. These data and detection monitoring approaches are relevant for understanding trends in biotic and abiotic hazard occurrence, identifying evolving vulnerability of forests to threats, and informing the appropriate selection of management practices for mitigating risk from these threats.

Key findings:

- In the United States, many data sets are available to assess the status, change, and trends in forest health across broad scales. Forest inventory and analysis data, Phase 2 standard inventory data, and additional Phase 3 ecological indicator data (initially developed by the Forest Health Monitoring national program), are particularly useful in this context.
- Funding and logistical constraints present significant challenges to the continued collection of some of these datasets. This is requiring a redesign of Phase 3 indicators into a more flexible ecosystem indicator system.
- Researchers are developing innovative methods to analyze these data to generate useful information to policy makers and managers.
- Forest health questions of the future will probably require a cohesive integration of a variety of forest health indicators and big datasets as opposed to studying a single indicator in isolation.

G-16 Forest Health in Changing Landscapes: The Roles of Landscape Patterns

Organizers: *Kurt Riitters (US Forest Service) & Peter Vogt (European Commission Joint Research Centre, Institute for Environment and Sustainability)*

Moderators: *Kurt Riitters & Peter Vogt*

Land use and climate change are the primary drivers of forest change and acting at different scales. Can landscape patterns be managed to mitigate forest health threats from climate change? If so, then landscape management may delay the effects of climate change. By researching the extent and cause of change, ecologists make important strides toward appreciating and adapting to our ever-changing world.

Key findings:

- Harifidy Rakoto Ratsimba reported on traditional slash and burn agriculture in Madagascar, which fragments lowland tropical rainforests. As soil fertility declines, farmers progressively clear land from lower to higher elevations, forcing them to use land farther from home and breaking up intact forests.
- Peter Vogt illustrated tools to detect and quantify change, pattern, connectivity, and fragmentation over space and time, targeted to help landscape ecologists classify land use and land cover. These tools are provided in the free software GuidosToolbox.
- Rosemeri Moro presented natural fragmentation patterns in Vila Velha and Guartelá State Parks of Brazil. Both parks exhibit a mosaic of forests and grassland patches, shaped by geographic features and raging rivers. Despite the structural fragmentation the landscape is functionally connected. Mammals and birds transport seeds from native trees anywhere from 50 to 740 m, distances greater than that separating a majority of forest patches.
- Olufunke Olayode reported on the rapid decrease of native forests by 90 percent in the Gambi Forest Reserve in southwest Nigeria from 1984 to 2006. Native forest loss in the Reserve has been driven by expansion of subsistence agriculture, illegal logging and plantation establishment.
- Tuula Kantola reported on decreasing rates of hemlock mortality in Appalachian forests. The Lower Linville River Watershed in North Carolina lost nearly 10,000 hemlock trees to mortality from the hemlock woolly adelgid (a sap-sucking insect from Japan). Death of new trees declined each year from 2009 to 2012. Surviving hemlocks and other tree species are happily extending branches into newly vacated growing space.
- David Coyle shared encouraging news about southern pine decline in the southeastern United States Spatial analysis and on-the-ground fieldwork suggest that managers can curb pine mortality. Education of landowners can improve forest practices and enhance tree vigor, making pines less susceptible to root-feeding beetles and fungi.
- Kurt Riitters analyzed forest cover for the 2015 Update of the Resource Planning Act Assessment combining the National Land Cover Dataset and data from the Forest Inventory. Results show a 0.2% annual loss of total forest cover across the United States from 2000 to 2006. Cover of intact forests, defined as 100% canopy closure, declined at an annual rate of 0.7% over the same time period.

G-17 Changes in Distributional Ranges in a Changing World

Organizers: *Patrick Tobin (US Forest Service) & Christelle Robinet (National Institute for Environmental and Agricultural Science and Research-URZF, France)*

Moderator: *Christelle Robinet*

This session included 10 talks dealing with the effects of biotic and abiotic factors on changes in species' distributional ranges.

Key findings:

- In at least one case, the introduction of a generalist natural enemy caused the decline of an invasive species, leading to widespread range retraction.
- Allele effects (positive-density dependence) can also affect range dynamics as was shown in the vector of the pine wood nematode. For example, the vector must visit a host tree twice: once to inoculate the nematode and weaken the tree, and then again to lay eggs in this weakened tree, and population density plays an important role in this process.
- A major driver of range dynamics is climate and changes in climate. Climate warming allows species to expand their distribution toward the poles, where higher temperatures increase the survival rate of insect species. However, high temperatures can also have a negative effect and lead to the retraction of the distribution, especially in regions that are already at the upper temperature limits of insects. All of these factors interact, and assessing the overall effects of biotic and abiotic factors is still challenging, and only a few case studies are well-documented.
- When considering the available literature, changes in the distribution of forest insect pests could also result from a number of new or modified

regulating factors, such as changes in tree vulnerability and genetic changes in the insect population. However, because there is no general rule applicable across insect taxa, these changes will likely be different for each host-pest system and in different regions of the world.

G-18 Research on Pathway Risk Management and Phytosanitary Policy to Prevent Invasions of Forest Insects and Pathogens

Organizers: *Eckehard Brockerhoff (Scion, New Zealand), Andrew Liebhold (US Forest Service), & Jolanda Roux (FABI/University of Pretoria, South Africa)*

Moderator: *Eckehard Brockerhoff*

This session covered a wide range of current research on pathway risk management and phytosanitary policy aimed at reducing the risk of pest and disease introduction associated with international trade.

Key findings:

- Globalized trade has been implicated in the introduction of numerous forest insect pests and pathogens, often with grave environmental and economic consequences. International trade in nursery stock, the use of untreated wood packaging material, and other pathways have been implicated.
- Much effort has been directed at developing phytosanitary policies that make international trade safer, with a reduced risk of facilitating biological invasions. While phytosanitary policies for some pathways (e.g., ISPM-15) have been implemented widely, the development and implementation of effective phytosanitary measures for other pathways such as live plants/nursery stock remain difficult.
- Studies examining the impacts of invasive species as well as the costs and benefits of phytosanitary measures can be carried out to assess the net benefits of such measures. It is likely that many measures ultimately provide net benefits and are therefore sensible investments.
- Such measures need to be based on good science, requiring information on pest biology, invasion risks, and potential impacts (environmental and economic), trade volumes and transportation pathways, benefits of costs and benefits of treatments and policy, and communication with the wide range of interest groups. This is an area where collaboration between scientists, trade organizations, policy makers, and the wider public is critical.

Special Sessions for Students and Young Scientists

I-1, I-2, I-3 The "IUFRO Incubator"

Organizers: *J.P. Skovsgaard (Swedish University of Agricultural Sciences) & IFSA (International Forestry Students Association)*

Moderators: *Session 1 – J.P. Skovsgaard & Hugo Pierre (IFSA, France); Session 2 – Lilli Kaarakka (IFSA, Finland), Yousry El-Kassaby (University of British Columbia, Canada), Ronald McRoberts, & Jamie Barbour (US Forest Service); Session 3 – Margaret Shannon (SUNY Buffalo Law School, USA) & Jakob Hörl (IFSA, Germany)*

The IUFRO Incubator sessions provided a venue for graduate students and recent graduates to present brief summaries of their BSc, MSc, or PhD theses. The speakers presented their research in three minutes with just one presentation slide. Abstracts from students from more than 26 countries, from every continent, were accepted as part of these sessions. At each session, a large variety of topics were discussed and the audience was eager to ask questions. Many of the presenters complimented the moderators and the audience for having prepared specific questions for them.

All in all the sessions were a tremendous success, and at IFSA, we received positive feedback from both the organizers and the presenters. Some presenters mentioned that this was the perfect way to learn the "elevator talk"; e.g., how to present your research in a very short and effective way.

Session 1 – Forest Ecology, Biodiversity, and Silviculture

The first session focused on forest ecology, biodiversity, and silviculture. Many of the presentations at this session presented on research plant community and ecosystem responses to forest harvesting and how biodiversity is affected by different logging operations.

Session 2 – Forest Inventory and Modeling, Forest Health, Tree Physiology and Genetics, Forest Operations, Engineering, Products, Biomass, and Bioenergy

This session was aimed at graduated students in the fields of forest inventory and modeling, forest health, tree physiology and genetics, forest operations, engineering, products, biomass, and bioenergy. Since three sessions were combined, there was a large variation of topics presented at this session. The first presentations focused on modeling,\ and statistical methods, whereas the second batch of presentations discussed tree health and pathogens. The final presentations focused on forest operations.

Session 3 – Forest Policy, Social Sciences, and Forest Economics

At the last session, students presented their research from the fields of forest policy, social sciences, and forest economics. The presenters discussed forest ownership, community forestry, and social aspects of forest management. There was an abundant discussion after the session about how to present research and how qualitative findings fit in the realm of forestry that has typically been viewed as rather quantitative.

PRESIDENT'S DISCUSSION

In all activities, forest research must not only ask the right questions, but it also needs to point at solutions.

President's Discussion – Emerging Issues in Forest Policy and Practice: Input from Stakeholders to the Science Community

The President's Discussion is a valued feature of IUFRO World Congresses. The topical focus is chosen by the current IUFRO President. The focus this time was on identifying emerging issues in forest policy and practice together with stakeholders.

Recognizing the fact that research needs to be tailored to stakeholder requirements, IUFRO President **Niels Elers Koch**, as session moderator, invited a diverse panel of stakeholders to engage in a dialogue with the audience. Panelists included **Jürgen Blaser** (Swiss Development Cooperation), **Tukka Castrén** (The World Bank), **Teresa Magro** (University of São Paulo), **T. Bently Wigley** (National Council for Air and Stream Improvement), **Steven Johnson** (International Tropical Timber Organization), and **Yemi Adeyeye** (International Forestry Students' Association).

The session started with a keynote by **Robert Bonnie**, Under Secretary for Natural Resources and the Environment, United States Department of Agriculture. He highlighted the complexity of emerging issues, such as forest restoration and the increasing demand for forest-based goods and services against the background of global change. He underlined the scientific community's role in informing related discussions and refereeing them. In addition, he placed particular emphasis on the role of markets, pointing out that forests must provide value to people who own them, manage them, and live around them.

Jürgen Blaser

(Global Adviser on Forests to the Swiss Agency for Development and Cooperation; Professor of International Forestry and Climate Change at Bern University of Applied Sciences, School of Agricultural, Forest, and Food Sciences) presented a list of four crucial global challenges: the need for forests to provide material for the world's growing population; climate change; the loss of ecosystem services; and the occurrence of extreme events. Actually, these global challenges have not changed in the past decades. However, new "tactical approaches" have emerged, which promise to help address these challenges more effectively. One of these tactical approaches is the restoration across landscapes, based on more integrated governance arrangements across sectors and land uses.

Tuukka Castrén

(Acting Forestry Advisor, World Bank) focused his talk on poverty reduction. He stressed the importance of forests and forest research for the eradication of extreme poverty and the promotion of shared prosperity. Castrén also addressed the need of scaling up success stories in order to be able to implement such best practices in different places.

Teresa Magro

(Professor for Protected Areas Management, University of São Paulo) talked about the main research issues regarding recreation and tourism and their effects on protected areas. There is a great need to learn more about the impact of recreational activities on forests, for example. Magro also stated that with the growth of urban populations, forest visitors had less knowledge about the forest and did not recognize the value of recreational areas or ecosystem services that forests provide. However, taking into account the actual value of recreation as an ecosystem service is important, especially because local communities should benefit from the activities offered in recreational areas.

Innovative ways and means of communication will be pivotal not only for reaching out to youth but also to widely share forest research and to raise awareness about forests and forestry from a policy and practice perspective.

Steven Johnson

(Assistant Director for Trade and Industry, International Tropical Timber Organization (ITTO) reminded the audience of the value of research that had already been carried out but not yet implemented. This research is just as valuable as new research. He also identified a need for more research on the impact of sustainable forest management on carbon storage. Tropical biodiversity is another priority topic, especially when it comes to determining the proper type and size of forests that will ensure a good biodiversity level. Johnson concluded that it would be decisive to put values on forests in order to be able to protect them.

T. Bently Wigley

(Vice-President of the Forestry Programs for the National Council for Air and Stream Improvement) referred to the need for research on the sustainability of fiber sources. Investment in the forest sector and in forest policy is crucial, and science can help to keep such investments sustainable. Here research can contribute to understanding the roles that sustainable forest management on the one hand and industry on the other hand play in climate change mitigation strategies.

Yemi Adeyeye

(Liaison Officer to FAO, International Forestry Students' Association) underlined the importance of showing youth what forestry is truly about in an innovative and attractive way. There is an identified need to encourage youth to enter the forest sector and overcome obstacles such as a lack of economic incentives, education, and awareness of jobs within the forest sector. However, clear definitions and communication of what forestry education entails are a prerequisite.

Throughout the discussion, the need to find integrated solutions for the world's forest problems was underlined. Implementing these solutions will require interdisciplinary research on drivers of change across landscapes. They also require solid information and data about our world's forest resources. Yet such information and data are still scattered or missing in many parts of the world. In this context, the continued importance of criteria and indicators for sustainable forest management was emphasized.

In all activities, forest research must not only ask the right questions, but it also needs to point at solutions. In doing so, communication with policy makers, stakeholders, and the public is crucial. Innovative ways and means of communication will be pivotal not only for reaching out to youth but also to widely share forest research and to raise awareness about forests and forestry from a policy and practice perspective.

In closing the meeting, **President Koch** thanked all participants and the audience for their contributions. He noted that crucial issues had been touched on in the session. They could help pave the way toward a greater relevance of forest-related research and better tailor research to the needs of practitioners. He was confident that the President's Discussion would add value to the work of IUFRO for the upcoming term.

INTERNATIONAL COUNCIL

The International Council is the highest governing body of IUFRO with representatives from all of the countries with IUFRO members.

International Council

The International Council is the highest governing body of IUFRO with representatives from all of the countries with IUFRO members. Forty-one representatives participated actively in the meetings in Salt Lake City, and seven representatives sent proxy votes before the meetings.

During this World Congress, the International Council (IC) met twice to discuss and decide on a number of matters of major significance for IUFRO. The IC engaged in a thorough discussion of the new IUFRO Strategy 2015-2019, which will pave the way for the many activities leading up to the 2019 Congress. The new Strategy has jointly been endorsed by the outgoing and incoming members of the board at a meeting on 11 October 2014.

The IC elected the new President, Vice-Presidents and other voting members of the IUFRO board for the 2014-2019 term. The IC also voted to award Honorary Membership to Don Koo Lee, in recognition of his long service and outstanding support to IUFRO.

Following a very competitive bidding process and detailed evaluation by the board, the IC also voted on the host of the next IUFRO World Congress. As a result, the XXV IUFRO Congress 2019 will be held in the beautiful city of Curitiba, Brazil.

Finally, the IC reviewed and approved the Salt Lake City Congress Declaration 2014.

2014–2019

IUFRO BOARD

IUFRO Board for 2014-2019

President

Mike Wingfield, South Africa

Vice-President responsible for Divisions

Björn Hånell, Sweden

Vice-President responsible for Task Forces, Special Programmes, Projects and IUFRO-Led Initiatives

John Parrotta, United States

Immediate Past President

Niels Elers Koch, Denmark

Division Coordinators

- Division 1: Jens Peter Skovsgaard, Sweden
- Division 2: Yousry El-Kassaby, Canada
- Division 3: Woodam Chung, United States
- Division 4: Jean-Luc Peyron, France
- Division 5: Pekka Saranpää, Finland
- Division 6: Tuija Sievänen, Finland
- Division 7: Eckehard Brockerhoff, New Zealand
- Division 8: Jean-Michel Carnus, France
- Division 9: Daniela Kleinschmit, Germany

President's Nominees

- Shirong Liu, China
- John Innes, Canada
- Ben Chikamai, Kenya
- Jung-Hwan Park, Republic of Korea
- Manuel Guariguata, Venezuela

Executive Director

- Alexander Buck, Austria

IUFRO Host Country Representative

- Gerhard Mannsberger, Austria

FAO Representative

- Eduardo Rojas-Briales, Italy

Special Programme for Development of Capacities (SPDC)

- Michael Kleine, Austria

Global Forest Information Service (GFIS)

- Eero Mikkola, Finland

World Forests, Society and Environment (WFSE)

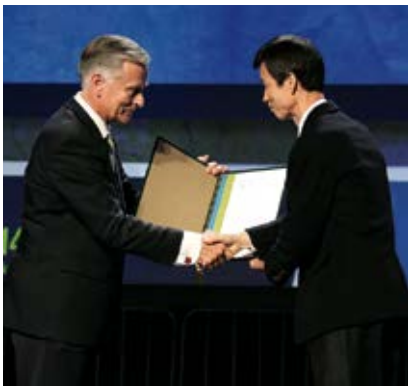
- Pia Katila, Finland

Global Forest Expert Panels (GFEP)

- Christoph Wildburger, Austria

Left to right: Daniela Kleinschmit, Jean-Michel Carnus, Eckehard Brockerhoff, Tuija Sievänen, Pekka Saranpää, Jean-Luc Peyron, Woodam Chung, Yousry El-Kassaby, Jens Peter Skovsgaard, Niels Elers Koch, Mike Wingfield, Björn Hånell, John Parrotta, Shirong Liu, John Innes, Jung-Hwan Park; not pictured: Ben Chikamai, Manuel Guariguata, Alexander Buck, Gerhard Mannsberger, Eduardo Rojas-Briales, Michael Kleine, Eero Mikkola, Pia Katila, Christoph Wildburger

IUFRO HONORS AND AWARDS



Don Koo Lee, Honorary Membership

Richard Guldin, Distinguished Service Award

Left to right: Niels Elers Koch, Chadwick Dearing Oliver, Harold Burkhart, Stephen Hubbell, Robert Bonnie, Richard Guldin

Harold E. Burkhart

Stephen Hubbell

Honorary Membership

Honorary Membership is IUFRO's highest award. At the Salt Lake City World Congress 2014, it was conferred upon an outstanding officeholder, **Don Koo Lee**, Immediate Past President of IUFRO, from the Republic of Korea.

Professor Don Koo Lee, one of the most prominent scholars in dendrology in Asia, has devoted his time over the past decades to research and development for the conservation, management, and restoration of forests around the world. He was the second Asian to serve as President of IUFRO and served for 18 years in several leading offices in IUFRO's governing bodies. Lee has also played an important role in Seoul National University (SNU) and in the Korean Forest Service. In recognition of his outstanding and valuable service to IUFRO, Professor Don Koo Lee is awarded IUFRO's Honorary Membership.

Distinguished Service Award (DSA)

The Distinguished Service Award (DSA) recognizes individuals whose work has substantially contributed to furthering the scientific, technical, and organizational aims of IUFRO. Two DSAs were presented during business sessions: to **Santiago Barros Asenjo** of Chile and **Peter Herbst** of Austria. An additional DSA was given during the Closing Ceremony to **Richard W. Guldin** of the United States of America for outstanding contributions to IUFRO as Working Party Leader in Division 6, creator and leader of the Task Force on the Forest Science-Policy Interface, and since 2010 as the Chair of the Congress Organizing Committee.

IUFRO World Congress Host-Country Scientific Achievement Award

The Congress Host Scientific Achievement Award honors outstanding scientists who have elevated the profile of forest science and research accomplishments. Award winners have an unchallengeable international standing in the scientific community, evidenced by demonstrated impact of their scientific achievements in one or more sectors of forest or forest-related scientific disciplines, spanning social/cultural, economic, or ecological perspectives.

- **Harold E. Burkhart**, University Distinguished Professor in the Department of Forest Resources and Environmental Conservation at the Virginia Polytechnic Institute and State University. A leading innovator in forest biometrics, Burkhart has made path-breaking contributions to the development of quantitative models for forecasting forest stand dynamics, growth, and yield. He has published extensively on forest growth and yield prediction, as well as forest inventory procedures, sampling, and statistical ecology. His textbooks are the standards for forestry schools in the United States and have had significant impact globally. His growth models for Loblolly Pine (Pinus taeda L.) have been used for plantations in Chile and South Africa, as well as being the standard for the southern United States. He was elected as a Fellow of the American Academy for the Advancement of Science in 1981 and a Fellow of the Society of American Foresters in 1985, and he received SAF's Barrington Moore Memorial Award in 1991. He has been active in IUFRO throughout his career, previously receiving an IUFRO Scientific Achievement Award in 1981 and the Distinguished Service Award in 1995. He also served as a member of the Congress Scientific Committee for the 2000 World Congress in Kuala Lumpur as well as other IUFRO divisional and research group meetings in Portugal, Austria, India, Chile, Denmark, and the United States.
- **Stephen Hubbell**, Distinguished Research Professor of Ecology and Evolutionary Biology at UCLA, and Senior Staff Scientist at the Smithsonian Tropical Research Institute, Panama. Hubbell is an internationally renowned ecologist for his research on tropical rainforests and theoretical ecology. He is the author of the unified neutral theory of biodiversity and biogeography, which explains the diversity and relative abundance of species in ecological communities. He is Founder and Chairman of the Board of the National Council for Science and the Environment, a national organization with a mission of improving the science underlying environmental decision-making, and Co-founder of the Center for Tropical Forest Science, which monitors the natural populations of tropical tree species across 23 countries and makes a major contribution to forest science and capacity building across the developing world. Hubbell is a Fellow of the American Academy of Arts and Sciences, the

American Association for the Advancement of Science, and the Ecological Society of America. He has been a Guggenheim Fellow and a Pew Scholar in Conservation and the Environment. He has received the Distinguished Service Award from the Society of Conservation Biology, the Marsh Prize in global ecology from the British Ecological Society, and the Kempe Price for Ecology from Sweden. He was elected an Honorary Lifetime Member of the British Ecological Society in 2013.

Chadwick Dearing Oliver

- **Chadwick Dearing Oliver**, Pinchot Professor of Forestry and Environmental Studies and Director of the Global Institute of Sustainable Forestry at the Yale School of Forestry & Environmental Studies. His early work on temperate and tropical forest stand dynamics led to a major book, "Forest Stand Dynamics," in 1990, co-authored with Bruce Larson. This led to work at broader spatial scales and the Landscape Management System – a downloadable, computer-based tool for managing timber resources, wildlife habitat, carbon sequestration, and fire protection. This model had major influence on forest management dialogues at the regional and national levels in the United States and led to him testifying 11 times before the United States Congress on forest management and forest policy issues. In recent years, he has become known as a global advisor on using research to help resolve scientific, technical, environmental, and management issues at the landscape and global levels. He has ongoing research collaboration and mentoring with scientists in developing countries, including Nepal, Uganda, Ecuador, and Liberia, and works with colleagues in Mexico, India, China, Thailand, and Ukraine. He was elected a Fellow of the Society of American Foresters in 2008, was a co-winner of the Sabin Prize for best environmental entrepreneur project in 2010, and serves on the Advisory Board of the Tropical Forest Foundation.

Scientific Achievement Award (SAA)

At each World Congress, IUFRO recognizes outstanding achievements of up to 10 scientists. Selections were made for research results published in scientific journals, proceedings of scientific meetings or books, or appropriate patents or other relevant evidence that clearly demonstrates the importance of the scientific or technical achievement to the advancement of regional or world forestry or forest research.

- **Sally Aitken**, Canada
- **Jürgen Bauhus**, Germany
- **Ben Cashore**, United States/Canada
- **Richard Hamelin**, Canada
- **Christopher Harwood**, Australia
- **Shibu Jose**, United States
- **Robert A. Kozak**, Canada
- **Aino Anniki Mäkelä-Carter**, Finland
- **Jolanda Roux**, South Africa
- **Giuseppe Scarascia Mugnozza**, Italy

Outstanding Doctoral Research Award (ODRA)

Left to right: Alexander Buck, Niels Elers Koch, Sally Aitken, Jürgen Bauhus, Benjamin Cashore, Richard Hamelin, Christopher Eric Harwood, Shibu Jose, Robert Kozak, Aino A. Mäkelä-Carter, Jolanda Roux, Guiseppe Scarascia, Renate Prueller, Shirong Liu

At the World Congress, awards were made for path-breaking doctoral dissertations completed within the past six years.

- **Jan R. Bannister Hepp**, Germany/Chile
- **Susana Barreiro**, Portugal
- **ShuaiFei Chen**, China
- **Puneet Dwivedi**, India
- **Zhun Mao**, China
- **César Pérez Cruzado**, Spain
- **Sandra Rodríguez Piñeros**, Mexico
- **Eli Sagor**, United States
- **Huei-Shing Sik**, Malaysia

IUFRO Student Award for Excellence in Forest Science (ISA)

Student Award winners gathered in their sub-plenary session

This award is aimed at master's degree students of forest-related sciences and recognizes outstanding individual scientific achievements during university studies to encourage further work within the fields of research covered by IUFRO.

- **Julius Adewopo**, United States/Nigeria
- **Tolulope Daramola**, United States/Nigeria
- **Md. Mohitul Hossain**, Bangladesh
- **Sharif Ahmed Mukul**, Bangladesh
- **Mika Yoshida**, Japan
- **Ivana Zivojinovic**, Serbia

Best Poster Award (BPA)

One Best Poster Award is given by each of the IUFRO Divisions with the goal of encouraging public dissemination of high-quality research and to recognize distinguished poster presentations by young scientists during the IUFRO World Congress. 2014 award winners and the titles of their posters were:

- Division 1: **Emma Soraya**, Australian National University, Australia, “Improving the productivity of native eucalypt forests”
- Division 2: **Chai Ting Lee**, Forest Research Institute Malaysia, Malaysia, “Discovery of genic microsatellite markers from transcriptome sequences of Eurycoma longifolia root”
- Division 3: **Lilli Kaarakka**, University of Helsinki, Finland, “Effects of repeated whole-tree harvesting on soil properties and tree growth in a Norway spruce stand”
- Division 4: **Nyein Chan**, Kyoto University, Japan, “Assessment of aboveground biomass and soil carbon storage of the fallow forests after swidden cultivation in the Bago Mountains, Myanmar”
- Division 5: **Min-Jay Chung**, National Taiwan University, China-Taipei, “Profiling of aroma compounds released from four major bamboo shoots of high economic value in Taiwan”
- Division 6: **Emmanuel Danquah**, Kwame Nkrumah University of Science and Technology, Ghana, “Exploring opportunities for participatory management at Bia Biosphere Reserve in western Ghana”
- Division 7: **Tsutomu Kanasashi**, Nagoya University, Japan, “Seasonal change of cesium in different age needles and male flowers of Japanese cedar (Cryptomeria japonica) in Fukushima”
- Division 8: **Althea A. Arch Miller**, Auburn University, United States, “Temporal and spatial variability of soil carbon flux in longleaf pine forests in the southeastern United States”
- Division 9: **Olivia Sanchez Badini**, University of British Columbia, Canada, “Small and medium forest enterprises in a REDD+ context: an analysis of enabling environments in developing countries”

Side and

COMMUNITY EVENTS

Side Events

IUFRO Congresses provide a unique opportunity for partners and relevant forest-focused organizations to host side events, as thousands of people interested in forests are gathered in one place. These events showcase new technologies and tools, provide opportunities for organizations to get feedback on new products or strategies, allow for planning and information sharing, and provide another pathway to share research.

Congress organizers provided an opportunity for organizations and other groups to hold side events through an open call for proposals. A total of 25 side events were accommodated.

Monday, 6 October – Side Events

Title	Organizing Institution	Event Lead	Description of Event
Wangari Maathai Award Presentation	Collaborative Partnership on Forests	Mita Sen	Presentation of the prestigious Wangari Maathai Award to honour an individual for his or her outstanding achievements for forests.

Wednesday, 8 October – Side Events

Title	Organizing Institution	Event Lead	Description of Event
Metla will become part of the Natural Resources Institute Finland	Finnish Forest Research Institute (Metla)	Erikki Kauhanen	On 1 January, 2015, the Finnish Forest Research Institute (Metla) with the Finnish Game and Fisheries Research (RKTL) and MTT Agrifood Research Finland, plus the statistical services of the Information Centre of the Finnish Ministry of Agriculture, will merge to form the Natural Resources Institute Finland. The new institute is presented to Metla's international partners.
Joint meeting of US Extension Foresters and IUFRO Extension and Knowledge Exchange Working Party	USDA National Institute of Food and Agriculture	Eric Norland	The US Extension Foresters welcome extensionists who are attending the IUFRO World Congress to a forum to meet and discuss opportunities and challenges in translating forest science into action by landowners and natural resource professionals.

Thursday, 9 October – Side Events

Title	Organizing Institution	Event Lead	Description of Event
Innovative Developments in Bamboo for Structural Utilization	World Bamboo Organization and Amphibia Group	Susanne Lucas and Hector Archila	The side event will showcase the latest advances in engineered bamboo product development and life cycle assessment tools applied to bamboo products. Experts from industry, academia, and the World Bamboo Organization will present these themes and discuss their importance on the future of bamboo as a sustainable alternative to traditional timber.
Quantifying and Certifying Ecosystem Services	The Gold Standard	Moriz Vohrer	Carbon, water, biodiversity, and erosion protection are all services that forests provide – and are under ongoing pressure. Through quantification and certification their value becomes visible and can be protected more effectively. The interest in these practices increases. This side event explores some of the best practice work done so far.
Marcus Wallenberg Prize Informational Session	Marcus Wallenberg Prize Committee Sweden	Kaj Rosen and Jeff Burley	The Marcus Wallenberg Prize is awarded annually for a unique research breakthrough that has had or is likely to have a major impact on the forestry and forest product industries. The prize is 2 million Swedish Crowns and is awarded to one or a small group of scientists. It is an international prize that, beside recognition of the laureate(s), has the intention to stimulate young scientists to engage in forest sector research. The prize is awarded by the King of Sweden at a glowing ceremony in Stockholm that is followed by a seminar on the topic of the winner. Details of procedures and past winners are shown at www.mwp.org.
Tropical Forests, Connecting the World through Sustainability	International Tropical Timber Organization	Takeshi Goto and Ramon Carrillo	Interactive panel discussions highlighting the contribution of forests to sustainability of humankind and its interconnections at a global level, including provision of goods and services, mitigation and adaptation to climate change, local livelihoods and their contribution to national economies, interconnected timber markets, and trans-boundary conservation. A special section will be devoted to the ITTO-IUFRO-FORNESSA project in West Africa.
Forests and Water – International Momentum and Action	Food and Agriculture Organization of the United Nations; IUFRO, ICRAF, and the Weyerhaeuser Company	Thomas Hofer	Numerous meetings on forests and water have taken place during recent years, the recommendations of which have been synthesized in an FAO publication entitled "Forests and Water: International Momentum and Action." Based on this publication, an international expert group met in Kunming, China, from 24 to 26 March, 2014, and developed a concrete five-year forests and water agenda. During the side event the agenda will be officially presented and further fleshed out from the scientific perspective. Also the building blocks for a forest and water event scheduled to take place at the World Forestry Congress in 2015 in Durban will be finalized.
Practical Issues in Implementing Uncertainty Analysis	Quantifying Uncertainty in Ecosystem Studies (QUEST), a Research Coordination Network	Ruth Yanai, David Paré, and George Gertner	We will discuss the decisions required in implementing uncertainty analyses and the compromises required when dealing with real-world applications. Do we need a true value to report error? What error term is relevant (uncertainty in an individual prediction, uncertainty in a mean)? What should we do when the magnitude of some sources of uncertainty is unknown?

Thursday, 9 October (Cont.) – Side Events

Title	Organizing Institution	Event Lead	Description of Event
Workshop on Trade and Forest Health	Food and Agriculture Organization of the United Nations	Shiroma Sathyapala	A workshop to introduce the e-learning course "Trade in forest commodities and the role of phytosanitary measures" and provide the examples of its implementation in different regions in the world. The course contains five modules covering everything from the possible threats to forest health associated with international trade to what information is needed to safely import/export forest products. The e-learning course was based on the "Guide to implementation of phytosanitary standards in forestry" developed by FAO and its partners in collaboration with the International Plant Protection Convention (IPPC). In addition there will be a presentation on abiotic factors affecting the forest health and possible remedial actions.
ITTO and CITES Collaboration to Sustain Tropical Tree Species	International Tropical Timber Organization	Steve Johnson	The International Tropical Timber Organization (ITTO) and the Convention on International Trade in Endangered Species (CITES) have been collaborating for nearly a decade to assist countries to improve management of tropical tree species listed in the CITES Appendices. This event will review progress achieved by this collaborative program throughout the tropics.
Enabling Productive Uses of Forests that Reduce Poverty, Create Jobs, and Build Resilience	PROFOR – Program on Forests	Diji Chandrasekharan Behr and Tuukka Castren	Productive uses of forests can contribute to growing local, national, and regional economies. We need to seize opportunities for expanding the contribution of productive uses of forests to green, inclusive, and resilient growth. Join a panel of experts to learn more about these opportunities and the potential contribution of forests, and to discuss how we can collectively engage in this area of work.
Celebrating 20 years of FSC Impacts on Forests and People	Forest Stewardship Council	Anakarina Pérez Oropeza	FSC is celebrating 20 years of continuous efforts to find solutions that benefit people and forests worldwide. In this session FSC and keynote speakers will share experiences and findings highlighting FSC's impacts globally over these two decades.
Bioeconomy and the Forest Sector – An Overview	Nordic Forest Research (SNS) and Scandinavian Journal of Forest Research	Mats Hannerz	The seminar gives an overview of the bioeconomy concept by reviews of social challenges, policy issues, biological constraints and options, and industrial innovations. The qualified speakers have summarized their fields in a special journal issue, launched at the seminar.
Wood Culture Technical Session	International Wood Culture Society	Howard Rosen	This special evening session will continue with the theme of Session 5 – Wood and Forest Culture: merging the past with the present. The session will include several technical talks, a general talk about World Wood Day programs around the world, as well as artisans doing craft demonstrations.
Toward Strengthened International Science Collaboration on Planted Forests – Main Research Questions from a Stakeholder Perspective	European Forest Institute	Christophe Orazio and Stephanie Hayes	The meeting will summarize the outcomes of the 3rd International Congress on Planted Forests 2013 (ICPF), explore the views of the private forestry sector, and discuss options for further collaboration with IUFRO.

Friday, 10 October – Side Events

Title	Organizing Institution	Event Lead	Description of Event
Shelterbelts' Roles, Functions, and Options to Combat Climate Change	University of Agricultural Sciences, Dharwad, Karnataka, India	Shivanna Honnurappa	The shelterbelts are essentially required in the arid and semiarid regions of the world. They also are required in both tropical and temperate conditions to normalise the environmental impacts on crops, microclimate change, crop growth, and conservation of water, soil, biomes, birds, and microbes; also they provide shelter for birds, wild animals, butterflies, honey bees, and other creatures in and around them. Hence it is an event to encourage the the scientific community to motivate the issues at the farmer level, whether community-based or as an official programme as in Canada. Global promotional events are essentially required.
Gender Lens Photo Book Launch	CGIAR	Purabi Bose	The International Center for Tropical Agriculture (CIAT) is one of the 15 CGIAR centers headquartered in Colombia. The photo book launch as part of IUFRO's side event will be part of CIAT's Forests, Trees, and Agroforestry integrating gender (FTA Gender). CIAT's FTA is taking an initiative to do science with a difference – publishing a photo book as an output of the International Photo Competition 2014 on "Forest-Agriculture Interface through a Gender Lens." The photo book will be a key output of our photo competition with 100 photos that best showcase (success and failure) of forest-agriculture interface with gender as a cross-cutting theme across the globe. For details kindly check this blog http://dapa.ciat.cgiar.org/international-photo-competition_purabi-bose/
Web Services and Workflows in Biodiversity and Ecosystem Science: A Technology Showcase	BioVeL	Hannu Saarenmaa	Shared data and models on the Internet can be combined with automated workflows to perform complex computational tasks. In this showcase the BioVeL project demonstrates the use of workflow technology in ecological niche modeling of forest pests, carbon modeling with the Biome-BGC model, and accessing and sharing data through GBIF and GEOSS.
FAO Open Foris Initiative: Free Tools for Forest Monitoring	Food and Agriculture Organization of the United Nations	Danilo Mollicone	Open Foris is an FAO-led initiative to develop and share tools and methods for forest monitoring. These tools support countries in gathering, analyzing, and disseminating reliable information on the state of forest resources. Emphasis is placed on building sustainable capacity through free sharing of all tools and methods, documentation, and source-code, thus promoting self-sufficiency, transparency, and vendor independence. Open Foris tools are available for everyone without restrictions. Therefore the initiative also supports educational and research institutions as they can apply the tools and even develop them further. Practical examples of Open Foris applications will be presented.
Forest Landscape Restoration as a Strategy for Mitigating and Adapting to Climate Change	IUFRO and World Resources Institute	Michael Kleine	Forest landscape restoration (FLR) aims to improve both ecological integrity and human well-being. To this end, a group of IUFRO scientists has developed a framework to demonstrate how FLR can contribute to climate change mitigation and adaptation. This communication tool should help decision-makers to build resilient landscapes and learn how climate objectives can be addressed through FLR. The results presented in this side event are based on the work of a collaborative project between the World Resources Institute and IUFRO funded by the German Ministry of Environment.

Friday, 10 October (Cont.) – Side Events

Title	Organizing Institution	Event Lead	Description of Event
Implementing a Global Plan of Action for Forest Genetic Resources	Bioversity International	Judy Loo	Short presentations: Highlights of the first State of the World's Forest Genetic Resources (FGR) report; Global Plan of Action (GPA) and its implementation; linking to international agendas; key issues in conservation and sustainable use of FGR. Presentations will be followed by discussion on implementing the GPA.
IBFRA: International Boreal Forest Research	International Boreal Forest Research Association	Rasmus Astrup	This is a side event arranged by IBFRA in order to foster increased international collaborative research on boreal forests. The side event will combine three short keynotes on the research frontier in boreal forest research and introduce new IBFRA research and network activities combined with discussions related to the future needs for boreal forest research.
Understanding the Resilience of Disturbed Forests in the Tropics	TmFO and its partners	Plinio Sist and Robert Nasi	TmFO aims to assess the impact of logging on forest dynamics, carbon storage, and tree species composition at the regional level in the Amazon basin, Congo basin, and Southeast Asia. This side event will present this new forest observatory as well as the first results of the research and will give participants the opportunity to share ideas and their experiences of this issue.
Developments and the Way Forward: Establishment of the International Union of Agroforestry	World Agroforestry Centre (ICRAF)	Margaret Kroma	The establishment of an International Union of Agroforestry (IUAF) was proposed and approved in Delhi, India, in February 2014 at the World Agroforestry Congress. To formally establish the IUAF, discussions around finalization of a charter and development of requisite institutional infrastructure and resource mobilization mechanisms are necessary. The purpose of the meeting is to engage professionals in the wider community of interest in agroforestry for input of constructive ideas and actions toward these ends.

Community Events

Key partners in the greater Salt Lake community took advantage of the Congress to develop a suite of diverse, meaningful activities to engage community members and organizations around the topic of forests. While these events were not sponsored by IUFRO, they were coordinated with the COC. The public engagement efforts were funded by a grant from the US National Science Foundation's Ecosystem Program, with the objective of having the IUFRO Congress community-engagement effort serve as a model for other scientific meetings and scientists to carry out public engagement about the content and importance of those meetings.

Community events included:

- Viewing of the film "Once upon a Forest" at the Utah Film Center, followed by a panel discussion consisting of three forest scientists (two from IUFRO, one from University of Utah), who led a rich discussion of policy and sentiment afterwards. (300+ in attendance)
- Broadcast of a radio program – Radio West, KUER – on the relationships between trees and humans, and about the IUFRO Congress.
- Poetry Slam (Mestizo Coffee House) on the topic of forests. (40+ in attendance)
- Bilingual book reading about the importance of forests and trees at an independent bookstore. (50+ in attendance)
- Bilingual promotional flyers (Spanish & English) about these events and the Congress were posted in over 100 community locations.
- A Tree Art Display at the public library and tours to a local natural area were organized.

In addition to these events, the Mayor of Salt Lake City requested a "think-tank" type meeting on the topic of urban forests. On Thursday during the Congress, leading urban forest researchers and managers participated with Salt Lake City employees, staff from various universities, and local community members for a rich discussion around Salt Lake City's current programs and potential future strategies. The topic of university versus public institution roles in forest research and science was also discussed.

PRE-CONGRESS TRAINING

SPDC delegates attend a pre-Congress training session

Pre-Congress Training

The Special Programme for Development of Capacities (IUFRO-SPDC) of IUFRO has a long history of organizing training workshops on pertinent subjects relevant to forest scientists from developing countries in conjunction with large IUFRO conferences and Congresses. To this end, a one-week training event was organized at Snowbird Mountain Resort near Salt Lake City, during the week prior to the IUFRO World Congress, 29 September to 3 October, 2014.

Participants were selected from a pool of more than 300 scientists applying for both sponsorship to the Congress Scientist Assistance Program and participation in the pre-Congress training week. Seventy-one early and mid-career scientists from 32 countries in Africa, Asia, and Latin America were selected.

The participants could choose between two main training modules: Training in Research Methods or Communicating Forest Science. These two training workshops were held concurrently from Monday to Thursday. On Friday participants attended a short workshop on "Introduction to the Global Forest Information Service (GFIS)" lead by the GFIS Team, followed by a Knowledge Café as a wrap-up session of the training week.

Workshop 1: Training in Research Methods

This training workshop with 41 participants was co-led by **Rolfe Leary**, US Forest Service (retired), and **John Kershaw**, University of New Brunswick. The workshop presented the scientific process, including: problem identification, question formulation, effective literature reviews, hypothesis development, scientific inference, sampling theory, experimental design, statistic inference, strong inference, and research ethics. Each participant was asked to bring a question or problem statement related to research they are currently undertaking to be used as examples and case studies. The workshop was structured so that participants understood the connections and parallels between philosophical and conceptual constructs of science and the mechanics of doing science. A website for the training session is found at: http://ifmlab.for.unb.ca/people/kershaw/Courses/IUFRO_Research_Methods/IUFRO_top.htm

The results of Knowledge Café show that the previous training sessions on communication of research, the science-policy interface, GFIS, and research methodology were relevant and addressed needs in the participants' countries.

Workshop 2: Communicating Forest Science: Making Science Work for Policy and Management

A total of 30 participants participated in this workshop led by **Cynthia Miner**, US Forest Service. This session provided basic and advanced concepts in communications. Concepts explored included one-way and two-way communications. Each participant developed a communications strategy that included purpose and scope, objectives, audience, key messages, methods, and measurement of success. The news media section explored what shapes news, types of media, and ways to get published. Media interviews were used to continue developing skills in delivering key messages. Discussions focused on how to prepare for an interview as a scientist, techniques for getting the science story out, and how to stay out of trouble in speaking to the press.

The Internet and social media section included the benefits and challenges of emails, electronic newsletters, websites, content development, providing access with various apps and tools, Twitter, Facebook, and blogs. Each participant developed a blog, some of which later were posted by the IUFRO Congress or the individuals themselves.

Teaching materials included a PowerPoint presentation, a manual entitled Communicating Forest Science, and handouts.

Workshop 3: Introduction to the Global Forest Information Service (GFIS)

On 3 October, 2014, the Global Forest Information Service (GFIS) Coordination Unit led a half-day workshop for all 71 participants aimed at promoting the GFIS gateway and addressing the challenges to scientific information sharing across different scales.

Eero Mikkola, GFIS Coordinator, described how the GFIS website interacts with partner-organizations' websites to harvest and store information for third-party information access. GFIS Communications Officer **Michael Huck** instructed participants in the evolution of online information management; the changing nature of the information search and scope of content found online; the evolving nature of dissemination; as well as best practices for readying information for online upload including introduction to web-ready standards.

Knowledge Café

The week concluded with a Knowledge Café for all 71 participants to share the information and insights obtained in the different training workshops. The focus was on discussing real-world cases likely to be encountered in practice. The results show that the previous training sessions on communication of research, the science-policy interface, GFIS, and research methodology were relevant and addressed needs in the participants' countries. They also show the need by the forest science community to increase efforts in training and networking, in order to achieve a greater impact of forest research in these countries.

Funding for Pre-Congress Training

Funding for the SPDC Program was provided by:

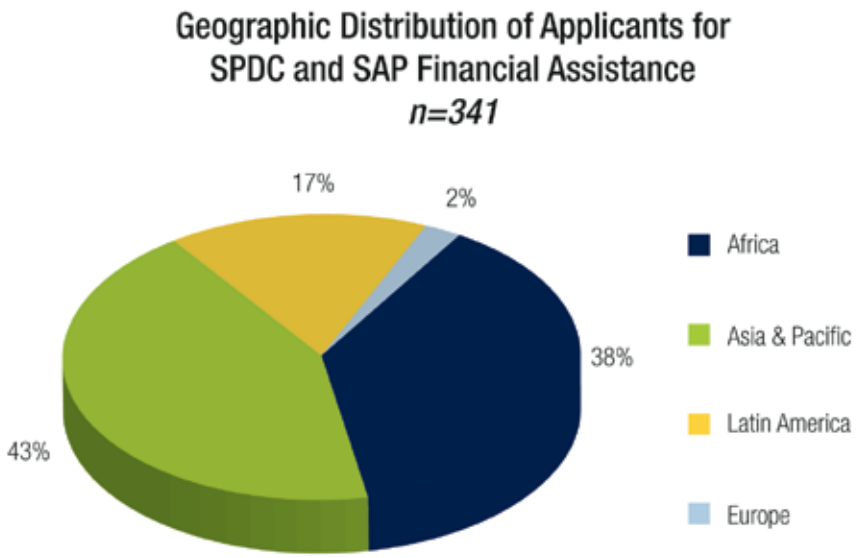
- Ministry of Foreign Affairs of Finland
- Korea Forest Research Institute, Republic of Korea
- US Forest Service
- Austrian Federal Ministry of Agriculture, Forestry, Environment, and Water Management
- Center for International Forestry Research (CIFOR)
- International Tropical Timber Organization (ITTO)
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

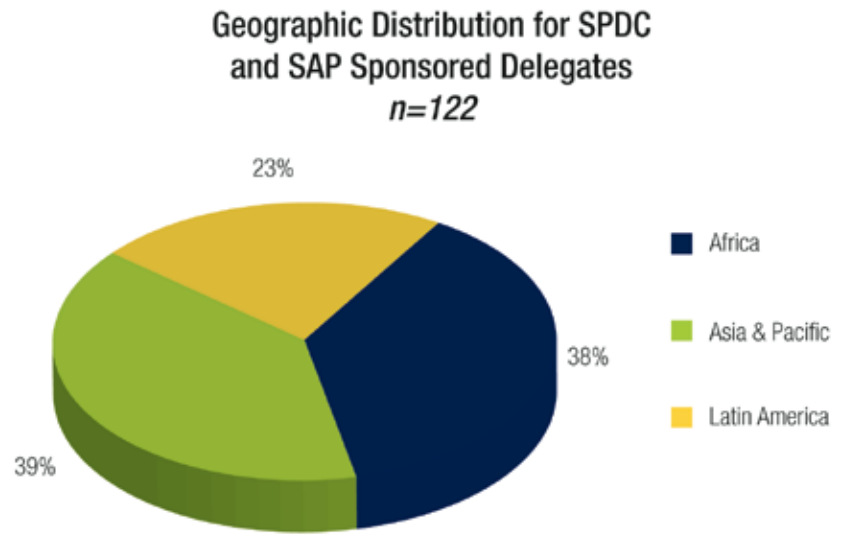
SCIENTIST ASSISTANCE PROGRAM

A total of 341 applications were received and evaluated. Factors considered include scientific achievements of the applicant, whether the applicant was an award recipient, and financial need.

Scientist Assistance Program

The Scientist Assistance Program (SAP) is designed to offer delegates from developing countries financial assistance to participate in the IUFRO World Congress. A total of 341 applications were received and evaluated. Factors considered include scientific achievements of the applicant, whether the applicant was an award recipient, and financial need. Consideration was also given to early-career scientists, geography, and gender balance. The IUFRO Special Programme for Development of Capacity made selections first, totaling 71. Then, the Congress Organizing Committee selected an additional 51 applicants for funding from the sponsorship by the US Department of Agriculture and from the Congress budget. In total, 122 delegates were funded – 60 women and 62 men.





Special

IUFRO MEETINGS

SPECIAL IUFRO MEETINGS

Making the Most of the Congress

This first session of the Congress on Sunday, 5, October 2014, provided Congress first-timers with guidance on how to make the most of their time at the Congress. The program included presentations about the scientific program and other Congress events, facilities available at the Salt Palace Convention Center, as well as best practices for networking and information exchange.

IUFRO Business Sessions

IUFRO Business Sessions were individually or jointly organized by IUFRO Research Groups, Working Parties, Task Forces and Special Programs. These sessions were intended for administrative and organizational issues of the respective IUFRO units (e.g., to plan activities for the upcoming IUFRO term, discuss unit leadership issues).

RESEARCH GROUP AND WORKING PARTY MEETINGS

DATE	IUFRO UNIT #	NAME OF IUFRO UNIT	CONTACT PERSON
Monday, 6 October	1.01.11	Ecology and Silviculture of Ash and Maple	Jens Peter Skovsgaard
	1.02.04	Sustainable Management and Genetic Resources in Meliaceae	Sheila Ward (Dep.)
	4.02.02	Multipurpose Inventories	R.k. Kohli
	5.01.00	Wood Quality	Pekka Saranpaa
	5.04.13	Industrial Engineering, Operations Analysis, and Logistics	Henry Quesada
	5.05.00	Composite and Reconstituted Products	Salim Hiziroglu
	5.12.00	Sustainable Utilization of Forest Products	Robert Deal
	7.01.00	Impacts of Air Pollution and Climate Change on Forest Ecosystems	Andrzej Bytnerowicz
	8.01.02	Landscape Ecology	Sandra Luque
	8.02.08	African Wildlife Conservation and Management	Chabi Djagoun
	9.00.00	Forest Policy and Economics	Daniela Kleinschmit
	9.01.00	Information and Communication	James Johnson
	9.01.02	Communication and Public Relations	Cynthia Miner
	9.03.04 & 9.03.05	Traditional Forest Knowledge in Temperate and Boreal Regions and in Tropical and Subtropical Regions	Yeo-Chang Youn (Dep.) & Jinlong Liu
Tuesday, 7 October	1.01.00	Temperate and Boreal Silviculture	Palle Madsen
	1.01.06	Ecology and Silviculture of Oak	Kurt W. Gottschalk

DATE	IUFRO UNIT #	NAME OF IUFRO UNIT	CONTACT PERSON
Tuesday, 7 October	1.01.07	Ecology and Silviculture of Beech	Palle Madsen (Dep.)
	1.01.12	Silviculture and Ungulates	Thomas Rooney
	1.02.05	Silviculture and Management in Arid and Semi-arid Regions	Santiago Barros
	1.03.00	Short-Rotation Forestry	Sanjeev K. Chauhan
	1.04.00	Agroforestry	August Temu
	1.06.00	Restoration of Degraded Sites	John Stanturf
	2.04.01	Population, Ecological, and Conservation Genetics	Om P. Rajora
	3.03.00	Forest Ergonomics	Yozo Yamada
	3.04.00	Forest Operations Management	Woodam Chung
	4.01.05	Process-Based Models for Predicting Forest Growth and Timber Quality	Oscar Garcia
	4.03.03	Information Management and Information Technologies	Harald Vacik (Dep.)
	5.02.00	Physiomechanical Properties of Wood and Wood-Based Materials	Xiping Wang
	5.03.00	Wood Protection	Andrew Wong (Dep.)
	5.06.00	Properties and Utilization of Plantation Wood	Roger Meder
	5.07.00	Biorefinery	Dominique Lachenal (Dep.)
	5.10.00	Forest Products Marketing and Business Management	Eric Hansen
	5.10.01	Wood Culture	Howard Rosen
	5.11.00	Non-Wood Forest Products	T. Hammett & J. Chamberlain
	6.01 & 6.02 & 6.03 & 6.04 & 6.10	Forest Recreation, Landscape and Nature Conservation & Landscape Planning and Management & Nature-Based Tourism & Nature Conservation and Protected Areas & Rural Development	Frank Søndergaard Jensen
	6.07.00	Urban Forestry	David Nowak
	6.08 & 6.09	Gender and Forestry; & Improving Education and Further Education in Forestry	Gun Lidestav & Siegfried Lewark
	7.01.04	Impacts of Air Pollution and Climate Change on Forest Ecosystems – Genetic Aspects	Om P. Rajora
	7.02.00	Pathology	Jolanda Roux
	7.03.00	Entomology	Andrew Liebhold

DATE	IUFRO UNIT #	NAME OF IUFRO UNIT	CONTACT PERSON
Tuesday, 7 October	8.02.04	Ecology of Alien Invasives	R. K. Kohli
	9.01.03	Extension and Knowledge Exchange	Jurij Begus
	9.01.04	Latin American and Caribbean Information Systems Network	Santiago Barros
	9.03.00	Forest History and Traditional Knowledge	Mauro Agnoletti
	9.04.03	Ecological Economics	Yeo-Chang Youn
	9.05.00	Forest Policy and Governance	Margaret A. Shannon
	9.05.08	Forest and Natural Resources Policy and Governance in Latin America and the Caribbean	Ronnie De Camino Velozo
	9.07.00	Forest Sector Analysis	Birger Solberg
	GFEP	Global Forest Expert Panel: Forests and Food Security	Bhaskar Vira
	TF Biodiversity	Biodiversity and Ecosystem Services	E. Brockerhoff

IUFRO DIVISION MEETINGS

DATE	IUFRO UNIT #	NAME OF IUFRO UNIT	CONTACT PERSON
Friday, 10 October	Division 1	Silviculture	Bjorn Hanell
	Division 2	Physiology and Genetics	Yousry El-Kassaby
	Division 3	Forest Operations Engineering and Management	Hans R. Heinimann
	Division 4	Forest Assessment, Modeling, and Management	Margarida Tomé
	Division 5	Forest Products	Andrew Wong
	Division 6	Social Aspects of Forests and Forestry	Tuija Sievänen
	Division 7	Forest Health	Eckehard Brockerhoff
	Division 8	Forest Environment	Jean-Michel Carnus
	Division 9	Forest Policy and Economics	Daniela Kleinschmit

SOCIAL EVENTS

Guests stand in the Canyons room of the museum and visit before the program begins

Social Events

Social events throughout the Congress were an opportunity for delegates to meet in a variety of settings.

Official Congress Receptions

Welcome Reception

The Welcome Reception was held the evening of Monday, 6 October, in Hall E of the Convention Center. The informal reception was an opportunity for delegates to greet old colleagues and friends and make new acquaintances. The **Mark Chaney Jazz Band** provided entertainment for the evening.

Exhibition Hall Opening Reception with Society of American Foresters & Canadian Institute of Forestry

The Exhibition Hall opened the evening of Wednesday, 8 October, with a reception. The Society of American Foresters and the Canadian Institute of Forestry meeting attendees joined IUFRO delegates in the Hall to interact with the various vendors.

Farewell Gala and Dinner

The American-West themed Farewell Gala and Dinner followed the Closing Ceremony on Saturday, 11 October. The evening began with a reception where delegates mingled and recounted the highlights of the Congress. After an hour, they were seated for the dinner at tables and the meal was served buffet-style. Key Congress partners and donors addressed the delegates during the meal.

Maxwell Hughes provided instrumental guitar entertainment during the reception and the **Red Desert Ramblers** provided traditional western music after dinner. A "caller" inspired attendees to participate in group square dances. Several hundred joined in enthusiastically.

Partner-Sponsored Receptions

Reception with National Association of University Forest Resources Programs (NAUFRP)

The National Association of University Forest Resources Programs (NAUFRP) was a key partner to the IUFRO World Congress. They held their annual executive committee and general assembly meeting on 6-7 October. After their meetings ended, they hosted an invitation-based reception on Tuesday evening, 7 October. The IUFRO President and the Chair and Project Manager of the Congress Organizing Committee attended this reception for IUFRO. Many other US universities and partners were in attendance.

Alumni Receptions

In the United States, there is a strong history of forestry schools hosting alumni receptions at large conferences, particularly annual conventions of the Society of American Foresters. These receptions are an opportunity for the Deans and Department Heads to share the latest school news and for students, professors, and alumni to network. Many North American universities hosted receptions on Thursday evening, October 9. While the Congress did not organize these receptions, many Congress delegates participated who had attended North American universities.

Other Social Events and Receptions

President's Reception

The President's Reception was held the evening of Sunday, 5 October, at the Natural History Museum of Utah. Approximately 80 invitees attended, including Congress sponsors and key partners, award winners, keynote and plenary speakers, and many heads of international organizations. Congress Organizing Committee advisor Pat Shea provided local context and history, and IUFRO President Niels Elers Koch provided welcoming comments in the Sky Terrace gallery, where a photographic exhibit was displayed paying tribute to the 50th anniversary of the US Wilderness Act. Attendees were invited to tour the entire museum, including the unique Native Voices gallery that highlighted the history and culture of the six Native American tribes indigenous to Utah. The IUFRO President recognized leaders of the University of Utah who helped organize and host the reception.

IUFRO Board Member John Innes mentors a group of IFSA students

IUFRO Vice-President Su See Lee shared her thoughts on leadership and forest science with IFSA students

IFSA Networking Reception

The International Forestry Students' Association (IFSA) hosted a networking reception at a local restaurant on Tuesday, 7 October. The reception was designed to introduce non-IFSA students to the organization, as well as allow IFSA members to mingle and get better acquainted. Before the formal program, the nine IUFRO Division coordinators as well as the IUFRO President were available at different tables to talk to the students about their Divisions and their roles in IUFRO.

International Student Quiz Bowl

A regular feature of the Society of American Foresters (SAF) annual conventions is a Quiz Bowl, where teams of students from universities compete to answer technical questions. This year, the format was broadened to include students from IUFRO/IFSA and Canadian universities. On Wednesday evening 8 October after the Exhibition Hall Opening Reception, the event drew several hundred participants and observers. The COC appreciated the efforts of the SAF organizers to reach out and include international students in the event.

President's Reception for the International Council

The International Council is the highest governing body of IUFRO. On Friday, 10 October, members of the International Council meeting were invited to a reception immediately following their meeting at the Hilton Salt Lake Hotel. Senior IUFRO officers participated in the reception.

Luncheon for Incoming and Outgoing Board Members

On Saturday, 11 October, the new members of the IUFRO Board joined the outgoing members for a luncheon hosted by the IUFRO President. This was an opportunity to share knowledge and ensure a smooth transition to leaders for 2014-2019. The group discussed the IUFRO Strategy for 2014-2019 and how it could guide activities of Divisions and Task Forces in the coming years.

Delegates enjoy the western themed Farewell Gala

TOURS

Participants in the pre-Congress tour Sustaining Diverse Ecosystems of the Great Basin and Colorado Plateau Through Community Partnership at a stop in the Grand Canyon

Participants of the pre-Congress tour Ecology and Biogeography of the Wasatch and Uinta Mountains enjoy a wonderful view during their tour

Tours

Congress organizers offered four types of tours:

- Pre-Congress tours
- In-Congress tours
- Post-Congress tours
- Accompanying Persons/Local Sightseeing tours

Pre-Congress Tours

Organizers solicited proposals from partners across the United States to organize and host pre-Congress tours. Nine tours were originally developed and advertised as part of the Congress program. Of the nine original tours, only three were offered. Six were cancelled due to lack of demand and not meeting minimum capacity requirements. A summary of the tours is below. The number of participants only includes the number of paid, registered delegates who attended, and not speakers, tour leads, and local guides.

TOUR TITLE	# OF PARTICIPANTS
Managing for Ecosystem Values Across Mesic & Dry Forests in the Pacific Northwest	Cancelled
Northern California: Red Wine to Redwoods	9 Delegates
Southern California: Fire, Restoration, Urban Forestry, & Land Management Practices	Cancelled
Lake Tahoe: Genetics, Air Pollution, & Fuels Management Research	Cancelled
Ecology and Biogeography of the Wasatch & Uinta Mountains	13 Delegates
Central Hardwood Forest Management	Cancelled
Sustaining Diverse Ecosystems of the Great Basin & Colorado Plateau through Community Partnership	14 Delegates
Hilo, Hawaii: Forest Health in a Changing World, Forest Biodiversity	Cancelled
Oak Silviculture in the Central Appalachians	Cancelled

Participants in the pre-Congress tour Northern California: Red Wine to Redwoods show off their hardhats at a tour stop.

In-Congress Tours

Twenty-seven In-Congress tours were offered on Wednesday, 8 October. Delegates selected tour preferences during the registration process and were able to change tours on-site. Attendees of the Society of American Foresters/Canadian Institute of Forestry Convention were also able to purchase tour tickets. Tours ranged in topic and geographic location. An estimated 2,300 IUFRO/SAF/CIF delegates took advantage of the In-Congress tours. A summary table of the tours offered is below.

Tour #	Title	Area	Stops	Depart	Return	Tour Lead(s)
IC-01-A	Alpine Hydrology & Snow Science	Little Cottonwood Canyon	Snowbird Ski Area; Alta Ski Area	8:00	14:30	Kelly Elder
IC-01-B	Alpine Hydrology & Snow Science	Little Cottonwood Canyon	Snowbird Ski Area; Alta Ski Area	8:00	14:30	Mike Jenkins
IC-03	Nature-Based Tourism	Little Cottonwood Canyon	Snowbird Ski Area; Alta Ski Area	9:30	17:30	Dan Williams
IC-04	Forests to Faucets – Watershed Management	Big Cottonwood Canyon	Silver Lake Visitor's Center; Brighton Ski Area; Big Cottonwood Water Treatment Plant	8:30	14:00	Tracie Kirkham
IC-05	Urban Forest Research and Management	Big Cottonwood Canyon	Spruces Campground; Brighton Ski Area	9:15	16:00	Sarah Hines
IC-06	Tourism and Recreation Management – Morning	Big Cottonwood Canyon	Silver Lake Visitor's Center; Brighton Ski Area	8:00	12:30	Steve Burr & Cathy Kahlow
IC-06	Tourism and Recreation Management – Afternoon	Big Cottonwood Canyon	Silver Lake Visitor's Center; Brighton Ski Area	13:00	17:15	Steve Burr & Cathy Kahlow
IC-07	Urban Forest Watershed Management	Big Cottonwood Canyon	Spruces Campground; Silver Lake Visitor's Center	13:00	17:30	Charlie Condrat
IC-08	Great Salt Lake Hydrology and International Bird Migration	Antelope Island State Park	Antelope Island; Garr Ranch	8:45	15:00	Alex Hoppus

Participants on the in-Congress tour IC-10 Walter Mueggler Research Natural Area Hike in the Wasatch-Cache National Forest

In-Congress tour IC-16 Wasatch Plateau – Managing for Multiple Uses participants stop at the Brigham Young Arboretum

Delegates on in-Congress tour IC-23, Forest Assessment, Inventory, and Monitoring stop for a group photo

IC-09	Salt Lake City Urban Forests	Salt Lake City	Redwood Natural Area; Red Butte Gardens; University of Utah	8:30	16:00	Meridith Perkins & Mike Kuhns
IC-10	Walter Mueggler Research Natural Area Hike	Big Cottonwood Canyon	Spruces Campground; Mueggler-Butler Fork Rna, Mt. Olympus Wilderness	7:45	15:00	Wayne Padgett & Steve Shelly
IC-11	A Changing Scene: Forest Health in the High Uinta Mountains	Mirror Lake Scenic Byway	Pine Valley Campground; Camp Rogers; Washington Lake Campground	7:45	17:30	Liz Hebertson
IC-12	Forest Operations and Recreation Management	Mirror Lake Scenic Byway	Blazzard Lumber; Mirror Lake Overlook	9:00	16:45	Nate Anderson
IC-13	Wildland Fire Management and Post-Fire Restoration	American Fork Canyon	Northern Interagency Fire Center; Quail Fire – City of Alpine; Mutual Dell; Tibble Fork Campground; Cascade Springs	8:30	16:00	George Garcia
IC-14	Shrublands Research and Restoration	Provo and American Fork Canyon	Forest Service Shrub Sciences Laboratory; Brigham Young University Arboretum; Mutual Dell Campground	8:00	15:00	Susan Meyer
IC-15	Wasatch Plateau 1 – Managing for Multiple Uses	Spanish Fork Canyon	Schofield State Park; Winter's Quarters Cemetery; Old Folks Flat Campground	7:30	17:00	Stan Kitchen
IC-16	Wasatch Plateau 2 – Managing for Multiple Uses	Spanish Fork Canyon	Price History Museum; Old Folks Flat Campground; Huntington Reservoir	7:30	19:00	Rosann Fillmore & Charmaine Thompson
IC-17	Aspen Reproductive Ecology and Genetics	Fish Lake National Forest & Pandoclone	Salina Overlook; Pandoclone; Fish Creek Campground	6:00	17:30	Karen Mock
IC-18	Pinyon Juniper Ecology and Management	Beaver/Southern Utah	Freemont Indian State Park; Cove Fort Pioneer Settlement; Beaver Treatment Zone; Beaver Equipment Demonstration	7:00	19:30	Doug Page
IC-19	Arches National Park (Not Scientific)	Moab	Arches National Park; Moab	6:15	19:00	N/A
IC-20	Capitol Reef National Park (Not Scientific)	Capitol Reef	Capitol Reef National Park	6:30	18:30	N/A
IC-21	Pinyon Juniper Treatment, Mobile Pyrolysis, and the Great Salt Lake Marina	South of Salt Lake City	Great Salt Lake Marina; Stockton Treatment Area; Clover Springs Campground; Pony Express Stop	7:15	16:30	Darren Mcavoy

IC-22	Aspen in Logan Canyon: Historical Impacts and Modern Indicators	Logan Canyon	Forest Service Logan Ranger District Office; Tony Grove; Limber Pine Trail	8:15	18:30	Paul Rogers
IC-23	Forest Assessment, Inventory; and Monitoring	Logan Canyon/Ogden Valley	Tony Grove; Beaver Ski Area; Bear Lake Overlook; Randolph; Monte Cristo Overlook	8:15/9:00	19:15/20:00	John Shaw
IC-25	Forest Health in Northern Utah	Logan Canyon/Bear Lake	Tony Grove Lake; Beaver Ski Area; Bear Lake Overlook; Immigration Pass; Dayton Plantation	6:30	19:15	Barbara Bentz
IC-26	Forest Operations and Management in Northern Utah	Logan Canyon/Bear Lake	Logan Canyon; Bear Lake Overlook; Treatment Areas; Jensen Lumber Company	6:30	16:30	Mike Battaglia
IC-27	American West Heritage Center (Not Scientific)	Logan Canyon	American West Heritage Center	10:00	18:30	N/A

Post-Congress Tours

Organizers worked with a contractor, Western Leisure, to offer two post-Congress sightseeing tours, and the International Wood Culture Society also organized a post-Congress tour. These tours visited national parks in Utah and Wyoming. Delegates were able to purchase seats on these tours through the contractor's website.

DESTINATION	# OF PARTICIPANTS
Yellowstone, Tetons, & Jackson Hole	25
National Parks Spectacular	17
International Wood Culture Society Tour	24

Accompanying Persons/Local Sightseeing Program

There were 83 accompanying persons registered at the Congress. This registration type allowed these accompanying persons to select a day tour, attend the In-Congress tour, and attend the ceremonies and receptions of the Congress.

Organizers contracted with a local company, Western Leisure, to provide accompanying persons program tours. Delegates were also able to purchase tickets for these local sightseeing opportunities.

DESTINATION	# OF PARTICIPANTS
Utah Olympic Park and Park City	34
Antelope Island, Great Salt Lake, & Ogden	63
Great Salt Lake and Salt Lake City	100
Gardens of Salt Lake	31
Snowbird Resort & Tram	48

SPONSORS AND EXPOSITION

Sponsors

Congress organizers and IUFRO are incredibly grateful for our sponsors, who helped make this Congress possible. There were 29 organizations and businesses that sponsored the Congress and an additional 7 who contributed specifically to the IUFRO Special Programme for Development of Capacities.

Diamond Sponsors

esri

Platinum Sponsors

FOREST SERVICE US DEPARTMENT OF AGRICULTURE

USDA Research, Education and Economics

Gold Sponsors

TD

NASA

University of Idaho College of Natural Resources

U.S. DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT

ITTO

Silver Sponsors

OSU Oregon State University

NAUFRP National Association of University Forest Resources Programs Creating Knowledge–Developing Leaders

American Forest Foundation We grow stewardship every day.

CIFOR

BIFOR Birmingham Institute of Forest Research

School of Environmental and Forest Sciences University of Washington College of the Environment

ArborGen

iptim

MB&G Mason, Bruce & Girard, Inc. Natural Resource Consultants Since 1921

International Paper

Sustainable Forestry Initiative

Weyerhaeuser

Bronze Sponsors

ASSOCIATION OF BC FOREST PROFESSIONALS

FFPRI
Forestry and Forest Products Research Institute
Tsukuba, Ibaraki 305-8687, JAPAN

Forest Biometrics Research Institute

GEICO®

forests

THE AMERICAN CHESTNUT FOUNDATION®

UTAH DNR FORESTRY

RMEF 1984 CELEBRATING 30 YEARS 2014
CELEBRATING 30 YEARS OF VOLUNTEERS

ALTA

SPDC Sponsors

CIFOR

FORMIN.FINLAND.FI
MINISTRY FOR FOREIGN AFFAIRS OF FINLAND

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

FOREST SERVICE US DEPARTMENT OF AGRICULTURE

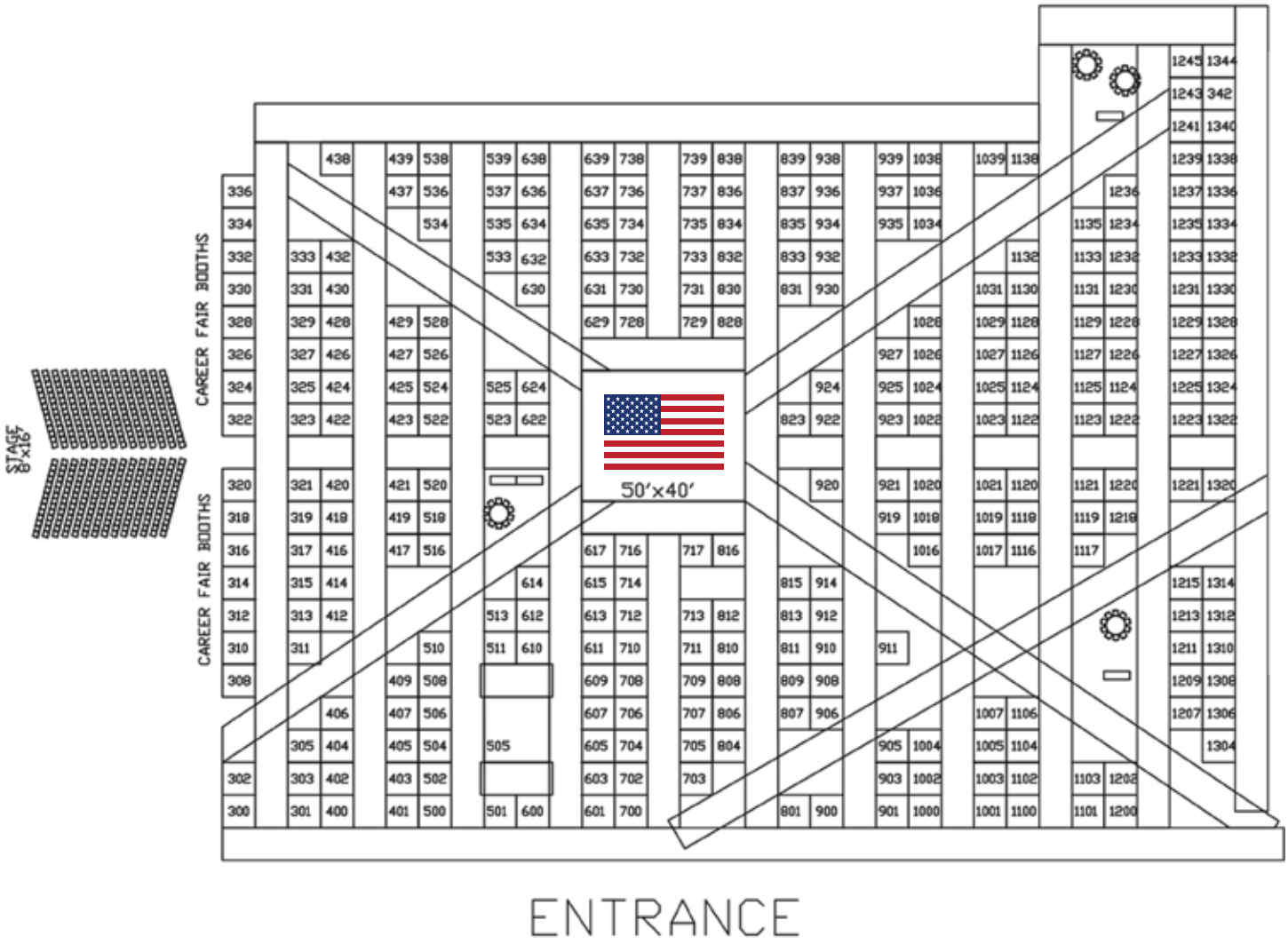
ITTO

lebensministerium.at

KFRI 국립산림과학원 KOREA FOREST RESEARCH INSTITUTE

Trade Exposition

The Trade Exposition, which was held jointly with the Society of American Foresters/Canadian Institute of Forestry, housed 127 different organizations, businesses, universities, and publishers who shared their tools, technologies, products, and information with delegates. The centerpiece of the Hall was the US Forests booth, which was constructed using sustainable materials and showcased wood product technologies and provided a wealth of information on forest issues and innovations in the US There was also a cluster of vendors sharing geospatial information services, anchored by Esri, our Diamond Sponsor. This "neighborhood" was an effective center of learning.



The Expo Hall opened the evening of 8 October and had 127 exhibitors

Delegates talk with exhibitors in the Congress Expo Hall

Delegates at the US Booth in the center of the Expo Hall

Exhibitor Listing

Organization Name	Booth Number(s)
Aervoe Industries, Inc.	412
AllPoints GIS	1221,1320
American Forest Management, Inc.	806
American Forests	406
ArborGen	1120
Arborjet	932
Association of British Columbia Forest Professionals	631
Baton Rouge: 2015 SAF Convention	1122
Ben Meadows	1000,1002
Bioversity International	417
Birmingham Institute of Forest Research	534
Cal Poly State University – NRES	525
Campbell Scientific	516
CATIE/ RIABM	922
Center for International Forestry Research	1103,1202
Chinese Academy of Forestry	901
Colorado State Forest Service	108
Construction Safety Products	414
CSIRO Publishing	612
D.R. Systems, inc.	1117
Decagon Devices, Inc.	501
Designers and Forests	437
Eagle Digital Imaging, Inc.	914
ECI – Environmental Consultants, Inc.	102
Electronic Data Solutions	801
Elsevier BV	712
Esri	807, 809, 811, 813, 900, 906, 908, 910, 912
F4 Tech	810 ,812
Finite Carbon	1211
Foothills Research Institute (FRI)	1123
Forest Biometrics Research Institute	1007
Forest History Society	703
Forest Metrix	905
Forest Practices Board	630

Organization Name	Booth Number(s)
Forest Stewardship Council US	425
Forestry and Forest Products Research Institute/REDD	1104
Forestry Suppliers	601, 700
Future Forests	523
Geographic Business Solutions	815
Globalstar	526
Haglof Sweden	919, 1016
Host Country: United States Forests	1500
Hub International Insurance Brokers	633
International Forestry Students' Association	311, 313, 315
International Tropical Timber Organization	1135
International Wood Culture Society	429, 526, 528
Intertribal Timber Council	924
IUFRO – Special Upcoming Events	1022, 1024,1026
Jiffy	1034
Joint Fire Science Program	1220
Juniper Systems, Inc.	617
Korea Forest Research Institute	923, 925
Korea Forest Service	921
Laser Technology, Inc.	823
LI-COR Biosciences	600
Lim Geomatics, Inc.	808
Mason, Bruce and Girard, Inc.	935
METI, Inc.	401
Michigan Technological University	624
Minnesota Department of Natural Resources	122
Mississippi State University	421
Montreal Process	716
NASA Science Mission Directorate	505, 507, 604, 606
National Association of State Foresters	1018
National Museum of Forest Service History	615
National Wild Turkey Federation	1004
Natural Resources Canada	1023
NCP Coatings, Inc.	520
Nelson Paint Company	920

Organization Name	Booth Number(s)
New Forests: Forest Carbon Partners	1106
NFPA – National Fire Protection Association	713
North Carolina State University	614
North Point Geographic Solutions	709
Northern Arizona University, School of Forestry	528
Omics Publishing Group	1028
Opti-Sciences, Inc.	605, 607
Oregon State University	100, 1215, 1314
Peace Corps	1322
Phos-Chek (ICL Performance Products LP)	816
Plum Creek	120
PP Systems	500
Purdue University	903
RECOFTC – The Center for People and Forests	522
Regional Forest Research Networks (APAFRI, CATIE, FORNESSA, NEAFF)	611
RELASKOP-TECHNIK	702
Remsoft Inc.	804
Routledge / Taylor & Francis	1019, 1021
SAF Foresters' Fund & Science Fund	317, 319, 321, 416, 418, 420
Simosol Oy	717
Society of American Foresters	303, 305, 402 404
Soil Science Society of America	1218
Spectral Evolution	1223
Spectrum Technologies, Inc.	927
Springer	1001, 1003
Stephen F. Austin State University	1100
Sustainable Forestry Initiative, Inc.	1102
Swedish University of Agricultural Sciences	513
Tajfun USA	711
TD Bank Group	323, 422
The Davey Tree Co.	118
The Finnish Forest Research Institute (Metla)	510

Organization Name	Booth Number(s)
Trimble Navigation Ltd.	911, 1010
Union of Concerned Scientists	1213
University of Arkansas at Monticello	1138
University of British Columbia, Faculty of Forestry	629
University of Idaho	1207,1209
University of Maine	533
University of Montana	1222
University of Washington	423
US Department of Agriculture – Research, Education and Economics Mission Area	405, 407, 504, 506
USDA Forest Service – Forest Health Technology Enterprise Team	831
USDA Forest Service – Forest Inventory and Analysis	828
USDA Forest Service – National Library	1017
USDA Forest Service – Remote Sensing Applications Center	830
USDA Forest Service – Research and Development	833, 835
USDI Bureau of Land Management	301, 400
Utah Department of Natural Resources	1029, 1031, 1130, 1128, 1132
Utah State University, Quinney College of Natural Resources	518
Virginia Tech	432
Waveland Press, Inc.	705
WERC	707
West Virginia University	419
Western Aspen Alliance – Utah State University	714
Western Forestry Leadership Coalition	1020
Weyerhaeuser Company	124
World Agroforestry Centre (ICRAF)	1101,1200
World Wood Day Foundation	1116
Yale School of Forestry & Environmental Studies	622

COMMUNICATIONS & MARKETING

A communications subcommittee was formed in July 2012, with representatives from various forest sector organizations (universities, government, nonprofits, IUFRO Secretariat) in the US and abroad.

SUSTAINING FORESTS, SUSTAINING PEOPLE
THE ROLE OF RESEARCH

Rich Guldin, Niels Elers Koch, Jennifer Hayes and Cindy Miner promote the Congress at the IUFRO-FORNESSA Regional Congress in Nairobi, Kenya

Communications & Marketing

Communications and marketing planning began in September 2010, immediately after the International Council awarded the 2014 Congress to the United States. Special emphasis was placed in all the advance work on outreach to a broad Latin American audience.

A communications subcommittee was formed in July 2012, with representatives from various forest sector organizations (universities, government, non profits, IUFRO Secretariat) in the US and abroad. This subcommittee provided feedback to communications initiatives and local community engagement opportunities. In September 2014, the subcommittee transformed itself to focus on on-site activities at the Congress.

Congress Promotion and Information Materials

With the Congress logo and brand finalized, the development of promotion and marketing materials began. Core to these efforts were a large booth that could be used at events and meetings to promote the Congress; print materials that could be distributed at meetings, in mailers, and online; a website that would house all relevant Congress information and serve as a portal to other related websites; and finally, personal attendance at important conferences or meetings of directly related or fringe disciplines to build awareness about IUFRO and the opportunities at the World Congress.

Website

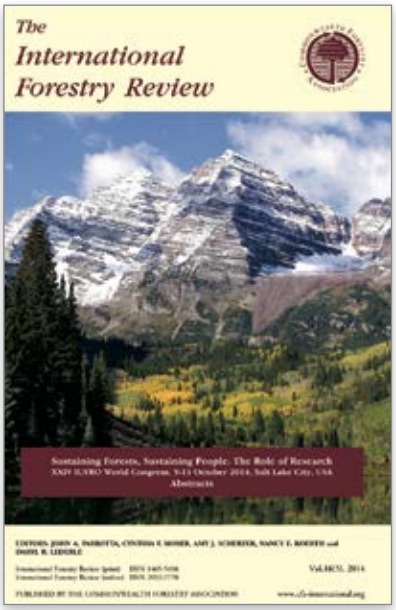
In June 2012, the home page of the website launched at www.iufro2014.com. Additional pages were built out and populated with content from there. Links to the abstract submission site and registration site were provided through the Congress website. The Congress website will remain online and active until October 2015. At that time, relevant information will be transferred to http://www.iufro.org/events/congresses/2014/ for archival purposes.

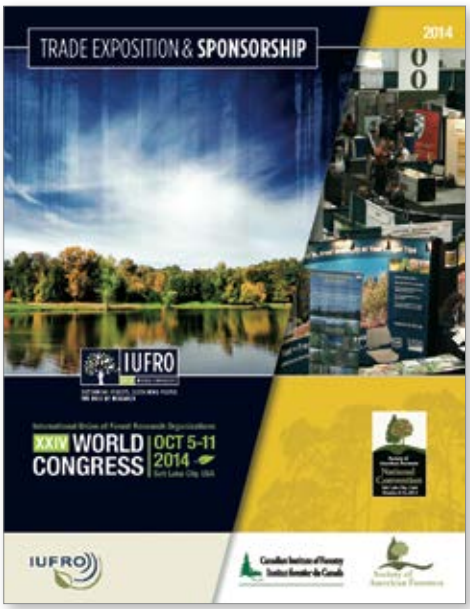
Print Materials

A suite of print materials were produced to support the Congress:

- May 2012: Initial brochure and official save-the-date postcard distributed
- March 2013: First Announcement published and distributed
- June 2013: Trade Exhibition and Sponsorship Book published and distributed
- September 2013: Information and Registration Booklet printed and distributed
- October 2014: Program Book and the International Forestry Review volume containing all the Congress abstracts distributed on-site in the satchels

The First Announcement, Trade Exhibition and Sponsorship Book, Information Book, and Program Book are all available for download on the Congress website in the News and Media section.





Promoting the Congress to a diverse audience was a primary strategic objective of the Congress Organizing Committee.

Promotions and Marketing

Promoting the Congress to a diverse audience was a primary strategic objective of the Congress Organizing Committee. The approach was multifaceted across a temporal scale with different goals and audiences along the way. The approach required both in-person attendance at meetings, presentations to various organizations and groups, purchasing booth space at major conferences, and utilizing print and email information,

In May 2012, two exhibit booths were constructed (one for the organizers and one for the IUFRO Secretariat). In 2013, several banner stands were also produced and circulated. Organizers and Secretariat staff attended many different meetings and conferences, and took the booths or banner stand with them to help promote the Congress.

IUFRO Spotlights

The IUFRO Secretariat worked through the list of Congress sessions and identified topics that they would feature in IUFRO Spotlights. Nine spotlights were produced for the Congress and were promoted through the IUFRO network, social media, and the Congress website. The IUFRO Congress spotlights are available for download here: http://www.iufro.org/publications/iufro-spotlights/.

Social Media

Special attention was devoted to planning for the use of social media – both prior to the Congress to create awareness and encourage registrations and also during the Congress. A social media plan was created to help guide efforts and focus on four key objectives:

- Maximize Congress attendance
- Highlight the importance of forest science and the Congress
- Raise overall awareness about the role of forest research through opportunities provided by the Congress
- Leverage communications during the Congress to encourage growth of an online community with the idea of increasing awareness of and engagement in the IUFRO network after the Congress

Cornerstones of this approach were the use of Facebook, Twitter, and a Congress blog, complemented by other communications activities. In August 2012, the Facebook and Twitter pages for the Congress were officially launched. The early focus of these platforms was to bring awareness to the Congress,

A social media plan was created to help guide efforts and focus on four key objectives:

- Maximize Congress attendance
- Highlight the importance of forest science and the Congress
- Raise overall awareness about the role of forest research through opportunities provided by the Congress
- Leverage communications during the Congress to encourage growth of an online community with the idea of increasing awareness of and engagement in the IUFRO network after the Congress

upcoming opportunities, and major deadlines (abstract submission deadlines, pre-Congress tours, Scientist Assistance Program applications, volunteer opportunities, registration information, highlighting sponsors, side events, etc.). As the Congress grew nearer, the sites began to share stories more focused on science, attendees, the IUFRO Spotlights – a more scientific content focus, to bring awareness to what would be presented at the Congress.

The blog launched in June 2014 and utilized a competition with a cash prize ($500) to entice scientists to write about their work. A total of 35 submissions were received to the blog competition, with one submission disqualified from the competition. During the Congress, generating content through blogs and sharing through the various social media outlets (Facebook, Twitter, YouTube) was truly the foundation for successful outreach, inclusion, and communication efforts. In total, 142 blog posts (67 from Congress writers, 34 from the competition, 14 guest posts, and 26 videos) were made available leading up to and during the Congress featuring a variety of scientific topics. The blog is available at: http://blog.iufro2014.com/.

A Flickr group (https://www.flickr.com/groups/iufro2014) was created to allow participants to share photographs from the Congress easily and a YouTube site (https://www.youtube.com/playlist?list=PLoCgwC3s55P4jHsu4lbsd6wYrR2Z8_rF-) was created to share video proceedings of major Congress events (ceremonies and plenary presentations) and interviews with various scientists during the Congress. A professional journalist completed 16 video interviews for the YouTube site. An app (IUFRO2014) was developed and launched just before the Congress for download from the Apple iTunes and Google Play stores, which provided a wealth of information on the sessions, side events, and included helpful information such as maps. Push notifications were distributed to Congress delegates via the app, which shared updated information about sessions and events.

	DECEMBER 2013	MARCH 2014	OCTOBER 2014
@IUFRO2014 Followers	154	232	542
#IUFRO2014 Tweets	4	17	1,412+
Twitter Followers Reached	2,558	14,860	561,000+
Twitter Impressions	2,722	52,004	3,600,000+
Facebook Likes	475	650	1,644
Facebook Monthly Reach	659	3001	30,769
YouTube Video Views	-	-	3,049
Blog Postings	-	-	142
Blog Views	-	-	72,291

KSL-TV provided in-depth written and television coverage of the Congress

Broadcast and Print Media

Local communication partners were instrumental in leveraging their networks and contacts to increase media interest and coverage. Over 110 reporters from all over the world received IUFRO press materials leading up to and during the Congress. Free registration was offered to appropriately credentialed media.

Interviews were conducted by the Salt Lake Tribune and Deseret News daily newspapers. The Tribune also published a significant editorial in the Sunday, 5 October, edition. All the local network television stations also shot video and did interviews, including KSL-TV, "Primetime Live," ABC 4 Utah, and CBS KUTV2. On Monday morning, 13 October, a five-minute summary of the Congress and its interactions with the local community was broadcast on KSL-TV (http://www.ksl.com/?nid=148&sid=31905604). Traditional print and TV media highlighted forests in our lives and the learning and networking of more than 3,000 researchers, managers, and policy makers from more than 100 countries in Salt Lake City.

Each daily newsletter covered preselected ceremonies, sessions, and special events that were determined to be the most representative cross-section of the event.

Congress Newsletters

Two newsletters were prepared in advance of the Congress to share information with registered delegates about local customs, practical information, helpful links, and more. One newsletter was sent just after the Congress, thanking delegates for their participation, providing important post-Congress wrap-up information, and providing links to information for download and viewing. One additional newsletter will be sent in the spring of 2015 with a link to the Congress report and information on IUFRO, upcoming events, and the 2019 Congress in Curitiba, Brazil. Copies of these newsletters are on the Congress website under the News and Media tab.

Daily newsletters were an important part of the Congress communications plan. Each daily newsletter covered preselected ceremonies, sessions, and special events that were determined to be the most representative cross-section of the event. Digital copies of the newsletter were completed and linked to the IUFRO 2014 website prior to 08:00 each day. A push notification went out through the Congress app as each newsletter was ready for download. Hard copies of the newsletter were produced and distributed at 10:30 each day during the morning refreshment break and as attendees were exiting the morning sessions/events.

Copies of each daily newsletter can be found at this link:
http://iufro2014.com/sub-news/connect-with-us/

Photography

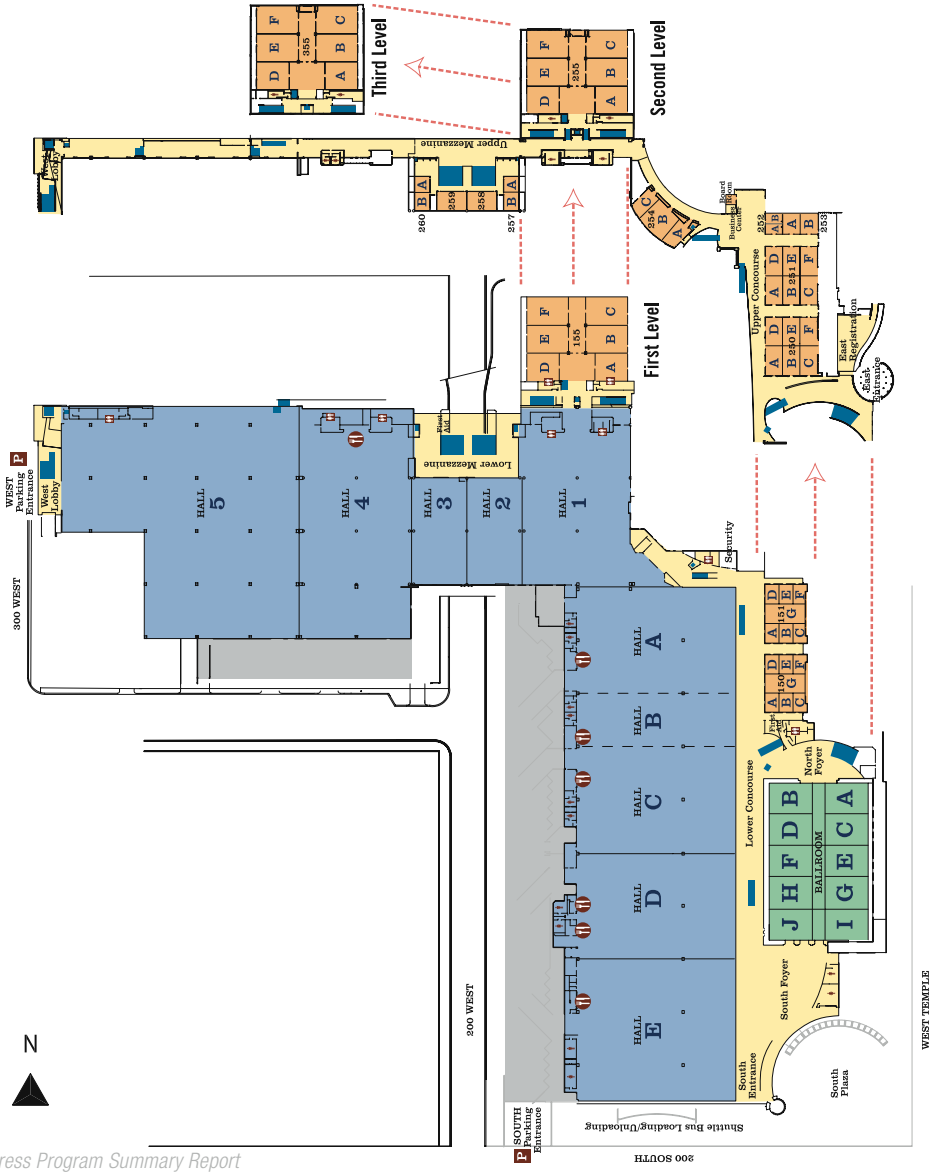
One professional, three volunteer, and four staff photographers captured thousands of images throughout the week. These images were used for the daily newsletter, blog postings, social media, the closing slideshow, this report, and more. IUFRO was provided all of these images, and many of them are also available for public download on Flickr. These photos may be accessed at this link:
https://www.flickr.com/groups/iufro2014

FACILITIES

Facilities

Salt Lake City was selected as the host city for many reasons, including its easily accessible international airport (Delta Airlines' largest western hub), its compact convention district with essential infrastructure, and its close proximity to natural landscapes that could be showcased during the field tours. The city offers numerous lodging and dining options at various price points and has a vibrant downtown area. The Salt Lake Visitor and Convention Bureau was particularly helpful to the Chair of the Congress Organizing Committee in preparing the US bid to host the Congress and in the early organizational stages of the event after the US won the bid.

The Salt Palace Convention Center has a strong commitment to sustainability. It has one of the largest rooftop solar arrays in the United States, is a certified energy-efficient green building, and partners with a caterer that encourages local food purchases and donates leftover food to those in need in the Salt Lake area. The Salt Palace Convention Center has 679,000 square feet of space – 160,000 square feet of meeting room space and 515,000 square feet of exhibit hall space. The Congress and SAF/CIF conventions used every bit of the meeting room space available and 312,000 square feet of exhibit hall space – 62 percent of the total exhibit hall space available. This allowed the COC to fully control the entire building during the Congress, which simplified security.

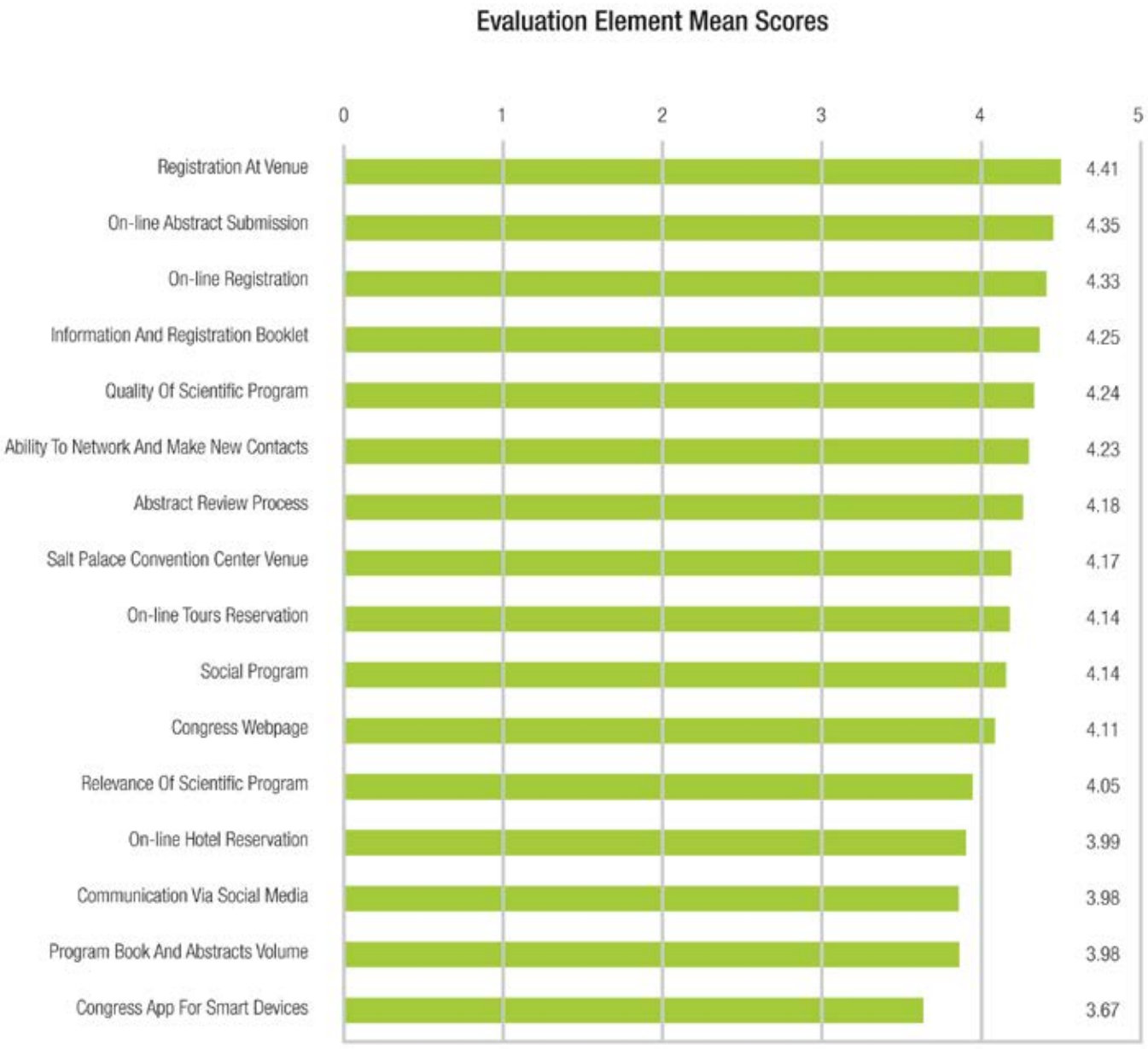


CONGRESS SURVEY

Congress Survey

As in previous IUFRO World Congresses, delegates were sampled to get their views regarding satisfaction with and opinions about the Congress. This information is used by IUFRO to advise future Congress organizers. 204 paper responses and 31 online surveys were submitted.

On the 14 questions that evaluated the quality of the Congress and performance of the organizers on a 0 to 5 scale, the overall mean score was 4.14 out of 5.0, and all means ranged from 3.67 to 4.41.

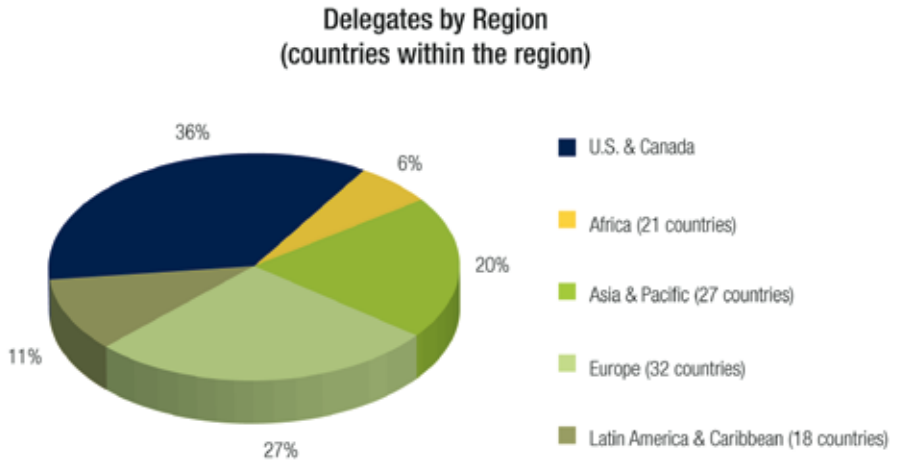


DELEGATE INFORMATION

The final attendance count for the 2014 IUFRO World Congress was 2,492 delegates from 100 countries.

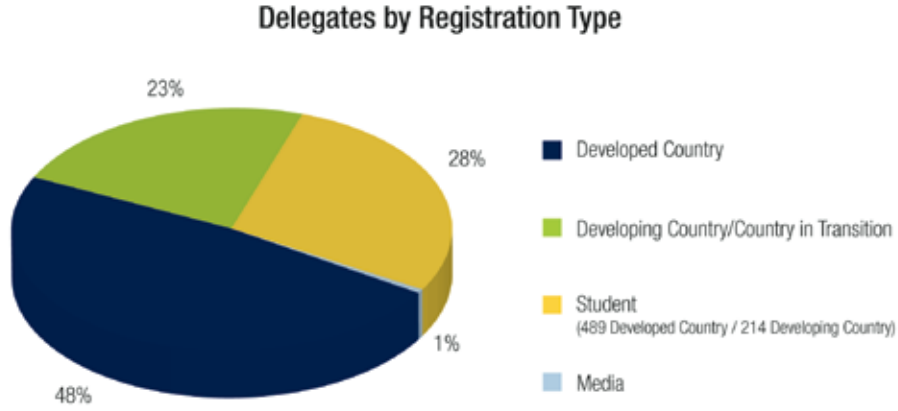
Delegate Information

The final attendance count for the 2014 IUFRO World Congress was 2,492 delegates from 100 countries. Our partners, the Society of American Foresters and the Canadian Institute of Forestry, brought an additional 1,300+ delegates to their co-located meeting, much of which was held jointly with the Congress from Thursday through Saturday. The following demographic graphs show only the IUFRO World Congress delegates and do not include the other co-located event attendees (SAF/CIF) or exhibitor attendees.



The COC put special emphasis on reaching out to potential delegates from Latin America (from Mexico to Chile and Argentina). The Communications Sub-Committee created "save the date" cards in Spanish, and most pages of the Congress website were translated into Spanish. Further, advertisements were placed in newsletters. Organizers received assistance from CATIE, host of the 2013 regional IUFRO Congress for Latin America, in disseminating information about the forthcoming World Congress throughout Latin America. While the CSC set a policy of using English as the language for abstracts, posters, and projected slides, oral presentations could be made in Spanish or other official IUFRO languages. Support staff in the Speaker Ready room were available to assist delegates with translating slides into English.

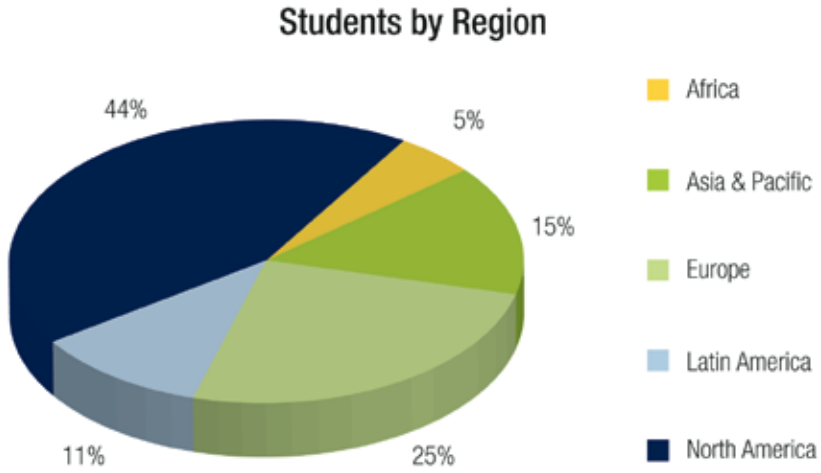
The COC was pleased with the number of delegates attending from developing countries and countries in transition. About 20 percent (121) of the delegates from these countries were supported by the Scientist Assistance Program.



While the COC expected strong student attendance from North American and European institutions, we were quite pleased with the number of students from Latin America, a key outreach region.

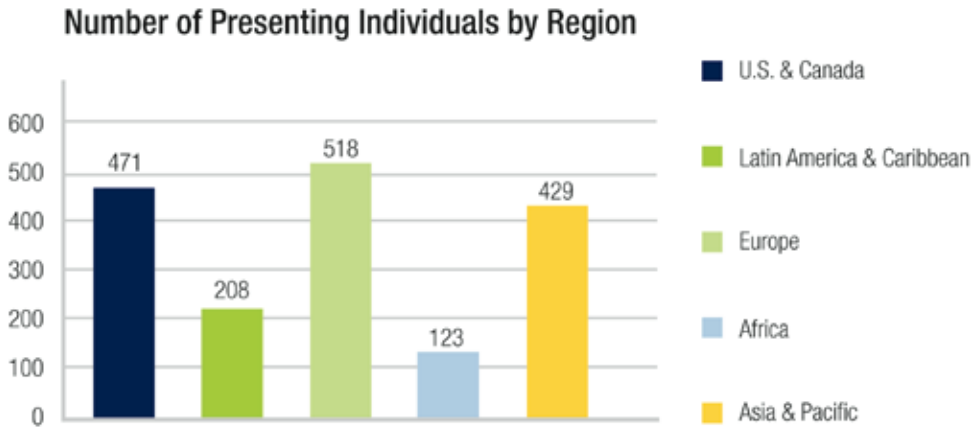
Students

One goal of Congress organizers was to ensure that students were provided opportunities to participate, contribute, and engage with professionals at the Congress. Developing and mentoring the next generation of forest researchers is very important to IUFRO. Discounted registration prices were available to students who could show proof of current enrollment. In addition, the volunteer program offered some students a registration fee refund in exchange for 16 hours of service. The International Forestry Student Association organized a student-to-student networking night and a student-to-professional networking night. In addition, the Society of American Foresters opened up their annual Quiz Bowl to international student teams. The demographic of the 700 student attendees is below.



Presenters

The 1,749 presenters accounted for 70 percent of the total number of IUFRO Congress delegates. This highlights the important role that being a presenter plays in motivating attendance and for many, in obtaining approval or permission from their employer to attend the Congress.



ALBANIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Haki	Kola	CNVP Kosovo	haki.kola_at_cnvp-eu.org
Erjon	Muharremaj	University of Tirana	emuharremaj_at_gmail.com

ARGENTINA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Hector	Bahamonde	National Institute of Agricultural Technology	bahamonde.hector_at_inta.gob.ar
Stella Marys	Bogino	State University of San Luis	stellabogino_at_gmail.com
Sandra Josefina del Valle	Bravo	National University of Santiago del Estero	sandrabrav_at_gmail.com
Juan	Corley	National Institute of Agricultural Technology	elmallin_at_gmail.com
Hugo	Fassola	National Institute of Agricultural Technology	fassola.hugo_at_inta.gob.ar
Maria Elena	Fernandez	National Institute of Agricultural Technology / CONICET	ecologia_forestal_at_yahoo.com.ar
Monica	Gabay	Subsecretaría de Planificación y Política Ambiental	mgabay_at_ambiente.gob.ar
Andres Santiago	Martinez von Ellrichshausen	National Institute of Agricultural Technology / CONICET	andmarv77_at_gmail.com
Clara Maria	Minaverry	University of Buenos Aires / CONICET	cminaverry_at_derecho.uba.ar
Mercedes	Sá	Directorate of Forestry	msa_at_ambiente.gob.ar

AUSTRALIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Mark Andrew	Adams	University of Sydney	agriculture.dean_at_sydney.edu.au
Cristina	Aponte	University of Melbourne	caponte_at_unimelb.edu.au
Stefan	Arndt	University of Melbourne	sarndt_at_unimelb.edu.au
Anthony	Bartlett	Australian Centre for International Agricultural Research (ACIAR)	tony.bartlett_at_aciar.gov.au
David	Brand	New Forests	awright_at_newforests.com.au
Leon	Bren	University of Melbourne	lbren_at_ncable.net.au

Angus	Carnegie	Department of Primary Industries, New South Wales	angus.carnegie_at_dpi.nsw.gov.au
Matthew	Chick	University of Melbourne	mchick_at_student.unimelb.edu.au
Thomas	Fairman	University of Melbourne	thomas.fairman_at_unimelb.edu.au
Melissa	Fedrigo	University of Melbourne	mel.fed_at_gmail.com
Rebecca	Ford	University of Melbourne	fordr_at_unimelb.edu.au
Anne	Griebel	University of Melbourne	agriebel_at_student.unimelb.edu.au
Giles	Hardy	Murdoch University	g.hardy_at_murdoch.edu.au
Richard	Harper	Murdoch University	r.harper_at_murdoch.edu.au
Christopher	Harwood	Commonwealth Scientific and Industrial Research Organisation (CSIRO)	chris.harwood_at_csiro.au
John	Herbohn	University of the Sunshine Coast	jherbohn_at_usc.edu.au
Mark	Hunt	University of Tasmania	m.hunt_at_utas.edu.au
Thu-Ba	Huynh	University of Melbourne	thubahuynh_at_gmail.com
Rodney	Keenan	University of Melbourne	rkeenan_at_unimelb.edu.au
Amelia (Amy)	Koch	Forest Practices Authority	amy.koch_at_fpa.tas.gov.au
Justine	Lacey	Commonwealth Scientific and Industrial Research Organisation (CSIRO)	justine.lacey_at_csiro.au
Christopher	Lafferty	Forest and Wood Products Australia Limited	chris.lafferty_at_fwpa.com.au
Kathryn	Lambert	University of New England	kathryn.ta.lambert_at_gmail.com
Simon	Lawson	Department of Agriculture, Fisheries and Forestry Queensland – Agri-Science Queensland	simon.lawson_at_daff.qld.gov.au
David	Lee	Department of Agriculture, Fisheries and Forestry Queensland – Agri-Science Queensland	david.lee_at_daff.qld.gov.au
Eko	Maiguo	University of Melbourne	emaiguo_at_student.unimelb.edu.au
David	Mannes	Forestry Tasmania	david.mannes_at_forestrytas.com.au
Tek	Maraseni	University of Southern Queensland	tek.maraseni_at_usq.edu.au
Albert Roger	Meder	Commonwealth Scientific and Industrial Research Organisation (CSIRO)	roger.meder_at_csiro.au
Daniel	Mendham	Commonwealth Scientific and Industrial Research Organisation (CSIRO)	daniel.mendham_at_csiro.au
Sharif Ahmed	Mukul	University of Queensland	sharif_a_mukul_at_yahoo.com

Helen	Nahrung	University of the Sunshine Coast	hnahrung_at_usc.edu.au
Craig	Nitschke	University of Melbourne	craign_at_unimelb.edu.au
Geoffrey	Pegg	Department of Agriculture, Fisheries and Forestry Queensland – Agri-Science Queensland	geoff.pegg_at_daff.qld.gov.au
Phil	Polglase	Commonwealth Scientific and Industrial Research Organisation (CSIRO)	philip.polglase_at_csiro.au
Katinka	Ruthrof	Murdoch University	K.Ruthrof_at_murdoch.edu.au
Gregor	Sanders	University of Melbourne	gsanders_at_student.unimelb.edu.au
Stanislaw	Sochacki	Murdoch University	s.sochacki_at_murdoch.edu.au
Emma	Soraya	The Australian National University	emma.soraya_at_anu.edu.au
Ross	Squire		rossandnolasquire_at_gmail.com
Geoff	Stoneman	Department of Parks and Wildlife	geoff.stoneman_at_dpaw.wa.gov.au
Jerome	Vanclay	Southern Cross University	jvanclay_at_scu.edu.au
Helen	Vickers	University of Melbourne	h.vickers2_at_student.unimelb.edu.au
Mingzhu	Wang	Macquarie University	mingzhu.wang_at_students.mq.edu.au
Robert	Waterworth	Australian National University	robert.waterworth_at_anu.edu.au

AUSTRIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Viktor	Bruckman	Commission for Interdisciplinary Ecological Studies of Austrian Academy of Science	Viktor.Bruckman_at_oeaw.ac.at
Alexander	Buck	IUFRO Headquarters	buck_at_iufro.org
Brigitte	Burger	IUFRO Headquarters	burger_at_iufro.org
Sylvia	Fiege	IUFRO Headquarters	sylvia_at_iufro.org
Heinz	Gallaun	Joanneum Research	dig-fer-sek_at_joanneum.at
Thomas	Geburek	Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW)	monika.lotter_at_bfw.gv.at
Douglas	Godbold	University of Natural Resources and Life Sciences (BOKU)	douglas.godbold_at_boku.ac.at
Michael	Grabner	University of Natural Resources and Life Sciences (BOKU)	michael.grabner_at_boku.ac.at

Manfred	Gronalt	University of Natural Resources and Life Sciences (BOKU)	manfred.gronalt_at_boku.ac.at
Hubert	Hasenauer	University of Natural Resources and Life Sciences (BOKU)	hubert.hasenauer_at_boku.ac.at
Peter	Herbst		hp_at_net4you.at
Maria Anna	Huka	University of Natural Resources and Life Sciences (BOKU)	maria.huka_at_boku.ac.at
Florian	Irauschek	University of Natural Resources and Life Sciences (BOKU)	florian.irauschek_at_boku.ac.at
Robert	Jandl	Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW)	robert.jandl_at_bfw.gv.at
Elisabeth	Johann		elisabet.johann_at_aon.at
Georg	Kanz	University of Natural Resources and Life Sciences (BOKU)	georgkanz_at_hotmail.com
Karl	Stampfer	University of Natural Resources and Life Sciences (BOKU)	karl.stampfer_at_boku.ac.at
Klaus	Katzensteiner	University of Natural Resources and Life Sciences (BOKU)	klaus.katzensteiner_at_boku.ac.at
Nikolay	Khabarov	International Institute for Applied Systems Analysis (IIASA)	khabarov_at_iiasa.ac.at
Ramin	Khorchidi	IUFRO Headquarters	khorchidi_at_tele2.at
Margareta	Khorchidi	IUFRO Headquarters	khorchidi_at_iufro.org
Michael	Kleine	IUFRO Headquarters	kleine_at_iufro.org
Heino	Konrad	Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW)	heino.konrad_at_bfw.gv.at
Andrey	Krasovskii	International Institute for Applied Systems Analysis (IIASA)	krasov_at_iiasa.ac.at
Florian	Kraxner	International Institute for Applied Systems Analysis (IIASA)	kraxner_at_iiasa.ac.at
Magdalena	Lackner	International Forestry Students' Association (IFSA)	lena.ifsa_at_gmail.com
Lisa	Lehner	University of Natural Resources and Life Sciences (BOKU)	lisa.lehner_at_boku.ac.at
Manfred J.	Lexer	University of Natural Resources and Life Sciences (BOKU)	mj.lexer_at_boku.ac.at
Antonia	Lindau	International Forestry Students' Association (IFSA)	antonia_lindau_at_gmx.at
Gerhard	Mannsberger	IUFRO Officeholder	gerhard.mannsberger_at_bmlfuw.gv.at
Peter	Mayer	Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW)	direktion_at_bfw.gv.at
Adam	Moreno	University of Natural Resources and Life Sciences (BOKU)	adammoreno_at_live.com

Nina	Mostegl	University of Natural Resources and Life Sciences (BOKU)	nina.mostegl_at_boku.ac.at
Michael	Obersteiner	International Institute for Applied Systems Analysis (IIASA)	oberstei_at_iiasa.ac.at
Mariana da Silva	Pedro	University of Natural Resources and Life Sciences (BOKU)	marianapedro_at_boku.ac.at
Susana	Perez	University of Natural Resources and Life Sciences (BOKU)	susana.perez_at_boku.ac.at
Hugo	Pierre	IUFRO Headquarters	pierre_at_iufro.org
Stephan A.	Pietsch	International Institute for Applied Systems Analysis (IIASA)	pietsch_at_iiasa.ac.at
Ulrike	Pröbstl-Haider	University of Natural Resources and Life Sciences (BOKU)	ulrike.proebstl_at_boku.ac.at
Renate	Prüller	IUFRO Headquarters	prueller_at_iufro.org
Helga	Puelzl	University of Natural Resources and Life Sciences (BOKU)	helga.puelzl_at_boku.ac.at
Peter	Rauch	University of Natural Resources and Life Sciences (BOKU)	peter.rauch_at_boku.ac.at
Tim	Ritter	University of Natural Resources and Life Sciences (BOKU)	tim.ritter_at_boku.ac.at
Gerlinde	Ruthner	Relaskop Technik	relaskop_at_relaskop.at
Eva-Maria	Schimpf	IUFRO Headquarters	schimpf_at_iufro.org
Andreas	Schindlbacher	Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW)	andreas.schindlbacher_at_bfw.gv.at
Martin	Schlaffer	University of Natural Resources and Life Sciences (BOKU)	martin.schlaffer_at_gmx.net
Carmen M.	Schmid	University of Natural Resources and Life Sciences (BOKU)	carmen_schmid_at_gmx.at
Heinrich	Schmutzenhofer	IUFRO Honorary Member	fam.schmutzenhofer_at_chello.at
Silvio	Schueler	Federal Research and Training Centre for Forests, Natural Hazards and Landscape (BFW)	silvio.schueler_at_bfw.gv.at
Rupert	Seidl	University of Natural Resources and Life Sciences (BOKU)	rupert.seidl_at_boku.ac.at
Dmitry	Shchepashchenko	International Institute for Applied Systems Analysis (IIASA)	schepd_at_iiasa.ac.at
Anatoly	Shvidenko	International Institute for Applied Systems Analysis (IIASA)	shvidenk_at_iiasa.ac.at
Astrid	Tippel	IUFRO Headquarters	tippel_at_iufro.org
Harald	Vacik	University of Natural Resources and Life Sciences (BOKU)	harald.vacik_at_boku.ac.at
Gerda	Wolfrum	IUFRO Headquarters	wolfrum_at_iufro.org

Jasmin	Zisch	University of Natural Resources and Life Sciences (BOKU)	geige92_at_gmail.com
Ivana	Živojinovi		ivana.zivojinovic_at_boku.ac.at

BANGLADESH

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
M.	Al Amin	University of Chittagong	prof.alamin_at_yahoo.com
Kazi Kamrul	Islam	Bangladesh Agricultural University, Kyushu University	kamrulbau_at_gmail.com
Mohammed	Mohiuddin	Bangladesh Forest Research Institute	uddinm59_at_gmail.com
Md Mizanur	Rahman	Upazila Nirbahi Officer, Mongla, Bagerhat	mizan_peroj_at_yahoo.com
Md. Nazmus	Sadath	Khulna University and Georg August University	mnsadath_at_yahoo.com

BELGIUM

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Kasso	Dainou	University of Liege, Gembloux Agro-Bio Tech	kdainou_at_ulg.ac.be
Jean-Louis	Doucet	University of Liege, Gembloux Agro-Bio Tech	jldoucet_at_ulg.ac.be
Christine Marie Henriette Jean	Farcy	Universitat Catholique de Louvain	christine.farcy_at_uclouvain.be
Pauline	Gillet	University of Liege, Gembloux Agro-Bio Tech	pgillet_at_ulg.ac.be
Julie	Morin-Rivat	University of Liege, Gembloux Agro-Bio Tech	jmorin_at_doct.ulg.ac.be
Bart	Muys	KU Leuven (University)	bart.muys_at_ees.kuleuven.be
Francois	Ridremont	University of Liege, Gembloux Agro-Bio Tech	francois.ridremont_at_ulg.ac.be

BENIN

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Adeloui Hugues	Akpona	Direction Générale des Forêts et des Ressources Naturelles	akpona_at_gmail.com
Tewogbade Jean Didier	Akpona	Laboratory of Applied Ecology	ajeandidier_at_gmail.com

Emeline Sessi Pelagie	Assede	University of Abomey-Calavi	assedeemeline_at_gmail.com
Achille	Assogbadjo	University of Abomey-Calavi	assogbadjo_at_gmail.com
Chabi Adéyèmi Marc Sylvestre	Djagoun	Laboratory of Applied Ecology	sylvestrechabi_at_gmail.com
Elie	Padonou	University of Abomey-Calavi	padonouelie_at_yahoo.fr
Valère	Salako	Laboratory of Applied Ecology	salakovalere_at_gmail.com
Koupamba Gisèle	Sinasson Sanni	University of Abomey	sinasson.gisele_at_gmail.com
Gbèlidji Fifanou	Vodouhe	Laboratory of Applied Ecology	vodouhefifanou_at_gmail.com

BOLIVIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Huascar	Camacho Mojica	Escuela de Ciencias Forestales/Fundación CONDES / Asociacion de Scouts de Bolivia	huascachoo_at_hotmail.com
Walter Benjamín	Rivera Coria	National Federation of Municipal Governments of Bolivia – FAM Bolivia	riveraw_at_gmail.com
Evelin	Sirpa Espinoza	Universidad Mayor de San Simon	eve.sirpa_at_hotmail.com

BOSNIA AND HERZEGOVINA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Mersudin	Avdibegovic	Faculty of Forestry	mavdibegovic_at_gmail.com

BRAZIL

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Ananda Virginia	Aguiar	Embrapa Forestry	ananda.aguiar_at_embrapa.br
Andréa	Alechandre da Rocha	Federal University of Acre	pzoo.ufac_at_gmail.com
Marcus Vinicius	Alves	Brazilian Forest Service	
Ariel	Andrade	ESALQ/USP	arielandrade_at_usp.br
Claudio	Anholetto	University of São Paulo	claudio.biologia_at_hotmail.com
Joana	Araujo Maria	Brazilian Forest Service	joana.maria_at_florestal.gov.br

Leonardo	Barbosa	Embrapa Forestry	leonardo.r.barbosa_at_embrapa.br
Antonio Carlos	Batista	Federal University of Paraná	batistaFederal University of Paraná_at_gmail.com
Fabricia	Benda de Oliveira	UFES	fabriciabenda_at_gmail.com
Michelliny	Bentes Gama	Embrapa Forestry	michelliny.bentes-gama_at_embrapa.br
Rodolpho	Bernardi		rodolphobernardi_at_gmail.com
Daniela	Biondi Batista	Federal University of Paraná	dbiondi_at_Federal University of Paraná.br
Kelly Tatiana	Bocanegra-Gonzalez	University of Tolima/Federal University of Lavras	kellynda7_7_at_hotmail.com
Carolina	Bozetti Rodrigues	University of São Paulo	cabreuva_at_gmail.com
Alice	Brites	University of São Paulo	alicebrites_at_usp.br
Luiz Marcelo	Brum Rossi	Embrapa	marcelo.rossi_at_embrapa.br
Gabriela	Bueno	University of Massachusetts Boston	gabriela.bueno001_at_umb.edu
Vagner	Camilotti	National Institute for Space Research (INPE)	vagner.camilotti_at_gmail.com
Eliana	Cardoso-Leite	Federal University of San Carlos	cardosoleite_at_yahoo.com.br
Marcelino	Carneiro Guedes	Embrapa Amapá	marcelino.guedes_at_embrapa.br
Silvia Méri	Carvalho	State University of Ponta Grossa	silviameri_at_brturbo.com.br
Vinicius	Castro	University of São Paulo	vresende_at_gmail.com
Caroline	Caum	São Paulo State University	carol_caum_at_hotmail.com
Felipe	Coelho de Souza Petean	University of São Paulo	coelho.petean_at_gmail.com
Ana Paula	Dalla Corte	Federal University of Paraná	anapaulacorte_at_gmail.com
Hassan Camil	David	Federal University of Paraná	hassancamil_at_gmail.com
Luis Carlos	De Freitas	Estate University of Southwest from Bahia	luiscarlos_ufv_at_yahoo.com.br
Cláudio	Del Menezzi	University of Brasília	cmenezzi_at_unb.br
Amy	Duchelle	Center for International Forestry Research (CIFOR)	a.duchelle_at_cgiar.org
Vera	Lex Engel	São Paulo State University	veralex_at_fca.unesp.br
Arlei Luiz	Fachinello	Federal University of Santa Catarina	fachinello_at_hotmail.com
Júlia	Faria	São Paulo State University	j.rdecarvalho_at_hotmail.com
Silvio	Ferraz	University of São Paulo	silvio.ferraz_at_usp.br

Maria das Graças	Ferreira Reis	Federal University of Viçosa	mgfreis_at_ufv.br
Joaquim Bento	de Souza Ferreira Filho	University of São Paulo	jbsferre_at_usp.br
Miguel Luiz Menezes	Freitas	Forestry Institute of São Paulo	miguellmfreitas_at_yahoo.com.br
Marco Andrés	González Carantón	Federal University of Paraná	marcocaranton_at_gmail.com
Raquel	Gonçalves	University of Campinas	raquel_at_agr.unicamp.br
José Leonardo de Moraes	Gonçalves	University of São Paulo	jlmgonca_at_usp.br
Vinicius	Guidotti de Faria	University of São Paulo	viniciusgf_at_usp.br
Eric Bastos	Görgens	University of São Paulo	gorgens_at_usp.br
Rodrigo	Hakamada	University of São Paulo	rodrigo_hakamada_at_yahoo.com.br
Rogério	Hartung Toppa	Federal University of São Carlos – Sorocaba	toppa_at_ufscar.br
Paulo	Hein	Federal University of Lavras	paulo.hein_at_dcf.ufla.br
Vitor Afonso	Hoeflich	Federal University of Paraná	vitor.hoeflich_at_gmail.com
Edson Tadeu	Iede	Embrapa	Cnpf.chgeral_at_embrapa.br
Anadalvo	Juazeiro Dos Santos	Federal University of Paraná	ajsantos.Federal University of Paraná_at_gmail.com
Luis Renato	Junqueira	Forestry Science and Research Institute (IPEF)	renato_at_ipef.br
Thelma	Krug	Fundação de Ciências, Aplicações e Tecnologias Espaciais	thelma_at_dir.iai.int
Andre	Lacerda	Embrapa Forestry	andre.biscaia_at_embrapa.br
Cristiane	Lemos	International Paper	Cristiane.Lemos_at_ipaper.com
José	Lima	Federal University of Lavras	jtlima_at_dcf.ufla.br
Everaldo	Lima Neto	State University of Roraima	everaldo.limaneto_at_gmail.com
Ana Cláudia	Lira-Guedes	Pesquisadora	ana.lira_at_embrapa.br
Manoela	Lopes	Federal University of Rio Grande do Sul	manoelasm_at_gmail.com
Carlos	Machado	Federal University of Vicosa	machado_at_ufv.br
Teresa Cristina	Magro	São Paulo University	teresa.magro_at_usp.br
Yeda Maria	Malheiros de Oliveira	Embrapa	yeda.oliveira_at_embrapa.br
Rafael Gustavo	Mansini Lorensani	State University of Campinas	rafaelmansini_at_hotmail.com
Eduardo	Marques	University of Washington	emarques_at_uw.edu

Leonardo Augusto	Martins	São Paulo State University	leonardoamartins_at_gmail.com
Mayssa	Mascarenhas Grise Monteiro	Federal University of Paraná	mayssamonteiro_at_gmail.com
Patricia	Mattos	Embrapa	patricia.mattos_at_embrapa.br
Lucas	Mazzei	Embrapa Amazônia Oriental	lucas.mazzei_at_embrapa.br
Milton	Meira-Junior	University of Brasilia	milton.serpa_at_gmail.com
Rosemeri	Moro	State University of Ponta Grossa	moro.uepg_at_gmail.com
Fabrícia Menez	Mota	University of Brasilia	fabriciacmm_at_yahoo.com.br
Magali	Nehemy	São Paulo State University	mfurlan_at_lakeheadu.ca
Silvana	Nobre	Atrium Forest Consulting	silvana_at_atriumforest.com
Yann	Nouvellon	CIRAD, UMR Eco&Sols	yann.nouvellon_at_cirad.fr
Adalberto	Novaes	State University from Southern Bahia	adalberto.brito_at_globo.com
Rozimar Campos	Pereira	Federal University of Recôncavo da Bahia	rozimarcp_at_gmail.com
Fernanda	Pieruzzi	Brazilian Forest Service	fernanda.pieruzzi_at_florestal.gov.br
Mariana	Pires Franco	University of São Paulo	marianapfranco_at_usp.br
Ana Milena	Plata Fajardo	Federal University of Paraná	aplatafa_at_gmail.com
Roberto	Porro	Embrapa Eastern Amazon	roberto.porro_at_embrapa.br
Carla	Portugal	OSU	carlamacport_at_hotmail.com
Geraldo Gonçalves dos	Reis	Federal University of Viçosa	greis_at_ufv.br
Ranieri	Ribeiro Paula	University of São Paulo	ranieri_at_usp.br
Carlos Henrique	Rodrigues de Oliveira	IFES – Campus Ibatiba	engcarloshenrique_at_gmail.com
Cintia	Rodrigues de Souza	Embrapa	cintia.souza_at_embrapa.br
Luiz Carlos Estraviz	Rodriguez	University of São Paulo	lcer_at_usp.br
Suzana	Salis	Embrapa Forestry	salis_sm_at_yahoo.com.br
Rita	Sampaio	São Paulo State University	ritacamilasampaio_at_gmail.com
Carla Andrea	Sandoval Rodríguez	University of São Paulo	c.sandoval_at_usp.br
Mateus	Sanquetta	Federal University of Paraná	mateus.sanquetta_at_hotmail.com
Carlos	Sanquetta	Federal University of Paraná	carlos_sanquetta_at_hotmail.com

Ernandes	Saraiva	Federal University of Paraná/Capes	ernandessaraiva_at_gmail.com
José Reinaldo	Silva	Federal University of Lavras	jreinaldo_at_dcf.ufla.br
Renata	Silva-Mann	Sergipe Federal University	renatamann_at_hotmail.com
Amaury Paulo de	Souza	Federal University of Viçosa	amaury_at_ufv.br
Luciano	Souza dos Santos	Jardim Botânico de Salvador	lusozah_at_yahoo.com.br
Paula	Surdi	University of São Paulo	paulasurdi_at_usp.br
Saly	Takeshita	University of São Paulo	takeshita.sa_at_gmail.com
Edivaldo	Thomaz	Universidade Estadual do Centro-Oeste	edi_thomaz_at_yahoo.com.br
Romano	Timofeiczyk Júnior	Federal University of Paraná	romano.timo_at_gmail.com
Marcia	Toffani Simao Soares	Embrapa	marcia.toffani_at_embrapa.br
Mario	Tommasiello Filho	University of São Paulo	mtomazel_at_usp.br
Daniel	Tristao	Brazilian Forest Service	daniel.tristao_at_florestal.gov.br
Paulo	Trugilho	Federal University of Lavras	trugilho_at_dcf.ufla.br
Maurício	Vassali	Federal Rural University of Rio de Janeiro	mauriciovassali_at_gmail.com
Joberto	Veloso de Freitas	Brazilian Forest Service	joberto.freitas_at_florestal.gov.br
Alejandro Danilo	Venegas González	University of São Paulo	avenegas_at_usp.br
Alexander	Vibrans	University of Blumenau	acv_at_furb.br
Maureen	Voigtlaender	Forestry Science and Research Institute (IPEF)	mvoigtlaender_at_gmail.com
Carlos	Wilcken	US Forest Service	cwilcken_at_fca.unesp.br
Marcos Silveira	Wrege	Embrapa	marcos.wrege_at_embrapa.br
Sven	Wunder	Center for International Forestry Research (CIFOR)	s.wunder_at_cgiar.org
Lucia Helena	de Oliveira Wadt	Embrapa Acre	lucia.wadt_at_embrapa.br

BULGARIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Alexander Haralanov	Alexandrov	Bulgarian Academy of Sciences	forestin_at_bas.bg

BURKINA FASO

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Michael Philippe	Bessike Balinga	Center for International Forestry Research (CIFOR)	mpbalinga_at_yahoo.fr
Blandine Marie Ivette	Nacoulma	University of Ouagadougou	nblandine_at_gmail.com
Oumarou	Ouedraogo	University of Ouagadougou	ouedraogoumar_at_yahoo.fr
Amade	Ouedraogo	University of Ouagadougou	o_amade_at_yahoo.fr
Saran	Traoré	Université Polytechnique de Bobo	sarantraore_2003_at_yahoo.fr
Bilasse	Zongo	University of Ouagadougou	azongo_at_hotmail.fr

CAMEROON

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Richard	Eba'a Atyi	Center for International Forestry Research (CIFOR)	r.atyi_at_cgiar.org
Kalame	Fobissie	University of Helsinki	fobissie.kalame_at_helsinki.fi
Verina	Ingram	Wageningen University / CIFOR	verina.ingram_at_wur.nl
Nayang Toukam	Inocent	Batoufam Fundom	nayangtoukam_at_yahoo.fr
Cheteu	Louis Bernard	Institute of Agricultural Research for Development (IRAD)	lbcheteu_at_yahoo.fr
William Armand	Mala	University of Yaounde	williammala_at_yahoo.fr
Nicolas	Picard	Central African Forest Commission (COMIFAC)	nicolas.picard_at_cirad.fr
Nnanga Mebenga	Ruth Laure	University of Douala	nnangaruth_at_yahoo.fr
Emmanuel	Suka	Ministry of Environment, Protection of Nature and Sustainable Development	emmanuelsuka_at_yahoo.com
Anne Marie	Tiani Epouse Amougou Akoa	Center for International Forestry Research (CIFOR)	a.tiani_at_cgiar.org
Martin	Yemefack	IITA Cameroon	myemefack_at_yahoo.fr

CANADA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Alexis	Achim	Laval University	alexis.achim_at_sbf.ulaval.ca

Shalom Daniel	Addo-Danso	University of British Columbia	shalomdanso_at_hotmail.com
Suborna Shekhor	Ahmed	University of British Columbia	suborna_at_alumni.ubc.ca
Sally	Aitken	University of British Columbia	Sally.Aitken_at_ubc.ca
Oluwabunmi	Akande	University of Alberta	oluwabun_at_ualberta.ca
Charles	Alderson	Lakehead University	cralders_at_lakeheadu.ca
Jared	Amos	University of Alberta	jamos_at_ualberta.ca
Andre	Arsenault	Canadian Forest Service	Andre.J.Arsenault_at_NRCan-RNCan.gc.ca
François	Beaulieu		fbeaulieu4_at_hotmail.com
Aaron	Bell	University of Alberta	ajbell_at_ualberta.ca
Jordan	Benner	Simon Fraser University	jpb7_at_sfu.ca
Anne	Bernard	Laval University	Anne.Bernard.1_at_ulaval.ca
Pierre	Bernier	Canadian Forest Service	pbernier_at_rncan.gc.ca
Felix	Boeck	University of British Columbia/MIT	felix.boeck_at_alumnia.ubc.ca
Joerg	Bohlmann	University of British Columbia	bohlmann_at_msl.ubc.ca
Michael	Brienesse	Ontario Ministry of Natural Resources	mike.brienesse_at_ontario.ca
Steven R.	Brouwer	Lakehead University	srbrouwe_at_lakeheadu.ca
Robert	Burt	IUFRO Headquarters	bburt3_at_cogeco.ca
Philip	Burton	University of Northern British Columbia	phil.burton_at_unbc.ca
Clara	Canac-Marquis		clara.cmarquis_at_gmail.com
Jean-Noel	Candau	Canadian Forest Service	Jean-Noel.Candau_at_nrcan.gc.ca
Allan	Carroll	University of British Columbia	allan.carroll_at_ubc.ca
Constance	Chan	University of British Columbia	cnstance_at_gmail.com
Ajith	Chandran	University of British Columbia	ajith.chandran_at_alumni.ubc.ca
Marcus J.	Chatelain	Lakehead University	michaetel_at_lakeheadu.ca
Virginia	Chavez Varela	Alberta Innovates Bio Solutions	virginia.chavez_at_albertainnovates.ca
Baozhang	Chen	University of British Columbia	baozhang.chen_at_ubc.ca
Michael	Cliche	Laval University	michael.cliche.2_at_ulaval.ca
David	Cohen	University of British Columbia	david.cohen_at_ubc.ca

David	Colville	Applied Geomatics Research Group, NSCC	David.Colville_at_nscc.ca
Philip	Comeau	University of Alberta	phil.comeau_at_ualberta.ca
Barry	Cooke	Canadian Forest Service	bcooke_at_nrcan.gc.ca
Edward	Czerwinski	University of New Brunswick	Ed.czerwin_at_unb.ca
Louis	De Grandpre	Natural Resources Canada	louis.degrandpre_at_nrcan-rncan.gc.ca
William	de Groot	Canadian Forest Service	bill.degroot_at_nrcan.gc.ca
Robert Jon	Deady	University of Quebec – Montreal	mycetophilid_at_gmail.com
Vincent	Del Bel Belluz	University of Alberta	vbelluz_at_gmail.com
John	Diiwu	Alberta Sustainable Resource Development	john.diiwu_at_gov.ab.ca
Carl	Douglas	University of British Columbia	carl.douglas_at_ubc.ca
Julie	Edwards	Lakehead University	jedward2_at_lakeheadu.ca
Felicitas	Egunyu	University of Saskatchewan	felicitas.egunyu_at_usask.ca
Yousry	El-Kassaby	University of British Columbia	y.el-kassaby_at_ubc.ca
Benjamin P.	Elliott	Lakehead University	bpelliot_at_lakeheadu.ca
Bianca	Eskelson	University of British Columbia	bianca.eskelson_at_ubc.ca
David	Fell	FPInnovations	David.fell_at_fpinnovations.ca
Cosmin	Filipescu	Canadian Forest Service	cosmin.filipescu_at_nrcan.gc.ca
Mike	Flannigan	University of Alberta	mike.flannigan_at_ualberta.ca
Robert	Fleming	Canadian Forest Service	rob.fleming_at_nrcan.gc.ca
Emily B.	Franz	Lakehead University	ebfranz_at_lakeheadu.ca
Chad	Gardeski	FPInnovations	chad.gardeski_at_fpinnovations.ca
Nicola	Gilbert	IFSA	sno_reason_at_inorbit.com
Jean-François	Gingras	FPInnovations	jean-francois.gingras_at_fpinnovations.ca
Denise	Golden	Lakehead University	dmgolden_at_lakeheadu.ca
Kelsey	Googel	Wildfire Management Branch British Columbia	Kelsey.l.winter_at_gmail.com
Neil	Graham	Lakehead University	ngraham_at_lakeheadu.ca
Laura	Gray	University of Alberta	lkgray_at_ualberta.ca
David	Greenberg	Commission for Environmental Cooperation	david.greenberg_at_lifesci.ucsb.edu

Kenneth	Greenway	Government of Alberta, Ministry of Environment and Sustainable Resource Development	ken.greenway_at_gov.ab.ca
Dayna N.	Griffiths	Lakehead University	dngrifi_at_lakeheadu.ca
Arthur	Groot	Canadian Forest Service	agroot_at_nrcan.gc.ca
Wolfgang	Haider	Simon Fraser University	whaider_at_sfu.ca
Reem	Hajjar	University of British Columbia	reem.hajjar_at_gmail.com
James	Halperin	University of British Columbia	j.halperin_at_alumni.ubc.ca
Caroline	Hamelin	University of Regina	hamelinc_at_uregina.ca
Richard	Hamelin	University of British Columbia	richard.hamelin_at_ubc.ca
Xiao	Han	University of Toronto	hanxiao2002_at_hotmail.com
Lisa	Hansen	University of British Columbia	hansen.lisa.c_at_gmail.com
Howie	Harshaw	University of Alberta	harshaw_at_ualberta.ca
Thora	Herrmann	University of Montreal	thora.martina.herrmann_at_umontreal.ca
Gordon	Hickey	McGill University	gordon.hickey_at_mcgill.ca
Keegan	Hofmann	International Forestry Students' Association (IFSA)	Keegan.hofmann_at_gmail.com
Krish	Homagain	Lakehead University	khomagai_at_lakeheadu.ca
Ngaio	Hotte	University of British Columbia	n.hotte_at_fisheries.ubc.ca
Kebiao	Huang	APFNet	huang_kebiao_at_apfnet.cn
Michael	Huck	IUFRO-GFIS	huck_at_iufro.org
John	Innes	University of British Columbia	john.innes_at_ubc.ca
Mark	Johnston	Saskatchewan Research Council	johnston_at_src.sk.ca
Dean	Johnston	Alberta Sustainable Resource Development	dean.johnston_at_gov.ab.ca
Shashi	Kant	University of Toronto	shashi.kant_at_utoronto.ca
Darrell	Kentner	Alberta Sustainable Resource Development	darrell.kentner_at_gov.ab.ca
In-Ae	Kim	University of British Columbia	inae.kim_at_alumni.ubc.ca
Nicole	Klenk	University of Toronto	nicole.klenk_at_utoronto.ca
Wyatt	Klopp	University of Northern British Columbia	wsklopp_at_gmail.com
Jennifer	Klutsch	University of Alberta	klutsch_at_ualberta.ca

Joshua C.	Knight	Lakehead University	jcknight_at_lakeheadu.ca
Robert	Kozak	University of British Columbia	rob.kozak_at_ubc.ca
David	Kreutzweiser	Canadian Forest Service	dave.kreutzweiser_at_nrcan.gc.ca
Mark	Kube	Alberta Sustainable Resource Development	mark.kube_at_gov.ab.ca
Werner	Kurz	Canadian Forest Service	werner.kurz_at_nrcan.gc.ca
Claudio	La Rocca	University of Alberta	larocca_at_ualberta.ca
Valerie	LeMay	University of British Columbia	Valerie.LeMay_at_ubc.ca
Luc	Lebel	Canadian Forest Service	luc.lebel_at_sbf.ulaval.ca
Jacinthe	Leclerc	Lakehead University	jacinthe.leclerc_at_rncan.gc.ca
Henri	Leclipteux	Lakehead University	hleclipt_at_lakeheadu.ca
Seung-Il	Lee	University of Alberta	seungil1_at_ualberta.ca
Graham	Legaarden	Alberta Environment and Sustainable Resource Development	graham.legaarden_at_gov.ab.ca
Mitchell J.	Legros	Lakehead University	mjlegros_at_lakeheadu.ca
Mathew	Leitch	Lakehead University	mathew_at_lakeheadu.ca
Christopher K.	Leitch	Lakehead University	ckleitch_at_lakeheadu.ca
Rebecca	Letkeman	Lakehead University	rletkema_at_lakehadu.ca
Brian	Leung	McGill University	brian.leung2_at_mcgill.ca
Abigail	Lewis	International Forestry Students' Association (IFSA)	alewis_at_unbc.ca
Qinglin	Li	Ministry of Forests, Lands, and Natural Resource Operations	Qinglin.Li_at_gov.bc.ca
Kyle	Lochhead	University of British Columbia	kyle.lochhead_at_live.forestry.ubc.ca
Ian	MacLachlan	University of British Columbia	ianrmaclachlan_at_gmail.com
Casey	Macaulay	Association of BC Forest Professionals	info_at_abcfp.ca
Alvaro	Madero Marquez	University of British Columbia	alvaromm.0530_at_gmail.com
Lal	Mahalle	FPInnovations	lal.mahalle_at_fpinnovations.ca
Alexander A.	Marcantonio	Lakehead University	aamarcan_at_lakeheadu.ca
Peter	Marshall	University of British Columbia	peter.marshall_at_ubc.ca
Brian	Marshall	Lakehead University	bmarsha3_at_lakeheadu.ca

Melanie J.	McCavour	Concordia University / University of Quebec – Montreal	mccavour_at_gmail.com
Ryan	Miles	Lakehead University	rmiles_at_lakeheadu.ca
Nicholas	Millward	Lakehead University	nmillwar_at_lakeheadu.ca
Stephen	Mitchell	University of British Columbia	stephen.mitchell_at_ubc.ca
Dan	Moore	University of British Columbia	dan.moore_at_ubc.ca
David	Morris	Ontario Ministry of Natural Resources	Dave.M.Morris_at_ontario.ca
Ian	Moss	University of British Columbia	forestree_at_shaw.ca
Harry	Nelson	University of British Columbia	harry.nelson_at_ubc.ca
Sonya	Odsen	University of Alberta	odsen_at_ualberta.ca
Rajat	Panwar	University of British Columbia	rajat.panwar_at_ubc.ca
David	Pare	Natural Resources Canada	dpare_at_rncan.gc.ca
Shyam	Paudel	University of British Columbia	shyam.paudel_at_gmail.com
Gaetan	Pelletier	Northern Hardwoods Research Institute	gaetan.pelletier_at_umoncton.ca
Jaime Hernando	Pinzon Cortes	University of Alberta	jpinzon_at_ualberta.ca
Tyler T.	Power	Lakehead University	ttpower_at_lakeheadu.ca
Cindy	Prescott	University of British Columbia	cindy.prescott_at_ubc.ca
Camille	Proulx	Laval University	camille.proulx.3_at_ulaval.ca
Deepa	Pureswaran	Canadian Forest Service	dpureswa_at_nrcan.gc.ca
Om	Rajora	University of New Brunswick	Om.Rajora_at_unb.ca
Ana Elia	Ramon Hidalgo	University of British Columbia	anaelia_at_interchange.ubc.ca
Tod	Ramsfield	Canadian Forest Service	tod.ramsfield_at_NRCan-RNCan.gc.ca
Jeremy	Rayner	University of Saskatchewan	jeremy.rayner_at_usask.ca
Maureen	Reed	University of Saskatchewan	m.reed_at_usask.ca
Anya	Reid	University of British Columbia	anyamartinareid_at_gmail.com
Douglas	Reid	CNFER	doug.reid_at_ontario.ca
Jeff	Renton	Agroforestry and Woodlot Extension Society	j.renton_at_awes-ab.ca
Gabrielle	Rivard	Laval University	rivardgabrielle8_at_gmail.com

David	Roberts	University of Alberta	drr3_at_ualberta.ca
Brian	Robinson	Association of BC Forest Professionals	brobinson_at_abcfp.ca
Flor de Maria	Robles Barreto	Laval University	flor-de-maria.robles.1_at_ulaval.ca
Georgina	Rodriguez	Laval University	gereroba_at_gmail.com
Jens	Roland	University of Alberta	jroland_at_ualberta.ca
Silvia	Ronzani	University of Alberta	ronzani_at_ualberta.ca
Tara L.	Rooney	Lakehead University	tlrooney_at_lakeheadu.ca
Olivia	Sanchez Badini	University of British Columbia	olivia.sanchez_at_alumni.ubc.ca
Niall C.	Scarr	Lakehead University	ncscarr_at_lakehadu.ca
Caitlin P.	Scheliga	Lakehead University	cpscheli_at_lakeheadu.ca
David C.	Scott	Lakehead University	dcscott_at_lakeheadu.ca
Chander	Shahi	Lakehead University	chander.shahi_at_lakeheadu.ca
Gail	Sherson	FPInnovations	gail.sherson_at_fpinnovations.ca
Vanessa	Silva Mascorro	University of British Columbia	vanessa.mascorro_at_alumni.ubc.ca
Monika	Singh	University of British Columbia	monika.singh_at_alumni.ubc.ca
William	Smirle	South Nation River Conservation Authority	dmacmillan_at_nation.on.ca
Guy Kinsey Morgan	Smith	Canadian Forest Service	guy.smith_at_nrcan.gc.ca
Nick	Smith	University of British Columbia	nick.smith_at_shaw.ca
Charles	Smith	University of Toronto	tat.smith_at_utoronto.ca
Michel	Soucy	University of Moncton	michel.soucy_at_umoncton.ca
John R.	Spence	University of Alberta	john.spence_at_ualberta.ca
Jacob	Stadt	Alberta Sustainable Resource Development	john.stadt_at_gov.ab.ca
Teresa	Stokes	Alberta Environment and Sustainable Resource Development	tstokes51_at_shaw.ca
Crisia	Tabacaru	University of Alberta	tabacaru_at_ualberta.ca
May Anne	Then	International Forestry Students' Association (IFSA)	t.mayanne_at_gmail.com
Ian	Thompson	Canadian Forest Service	ian.thompson_at_nrcan.gc.ca
Brian	Titus	Canadian Forest Service	Brian.Titus_at_NRCan-RNCan.gc.ca

Dustin	Tizzard	Bamboo Innovations	dustin_at_dead-bolt.ca
JoDana Marie	Tokamp	Bamboo Innovations	info_at_bamboo-innovations.ca
Tessie	Tong	FPInnovations	Tessie.Tong_at_FPInnovations.ca
Randal	Trerise	Association of BC Forest Professionals	whalaszcorless_at_abcfp.ca
Benoît	Trépanier	Laval University	trepaben_at_gmail.com
Andrea	Vasquez Fernandez	University of British Columbia	ecomundo.andrea_at_gmail.com
Guangyu	Wang	University of British Columba	guangyu.wang_at_ubc.ca
Tongli	Wang	University of British Columbia	tongli.wang_at_ubc.ca
Danielle	Way	University of Western Ontario	dway4_at_uwo.ca
Xiaohua	Wei	University of British Columbia	adam.wei_at_ubc.ca
Sarah	Welter	University of Saskatchewan	srw099_at_mail.usask.ca
Barry	White	Government of Alberta	barry.white_at_gov.ab.ca
Timothy	Work	University of Quebec – Montreal	work.timothy_at_uqam.ca
Linhao	Wu	University of Alberta	linhao1_at_ualberta.ca
Stephen	Wyatt	University of Moncton	swyatt_at_umce.ca
Jewel Irene	Yurkewich	Erasmus Mundus MSc European Forestry	jewel_yurkewich_at_hotmail.com
Svetlana	Zeran	Lakehead University	szeran_at_lakeheadu.ca
Cody	Zurkuhl	Lakehead University	czurkuhl_at_lakeheadu.ca

CHILE

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Rodrigo	Ahumada	Bioforest S.A.	rodrigo.ahumada_at_arauco.cl
Adison	Altamirano	Universidad de La Frontera	adison.altamirano_at_ufrontera.cl
Elias	Apud	University of Concepcion	eapud_at_udec.cl
Carlos	Bahamondez	Instituto Forestal de Chile	cbahamon_at_infor.cl
Jan	Bannister	Instituto Forestal de Chile	janlija_at_yahoo.com
Santiago	Barros	Instituto Forestal de Chile	sbarros_at_infor.cl

Susana	Benedetti	Instituto Forestal de Chile	sbenedet_at_infor.cl
Francis	Dube	Universidad de Chile	fdube_at_udec.cl
Sergio	Espinoza	Universidad Católica del Maule	espinoza_at_ucm.cl
Hans	Grosse	Instituto Forestal de Chile	hagrosse_at_infor.cl
Jose	Hernandez	Agricultural Research Institute	jose.hernandez_at_inia.cl
Esteban	Onate	University of Concepcion	estebanonate_at_udec.cl
José	Pico Mendoza		josepicomn_at_hotmail.com
Juan Carlos	Valencia	Forestal Mininco	jvalenciab_at_forestal.cmpc.cl

CHINA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Yukun	Cao	Northeast Forestry University	cyklk_at_163.com
Yuan	Chai	Beijing Forestry University	chinacacy_at_163.com
Ruihai	Chai	Northeast Forestry University	relayjfr_at_gmail.com
Lixin	Chen	Beijing Forestry University	myclover17_at_gmail.com
Ruimei	Cheng	Chinese Academy of Forestry	chengrm_at_caf.ac.cn
Wang	Chengyi		wcy758_at_163.com
Fuxiang	Chu	Chinese Academy of Forestry	chufuxiang_at_caf.ac.cn
Limin	Dai	Chinese Academy of Sciences	lmdai_at_iae.ac.cn
Xu	Daping	Chinese Academy of Forestry	gzfsrd_at_163.com
Yi	Ding	Chinese Academy of Forestry	ydingcaf_at_gmail.com
Jiayun	Dong	Fujian Agriculture and Forestry University	dsz.djy_at_163.com
Zhaozhong	Feng	Chinese Academy of Sciences	fzz_at_rcees.ac.cn
Jinhe	Fu	International Network for Bamboo and Rattan	jfu_at_inbar.int
Yuhang	Ge	Chinese Academy of Forestry	geyuhangcaf_at_126.com
Lan	Gong	Beijing Forestry University	lan.gong86_at_gmail.com
Huiyan	Gu	Northeast Forestry University	ghuiyan_at_nefu.edu.cn
Dali	Guo	Chinese Academy of Sciences	guodl_at_igsnrr.ac.cn

Xingyuan	He	Chinese Academy of Sciences	hexingyuan_at_iga.ac.cn
Youjun	He	Chinese Academy of Forestry	hyjun163_at_163.com
Yuanhui	Hu	Chinese Academy of Forestry	huyuanhui_at_hotmail.com
Jianchun	Jiang	Industry of Forest Products (ICIFP)	lexu1023_at_163.com
Chang Jie	Jin	Chinese Academy of Sciences	cjjin_at_iae.ac.cn
Fanhua	Kong	Nanjing University	Fanhuakong_at_163.com
Zhe	Kong	APFNet	kong_zhe_at_apfnet.cn
Jingping	Lei	Chinese Academy of Forestry	leijp_at_caf.ac.cn
Huiyu	Li		lihuiyu0519_at_aliyun.com
Fengbo	Li	International Center for Bamboo and Rattan	icbr.info_at_gmail.com
Xiaogang	Li		xiaogang841025_at_yahoo.co.jp
Xin	Li	Shanghai Ocean University	Xinli_at_shou.edu.cn
Zhiqiang	Li	International Center for Bamboo and Rattan	lizq_at_icbr.ac.cn
Zhiyong	Li	International Center for Bamboo and Rattan	zyli_at_inbar.int
Ming	Liang	Renmin University of China	alexliang2_at_126.com
Yuechen	Liang	Northeast Forestry University	3262526_at_qq.com
Yingchun	Liao	Chinese Academy of Sciences	liaoyingc_at_163.com
Shirong	Liu	Chinese Academy of Forestry	liusr9311_at_163.com
Wei	Liu	APFNet	liu_wei_at_apfnet.cn
Wenfei	Liu	Nanchang Institute of Technology/Jiangxi Agricultural University	liuwf729_at_126.com
Yuan-qiu	Liu	Jiangxi Agricultural University	liuyq404_at_163.com
Zhouli	Liu	Chinese Academy of Sciences	forestry83_at_gmail.com
Hexing	Long	Renmin University of China	longhx1986_at_163.com
Mengzhu	Lu	Chinese Academy of Forestry	lumz_at_caf.ac.cn
Wenming	Lu	Chinese Academy of Forestry	luwenmingcaf_at_126.com
Yaofeng	Luo	Northwest A&F University	lyfcl_at_163.com
Yong	Pang	Chinese Academy of Forestry	pangy_at_ifrit.ac.cn

He	Shang	Chinese Academy of Forestry	shanghechina_at_126.com
Liming	Shen	Nanjing Forestry University of China	shenlimingda_at_hotmail.com
Keyin	Sheng	Jiangxi Agricultural University	skyjxau_at_163.com
Zuomin	Shi	Chinese Academy of Forestry	shizm_at_caf.ac.cn
Jinling	Su	International Wood Culture Society	sujinling_at_iwcs.com
Hailong	Sun	Northeast Forestry University	hailong12_at_gmail.com
Jianghua	Sun	Chinese Academy of Sciences	sunjh_at_ioz.ac.cn
Pengsen	Sun	Chinese Academy of Forestry	sunpengsen_at_gmail.com
Zhong	Tang	Renmin University of China	tangzhong_at_ruc.edu.cn
Chengyue	Tu	Renmin University of China	411933630_at_qq.com
Shuping	Tu	Jiangxi Agricultural University	tspjxau_at_163.com
Hui	Wang	Chinese Academy of Forestry	whui1919_at_gmail.com
Huimin	Wang	Chinese Academy of Sciences	wanghm_at_igsnrr.ac.cn
Wenjie	Wang	Chinese Academy of Sciences	wangwenjie_at_iga.ac.cn
Xiaoke	Wang	Chinese Academy of Sciences	wangxk_at_rcees.ac.cn
Xiaoyi	Wang	Chinese Academy of Forestry	xywang_at_caf.ac.cn
Yanhui	Wang	Chinese Academy of Forestry	wangyh_at_caf.ac.cn
Zuomin	Wen	Nanjing Forestry University	zmwen_at_njfu.edu.cn
Junqi	Wu	International Network for Bamboo and Rattan (INBAR)	jqwu_at_inbar.int
Wenfa	Xiao	Chinese Academy of Forestry	chengrm_at_yeah.net
Yongqun	Xie	Fujian Agriculture and Forestry University	fjxieyq_at_hotmail.com
Ying	Xin	Northeast Forestry University	xinying2004_at_126.com
Chengyang	Xu	Beijing Forestry University	xuchybl_at_sina.com
Jianfeng	Xu	Chinese Academy of Forestry	xujianfeng198216_at_aliyun.com
Huidan	Xue	Chinese Academy of Forestry	xuehuidanlinlin_at_126.com
Wang	Xuequan	Chinese Academy of Forestry	wxq_at_caf.ac.cn
Hang	Xun	International Centre for Bamboo and Ratan	xunhang_at_icbr.ac.cn

Qiaoling	Yan	Chinese Academy of Sciences	qlyan_at_iae.ac.cn
Jian	Yang	Chinese Academy of Sciences	yangjian_at_iae.ac.cn
Jun	Yang	Tsinghua University	larix001_at_gmail.com
Wenbin	Yang	Chinese Academy of Forestry	hzdang_at_sina.com
Bing	Ye	Chinese Academy of Forestry	yb70_at_caf.ac.cn
Yafang	Yin	Chinese Academy of Forestry	yafang_at_caf.ac.cn
Yan	Yu	International Center for Bamboo and Rattan	yuyan9812_at_icbr.ac.cn
Juanwen	Yuan	Guizhou University of Finance and Economics	yuanjuanwen_at_yahoo.com
Meng	Yuan	Renmin University of China	foreverjane2006_at_126.com
Fansuo	Zeng	Northeast Forestry University	zengfansuo_at_126.com
Yuan	Zeng	Chinese Academy of Sciences	yuanz_at_irsa.ac.cn
Yaguang	Zhan	Northeast Forestry University	yaguangzhan_at_126.com
Decheng	Zhang	Chinese Academy of Forestry	zdc_at_caf.ac.cn
Minghui	Zhang	Renmin University of China	cathy_minghuizhang_at_163.com
Shougong	Zhang	Beijing Forestry University	shougong.zhang_at_caf.ac.cn
Yiwen	Zhang	Renmin University of China	zhangyiwen_at_ruc.edu.cn
Yuandong	Zhang	Chinese Academy of Forestry	zyd_at_caf.ac.cn
Fengjun	Zhao	Chinese Academy of Forestry	zhaofengjun1219_at_163.com
Guoyi	Zhou	South China Botanical Garden, Chinese Academy of Sciences	gyzhou_at_scib.ac.cn
Li	Zhou	Chinese Academy of Sciences	zhouli930_at_163.com
Ping	Zhou	Guangdong Academy of Forestry	zhoupinger_at_sinogaf.cn
Xudong	Zhou	FuturaGene Ltd.	david_at_futuragene.com
Daoguang	Zhu	Northeast Forestry University	zhudg01_at_163.com
Hongge	Zhu	Northeast Forestry University	none_at_163.com
Jiaojun	Zhu	Chinese Academy of Sciences	jiaojunzhu_at_iae.ac.cn
Renying	Zhuo		zhuory_at_gmail.com

CHINA - TAIPEI

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Feng-Cheng	Chang	National Taiwan University	fcchang_at_ntu.edu.tw
Tzu-Cheng	Chang	National Taiwan University	d00625001_at_ntu.edu.tw
Chaur-Tzuhn	Chen	National Pingtung University of Science and Technology	cct_at_mail.npust.edu.tw
Ying-Ju	Chen	National Taiwan University	d00625003_at_ntu.edu.tw
Sen-Sung	Cheng	National Taiwan University	d89625006_at_ntu.edu.tw
Po Neng	Chiang	National Taiwan University	pnchiang_at_ntu.edu.tw
Chih-Lung	Cho	National Iman University	rockcho_at_seed.net.tw
Min-Jie	Chuang	National Taiwan University	r90625001_at_ntu.edu.tw
Biing Tzuang	Guan	National Taiwan University	btguan_at_ntu.edu.tw
Hsin-Fu	Huang	Taiwan Provincial Government	hhf181_at_gmail.com
Jing-Yen	Huang	Taiwan Provincial Government - Forestry Bureau	yellow5255_at_gmail.com
Ya-Li	Huang	National Pingtung University of Science and Technology	goodrinoa93_at_gmail.com
Yue-hsing	Huang	Taiwan Forestry Research Institute	ystar_at_tfri.gov.tw
Chia-Ho	Kuo	National Pingtung University of Science and Technology	kawakamii01_at_gmail.com
Chia-Hua	Lee	International Wood Culture Society	chiahua.lee_at_iwcs.com
Chia-Ju	Lee	National Taiwan University	chiaju_at_ntu.edu.tw
Chi-Man	Leong	National Taiwan University	man_at_exfo.ntu.edu.tw
Shu Tzong	Lin	National Ilan University	stlin_at_niu.edu.tw
Tzu-Fang	Lin	National Pingtung University of Science and Technology	ybf90905_at_hotmail.com
Su Ling	Liu	National Taiwan University	liusl0325_at_gmail.com
Ya-Nan	Wang	National Taiwan University	m627_at_ntu.edu.tw
Chiang	Wei	National Taiwan University	d87622005_at_ntu.edu.tw

COLOMBIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Dolors	Armenteras	Universidad Nacional de Colombia	darmenterasp_at_unal.edu.co
Adriana Paola	Barbosa Herrera	Instituto de Hidrologia, Meteorologia y Estudios Ambientales (IDEAM)	abarbosa_at_ideam.gov.co
Maria	Becerra	International Forestry Students' Association (IFSA)	cata007201_at_gmail.com
Jeimy Lorena	Bonilla Vargas	University of Tolima	forest.lorena_at_gmail.com
Purabi	Bose	International Center of Tropical Agriculture (CIAT)	purabibose_at_gmail.com
Ana	Briceño	National University of Colombia	bricenoan_at_gmail.com
Edersson	Cabrera Montenegro	Instituto de Hidrologia, Meteorologia y Estudios Ambientales (IDEAM)	ecabreram_at_ideam.gov.co
Miguel Eugenio	Cadena Romero	Universidad Distrital Francisco José de Caldas	mecadenar_at_udistrital.edu.co
Andres	Carvajal		estabulado8_at_hotmail.com
Anagibeth	Chocontá	Universidad Distrital Francisco José de Caldas	anagibeth73_at_hotmail.com
Alejandro	Coca Castro	International Center of Tropical Agriculture (CIAT)	a.coca_at_cgiar.org
Leidy Johana	Escobar Quemba	Universidad Distrital Francisco José de Caldas	hojyann_at_yahoo.com
Jorge	Estrada		jestradamarin7_at_hotmail.com
Fernando	Fernandez Mendez	University of Tolima	fmendez_at_ut.edu.co
Martha Cecilia	Henao Toro	Universidad Nacional de Colombia	mchenaoto_at_unal.edu.co
Jair fernando	Hincapie almeciga	Colombian Forestry Students Association (ACEF)	info_at_sempervirens.co
Luis Alfredo	Lozano Botache	University of Tolima	llozano_at_ut.edu.co
Omar	Melo Cruz	University of Tolima	omelo_at_ut.edu.co
Alisson	Molina Bejarano	Universidad Distrital Francisco José de Caldas	alisson_molina_at_hotmail.com
Victor	Nieto	Corporación Nacional de Investigación y Fomento Forestal	administracion_at_conif.org.co
Olga Patricia	Pinzon	Universidad Distrital Francisco José de Caldas	oppinzon78_at_hotmail.com
César	Polanco	Universidad Distrital Francisco José de Caldas	cpolanco_at_udistrital.edu.co

Miguel Angel	Quimbayo Cardona	University of Tolima	miguelq_at_ut.edu.co
Carlos	Rodas	Smurfit Kappa Cartón de Colombia	carlos.rodas_at_smurfitkappa.com.co
Nathaly	Rodríguez Santos	University of Tolima	natha8902_at_hotmail.com
John	Sánchez Correa	Universidad Distrital Francisco José de Caldas	jeanbap563_at_hotmail.com
Luis Enrique	Vega	Corporación Nacional de Investigación y Fomento Forestal	enriquevega_at_conif.org.co
Fernando	Velez		fernando.velez52_at_gmail.com
Liz	Villarraga	Universidad Distrital Francisco José de Caldas	lizfvf_at_yahoo.es
Blanca	Yagüe	Universidad Nacional de Colombia Sede Amazonia	blancayaguepascual_at_gmail.com
Guillaume	Zeender	ONF International – ONF Andina	gzeender_at_onfandina.com
Daniel Felipe	Zuleta Zapata	Universidad Nacional de Colombia	dfzuleta_at_gmail.com

CONGO, DEMOCRATIC REPUBLIC OF THE

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Jean	Semeki Ngabinzeke	University of Kinshasa	jeansemeki_at_gmail.com
Carlos	de Wasseige	Observatoire des Forêts d'Afrique Centrale (OFAC)	cdewasseige_at_observatoire-comifac.net

COSTA RICA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Luis Guillermo	Acosta Vargas	Instituto Tecnológico de Costa Rica	lacosta_at_itcr.ac.cr
Marcela	Arguedas	Instituto Tecnológico de Costa Rica	marguedas_at_itcr.ac.cr
Elemer	Briceño-Elizondo	Instituto Tecnológico de Costa Rica	ebriceno_at_itcr.ac.cr
José Joaquín	Campos Arce	CATIE	jcampos_at_catie.ac.cr
Ronnie	De Camino	CATIE	rcamino_at_catie.ac.cr
Edwin	Esquivel	Instituto Tecnológico de Costa Rica	eesquivel_at_itcr.ac.cr
Bryan Gerald	Finegan	CATIE	bfinegan_at_catie.ac.cr
Ana	Hine	Universidad Nacional	ana.hine.gomez_at_una.cr

Josique	Lorenzo Lemire	CATIE	josique_at_catie.ac.cr
Bastiaan	Louman	CATIE	blouman_at_catie.ac.cr
Nancy	Merlo	CATIE	Nmerlo_at_catie.ac.cr
Sergio	Molina Murillo	National University of Costa Rica (UNA)	sergiomolina_at_una.cr
Sara Elena	Molina Quesada	Instituto Tecnológico de Costa Rica	samolina117_at_gmail.com
Lucía	Morales	Bangor University	moralesluciacr_at_gmail.com
Jean Pierre	Morales Aymerich	CATIE	moralesj_at_catie.ac.cr
Alejandra	Rojas	National University of Costa Rica (UNA)	alejandra.rojas.vargas_at_una.cr
Ricardo J.	Santiago García	CATIE	rsantiago_at_catie.ac.cr
Roger	Villalobos	CATIE	rvillalo_at_catie.ac.cr

COTE D'IVOIRE

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Bossombra Nadege-Parfaite	Kouame	West African Science Service Center on Climate Change & Adapted Land Use (WASCAL)	degeofr_at_yahoo.fr

CUBA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Humberto	Garcia Corrales	Instituto de Investigacion Forestal	humbertogarcia1966_at_gmail.com
Marta Marina	Jiménez Águila	Instituto de Investigacion Forestal	mjimenez_at_forestales.co.cu
Katia	Manzanares Ayala	Instituto de Investigacion Forestal	katia_at_forestales.co.cu
Adolfo	Núñez Barrizonte	Instituto de Investigacion Forestal	adolfo_at_forestales.co.cu

CZECH REPUBLIC

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Pavel	Cudlín	Academy of Sciences of the Czech Republic	centrum_at_czechglobe.cz
Marketa	Davidkova	University of South Bohemia	marketadavidkova_at_seznam.cz
Petr	Dolezal	University of South Bohemia	dolezal_at_entu.cas.cz

Vilem	Jarsky	Czech University of Life Sciences Prague	jarsky_at_fld.czu.cz
Jan	Kašpar	Czech University of Life Sciences Prague	kasparj_at_fld.czu.cz
Michal V.	Marek	Global Change Research Centre	marek.mv_at_czechglobe.cz
Robert	Marusak	Czech University of Life Sciences Prague	marusak_at_fld.czu.cz
Jan	Okrouhlik	University of South Bohemia	okrouhl_at_prf.jcu.cz
Ludek	Sisak	Czech University of Life Sciences Prague	sisak_at_fld.czu.cz
Kristyna	Stefkova	University of South Bohemia	kristef_at_seznam.cz
Josef	Urban	Mendel University in Brno	Josef.urban_at_email.cz
Katerina	Ventrubova	Czech University of Life Sciences Prague	ventrubova_at_fld.czu.cz
Jiri	Woitsch	Institute of Ethnology ASCR	jiri.woitsch_at_post.cz

DENMARK

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Yemi	Adeyeye	FAO	yemi.ifsa_at_gmail.com
Fatemeh	Bakhtiari	University of Copenhagen	fba_at_ifro.ku.dk
Niclas Scott	Bentsen	University of Copenhagen	nb_at_ign.ku.dk
Ingeborg	Callesen	University of Copenhagen	ica_at_ign.ku.dk
Jamie	Cotta	University of Copenhagen	jcotta_at_earthlink.net
Anna	Filyushkina	University of Copenhagen	anfi_at_ifro.ku.dk
Christian	Gamborg	University of Copenhagen	chg_at_ifro.ku.dk
Christian Pilegaard	Hansen	University of Copenhagen	cph_at_ifro.ku.dk
Frank Søndergaard	Jensen	University of Copenhagen	fsj_at_life.ku.dk
Ib	Johnsen	University of Copenhagen	ibj_at_bio.ku.dk
Niels Elers	Koch	Forest & Landscape Denmark	nek_at_ign.ku.dk
Søren	Larsen	University of Copenhagen	slar_at_life.ku.dk
Palle	Madsen	University of Copenhagen	pam_at_ign.ku.dk
Iben	Nathan	University of Copenhagen	in_at_ifro.ku.dk
Anders Tærø	Nielsen	University of Copenhagen	atn_at_life.ku.dk

Tobias	Plieninger	University of Copenhagen	tobias.plieninger_at_ign.ku.dk
Mariève	Pouliot	University of Copenhagen	mapo_at_ifro.ku.dk
Dorthe Varning	Poulsen	University of Copenhagen	dvp_at_life.ku.dk
Anne Dahl	Refshauge	University of Copenhagen	adre_at_ign.ku.dk
Antoine	Sambou	University of Copenhagen	ansa_at_life.ku.dk
Siddharth	Sareen	University of Copenhagen	sid_at_ifro.ku.dk
Ulrik	Sidenius Petersen	University of Copenhagen	us_at_ign.ku.dk
Carsten	Smith-Hall	University of Copenhagen	cso_at_ifro.ku.dk
Ulrika	Stigsdotter	University of Copenhagen	uks_at_life.ku.dk
Inge	Stupak	University of Copenhagen	ism_at_ign.ku.dk
Rikke Stamp	Thorsen	University of Copenhagen	rith_at_ifro.ku.dk

ECUADOR

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Alvaro Gustavo	Cañadas	Universidad Técnica del Norte	alvarocaniadas_at_yahoo.es
Alonso Danilo	Granja	Ministerio del Ambiente	alonso.granja_at_ambiente.gob.ec
Daniel Alexander	Segura	Ministerio del Ambiente	daniel.segura_at_ambiente.gob.ec

EL SALVADOR

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Hector	Castaneda	German Cooperation Agency in El Salvador	hector.castaneda_at_giz.de
Abner	Jimenez	German Cooperation Agency in El Salvador	abner.jimenez_at_giz.de
Laslo	Pancel	German Cooperation Agency in El Salvador	laszlo.pancel_at_giz.de

ESTONIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Kalle	Karoles	Estonian University of Life Sciences	kalle.karoles_at_envir.ee

Reimo	Lutter	Estonian University of Life Sciences	reimo.lutter_at_emu.ee
Andre	Purret		andre.purret_at_gmail.com
Arvo	Tullus	University of Tartu	arvo.tullus_at_ut.ee
Hardi	Tullus	Estonian University of Life Sciences	hardi.tullus_at_emu.ee
Tea	Tullus	Estonian University of Life Sciences	tea.tullus_at_emu.ee

ETHIOPIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Haile Yineger	Tariku	Griffith University	h.tariku_at_griffith.edu.au
Adefires	Worku Gizaw	Forestry Research Center of Ethiopia	adefires_at_yahoo.com

FINLAND

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Tuula	Aarnio	Academy of Finland	tuula.aarnio_at_aka.fi
Syed Ashraful	Alam	University of Helsinki	ashraful.alam_at_helsinki.fi
Jukka	Antikainen	Finnish Forest Research Institute (Metla)	jukka.antikainen_at_metla.fi
Javier	Arevalo	University of Eastern Finland	javier.arevalo_at_uef.fi
Anne	Arvola	University of Helsinki	anne.arvola_at_helsinki.fi
Zhuo	Cheng		abczefg_at_gmail.com
Kyle Johann	Eyvindson	University of Helsinki	kyle.eyvindson_at_helsinki.fi
Leena	Finér	Finnish Forest Research Institute (Metla)	leena.finer_at_metla.fi
Jarkko	Hantula	Finnish Forest Research Institute (Metla)	jarkko.hantula_at_metla.fi
Juha	Hautakangas	IUFRO Headquarters	hautakangas_at_iufro.org
Anne-Maarit	Hekkala	Finnish Forest Research Institute (Metla) / Thule Institute	anne-maarit.hekkala_at_metla.fi
Heljä-Sisko Marketta	Helmisaari	University of Helsinki	helja-sisko.helmisaari_at_helsinki.fi
Henrik	Heräjärvi	Finnish Forest Research Institute (Metla)	henrik.herajarvi_at_metla.fi
Lauri	Hetemaki	European Forest Institute	lauri.hetemaki_at_efi.int

Veikko	Hiltunen	Metsähallitus	veikko.hiltunen_at_metsa.fi
Jani	Holopainen	University of Helsinki	jani.m.holopainen_at_helsinki.fi
Juha	Honkaniemi	Finnish Forest Research Institute (Metla)	juha.honkaniemi_at_metla.fi
Antti Elias	Hurmekoski	European Forest Institute	elias.hurmekoski_at_efi.int
Roope	Husgafvel	Aalto University	roope.husgafvel_at_aalto.fi
Katri Annika	Hyytiä	University of Helsinki	annika.hyytia_at_helsinki.fi
Liina	Häyrinen	University of Helsinki	liina.hayrinen_at_helsinki.fi
Paula	Jylhä	Finnish Forest Research Institute (Metla)	paula.jylha_at_metla.fi
Lilli	Kaarakka	University of Helsinki	lilli.kaarakka_at_helsinki.fi
Annika	Kangas	University of Helsinki	annika.kangas_at_helsinki.fi
Markku	Kanninen	University of Helsinki	markku.kanninen_at_helsinki.fi
Pia	Katila	Finnish Forest Research Institute (Metla)	pia.katila_at_metla.fi
Simo Antti	Kilpeläinen	University of Eastern Finland	antti.kilpelainen_at_uef.fi
Jaana	Korhonen	University of Helsinki	jaana.e.korhonen_at_helsinki.fi
Elena	Kulikova	European Forest Institute	elena.kulikova_at_efi.int
Maija	Kymäläinen	University of Helsinki	maija.kymalainen_at_helsinki.fi
Katja	Lähtinen	University of Helsinki	katja.lahtinen_at_helsinki.fi
Christian	Lankinen	International Forestry Students' Association (IFSA)	christian.lankinen_at_gmail.com
Jani	Laturi	Finnish Forest Research Institute (Metla)	jani.laturi_at_metla.fi
Aleksi	Lehtonen	Finnish Forest Research Institute (Metla)	aleksi.lehtonen_at_metla.fi
Ning	Li	University of Helsinki	ning.li_at_helsinki.fi
Jussi	Lintunen	Finnish Forest Research Institute (Metla)	jussi.lintunen_at_metla.fi
Kai	Lintunen	Finnish Forest Association	kai.lintunen_at_smy.fi
Petr	Lukeš	University of Helsinki	petr.lukes_at_helsinki.fi
Minna	Lyytikäinen	University of Helsinki	minna.lyytikainen_at_helsinki.fi
Päivi	Lyytikäinen-Saarenmaa	University of Helsinki	paivi.lyytikainen-saarenmaa_at_helsinki.fi
Ossi	Malmberg	Academy of Finland	ossi.malmberg_at_aka.fi

Salvatore	Martire	University of Eastern Finland	salvatore.martire_at_efi.int
Osmo	Mattila	University of Helsinki	osmo.mattila_at_helsinki.fi
Robert	Mavsar	European Forest Institute	robert.mavsar_at_efi.int
Eero	Mikkola	IUFRO Headquarters	mikkola_at_iufro.org
Alexander	Moiseyev	Norwegian University of Life Sciences	moiseyev_at_efi.int
Veikko	Mottonen	Finnish Forest Research Institute (Metla)	veikko.mottonen_at_metla.fi
Aino Annikki	Mäkelä-Carter	University of Helsinki	annikki.makela_at_helsinki.fi
Antti	Mäkinen	Simosol	antti.makinen_at_simosol.fi
Harri	Mäkinen	Finnish Forest Research Institute (Metla)	harri.makinen_at_metla.fi
Karthikeyan	Natarajan	University of Eastern Finland	karthiforester_at_gmail.com
Pekka	Niemela	University of Turku	pekka.niemela_at_utu.fi
Kaisa	Nieminen	Finnish Forest Research Institute (Metla)	kaisa.nieminen_at_metla.fi
Pekka	Nygren	Finnish Society of Forest Science	pekka.nygren_at_metla.fi
Leena	Paavilainen	Finnish Forest Research Institute (Metla)	leena.paavilainen_at_metla.fi
Petteri	Packalen	University of Eastern Finland	petteri.packalen_at_uef.fi
Tuula	Packalen	Finnish Forest Research Institute (Metla)	tuula.packalen_at_metla.fi
Md Parvez	Rana	University of Eastern Finland	parvez.rana_at_uef.fi
Tarmo	Raty	Finnish Forest Research Institute (Metla)	tarmo.raty_at_metla.fi
Mika	Rekola	University of Helsinki	mika.rekola_at_helsinki.fi
Annariikka	Roselli	Aalto University	annariikka.roselli_at_aalto.fi
Svetlana	Saarela	University of Helsinki	svetlana.saarela_at_helsinki.fi
Hannu	Saarenmaa	University of Eastern Finland	hannu.saarenmaa_at_uef.fi
Jarmo	Saarikko	Finnish Forest Research Institute (Metla)	jarmo.saarikko_at_metla.fi
Pekka	Saranpää	Finnish Forest Research Institute (Metla)	pekka.saranpaa_at_metla.fi
Tytti	Sarjala	Finnish Forest Research Institute (Metla)	tytti.sarjala_at_metla.fi
Risto	Seppälä	Honorary Member	ristojseppala_at_gmail.com
Tuija	Sievänen	Finnish Forest Research Institute (Metla)	tuija.sievanen_at_metla.fi

Pauline	Stenberg	University of Helsinki	pauline.stenberg_at_helsinki.fi
Yitagesu Tekle	Tegegne	European Forest Institute	yitagesu.tekle_at_efi.int
Ilpo	Tikkanen	Metsämiesten Säätiö Foundation	ilpo.tikkanen_at_mmsaatio.fi
Anne	Toppinen	University of Helsinki	anne.toppinen_at_helsinki.fi
Maxim	Trishkin	University of Eastern Finland	maxim.trishkin_at_uef.fi
Liisa	Tyrväinen	Finnish Forest Research Institute (Metla)	liisa.tyrvainen_at_metla.fi
Liisa	Ukonmaanaho	Finnish Forest Research Institute (Metla)	liisa.ukonmaanaho_at_metla.fi
Jari	Varjo	Finnish Forest Research Institute (Metla)	jari.varjo_at_metla.fi
Parvathy	Venugopal	University of Eastern Finland	venugopa_at_student.uef.fi
Sinikka	Västilä	Finnish Forest Research Institute (Metla)	sinikka.vastila_at_metla.fi
Pauli	Wallenius	Metsähallitus	pauli.wallenius_at_metsa.fi
Minli	Wan	University of Helsinki	minli.wan_at_helsinki.fi
Kristiina	Wähälä Hase	University of Helsinki	kristiina.wahala_at_helsinki.fi

FRANCE

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Maria Victoria	Asensi Amoros	Xylodata SARL	victoria.asensi_at_free.fr
Fabienne	Benest	Forest Logistique Conseil	fabienne.benest_at_foretlogistique.eu
Thomas	Boivin	National Institute of Agronomic Research (INRA)	Thomas.Boivin_at_avignon.inra.fr
Marielle	Brunette	National Institute of Agronomic Research (INRA)	marielle.brunette_at_nancy.inra.fr
Jean-Michel	Carnus	National Institute of Agronomic Research (INRA)	carnus_at_pierroton.inra.fr
Marie	Castagnet	Castagnet Dumeon SA	scastagnet_at_yahoo.com
Christian	Castagnet	Castagnet Dumeon SA	nicolasesguerra07_at_gmail.com
Fatima	Charrier	University of Pau and Pays de l'Adour	fatima.charrier_at_univ-pau.fr
Mathias	Christina	CIRAD	mathias.christina_at_cirad.fr
Frederic	Coppin	Radioprotection and Nuclear Safety Institute (IRSN)	frederic.coppin_at_irsn.fr

Philippe	Deuffic	IRSTEA	philippe.deuffic_at_irstea.fr
Marc	Deconchat	National Institute of Agronomic Research (INRA)	marc.deconchat_at_toulouse.inra.fr
Erwin	Dreyer	National Institute of Agronomic Research (INRA)	dreyer_at_nancy.inra.fr
Sylvain	Dupire	IRSTEA	sylvain.dupire_at_irstea.fr
Jose	Egas	AgroParisTech – ENGREF	jjegas_at_yahoo.com
Richard	Emeyriat	Foret Logistique Conseil	richard.emeyriat_at_foretlogistique.eu
Martin	Godefroid	National Institute of Agronomic Research (INRA)	martin.godefroid_at_supagro.inra.fr
Valery	Gond	CIRAD	valery.gond_at_cirad.fr
Marc-Andre	Gonze	Radioprotection and Nuclear Safety Institute (IRSN)	marc-andre.gonze_at_irsn.fr
Frédéric	Gosselin	IRSTEA	frederic.gosselin_at_irstea.fr
Emeline	Hily	National Institute of Agronomic Research (INRA)	emeline.hily_at_gmail.com
Henri Pascal	Husson	Centre Régional de la Propriété Forestière-Aquitaine	h.husson_at_crpfaquitaine.fr
Herve	Jactel	National Institute of Agronomic Research (INRA)	herve.jactel_at_pierroton.inra.fr
Dominique	Lachenal	Grenoble INP Pagora	dominique.lachenal_at_grenoble-inp.fr
Jean-Paul	Laclau	CIRAD	laclau_at_cirad.fr
Valentine	Lafond	IRSTEA	valentine.lafond_at_irstea.fr
Francois	Lieutier	University of Orleans	francois.lieutier_at_univ-orleans.fr
Sandra	Luque	IRSTEA	sandra.luque_at_irstea.fr
Jl	Maeght	IRD	jean-luc.maeght_at_ird.fr
Zhun	Mao	IRSTEA	zhun.mao_at_irstea.fr
Céline	Meredieu	National Institute of Agronomic Research (INRA)	celine.Meredieu_at_pierroton.inra.fr
Juliette	Mouche	International Forestry Students' Association (IFSA)	ifsa.jmouche_at_gmail.com
Christophe	Orazio	European Forest Institute	christophe.orazio_at_efi.int
Liz	Ota	UNESP	lizmsota_at_gmail.com
Jordan	Perrin	Grenoble INP Pagora	jordan.perrin_at_grenoble-inp.org
Claudio	Petucco	National Institute of Agronomic Research (INRA)	claudio.petucco_at_nancy.inra.fr

Jean-Luc	Peyron	ECOFOR	jean-luc.peyron_at_gip-ecofor.org
Herve	Piegay	CNRS	herve.piegay_at_ens-lyon.fr
Simon	Rizzetto	CNRS-EcoLab	simon.rizzetto_at_ensat.fr
Christelle	Robinet	National Institute of Agronomic Research (INRA)	christelle.robinet_at_orleans.inra.fr
Cara	Rockwell	Center for International Forestry Research (CIFOR)	rockwell_cara_at_yahoo.com
Alain	Roques	National Institute of Agronomic Research (INRA)	alain.roques_at_orleans.inra.fr
Jérôme	Rousselet	National Institute of Agronomic Research (INRA)	jerome.rousselet_at_orleans.inra.fr
Géraldine	Roux	National Institute of Agronomic Research (INRA)	geraldine.roux_at_orleans.inra.fr
Philippe	Rozenberg	National Institute of Agronomic Research (INRA)	philippe.rozenberg_at_orleans.inra.fr
Margot	Régolini	National Institute of Agronomic Research (INRA)	margot.regolini_at_pierroton.inra.fr
Plinio	Sist	CIRAD	sist_at_cirad.fr
Alexia	Stokes	National Institute of Agronomic Research (INRA)	alexia.stokes_at_cirad.fr
Yves	Thiry	Andra	yves.thiry_at_andra.fr
Morgan	Vuillermoz	FCBA	morgan.vuillermoz_at_fcba.fr

GEORGIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Giorgi	Kavtaradze	Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) GmbH	g.kavtaradze_at_agruni.edu.ge
Nato	Kobakhidze	Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) GmbH	n.kobakhidze_at_agruni.edu.ge

GERMANY

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Asmamaw Alemu	Abtew	Technical University of Dresden	asmamawalemu_at_yahoo.com
Angela Luciana	de Avila	University of Freiburg	angela.de.avila_at_waldbau.uni-freiburg.de
Jürgen	Bauhus	University of Freiburg	juergen.bauhus_at_waldbau.uni-freiburg.de

Gero	Becker	University of Freiburg	gero.becker_at_fobawi.uni-freiburg.de
Adam	Benneter	University of Freiburg	adam.benneter_at_waldbau.uni-freiburg.de
Heinrich Andreas	Bolte	Thünen Institute of Forest Ecosystems	andreas.bolte_at_ti.bund.de
Pau	Brunet-Navarro	Leibniz-Centre for Agricultural Landscape Research (ZALF)	pau.brunet_at_zalf.de
Martin	Brunsmeier	University of Freiburg	martin.brunsmeier_at_fobawi.uni-freiburg.de
Lea	Bächle	University of Goettingen	baechle.lea_at_gmail.com
Michael	Böcher	University of Goettingen	mboeche_at_uni-goettingen.de
Sophia	Carodenuto	UNIQUE forestry and land use	sophia.carodenuto_at_unique-landuse.de
Siu Lang	Carrillo Yap	University of Goettingen	siulang.muchik_at_gmail.com
Scott	Cettie	University of Freiburg	scott.cettie_at_ifp.uni-freiburg.de
Tamalika	Chakraborty	University of Freiburg	tamalika.chakraborty_at_waldbau.uni-freiburg.de
Chunling	Dai	University of Freiburg	dai.chunling_at_waldbau.uni-freiburg.de
Ernst Siegfried	Lewark	University of Freiburg	siegfried.lewark_at_fobawi.uni-freiburg.de
Tefera Belay	Endalamaw	TU Dresden	tefera10_at_yahoo.com
Benjamin	Engler	University of Freiburg	benjamin.engler_at_fobawi.uni-freiburg.de
Lutz	Fehmann	University of Goettingen	lfehrma_at_gwdg.de
Susanne	Frank	TU Dresden	susanne.frank_at_uni-bonn.de
Sabine	Fuss	Mercator Research Institute on Global Commons and Climate Change	fuss_at_mcc-berlin.net
Christine	Fürst	University of Bonn	cfuerst_at_uni-bonn.de
Lukas	Giessen	University of Goettingen	lgiesse_at_uni-goettingen.de
Alejandro	Guarin	German Development Institute	alejandro.guarin_at_die-gdi.de
Sven	Guenter	Thünen Institute of International Forestry and Forest Economics	sven_gunter_at_yahoo.de
Christoph	Hartebrodt	Forest Research Institute	christoph.hartebrodt_at_forst.bwl.de
Taisser	Hassan Hamadelnile Deafalla	TU Dresden	taisserhassan_at_yahoo.com
Sebastian	Hauk	HSWT University of Applied Sciences Weihenstephan-Triesdorf	s.hauk_at_wz-straubing.de
Daniel	Hawtree	TU Dresden / University of Padova	dhawtree_at_gmail.com
Joachim	Hill	Trier University	hillj_at_uni-trier.de

Anique	Hillbrand	Bangor University	Anique.Hillbrand_at_web.de
Md. Mohitul	Hossain	University of Freiburg	mohitulh_at_yahoo.com
Karin	Höglmeier	TU Munich	hoeglmeier_at_hfm.tum.de
Jakob	Hörl	International Forestry Students' Association (IFSA)	jakob.ifsa_at_gmail.com
Miriam	Isaac-Renton	University of Alberta	isaacren_at_ualberta.ca
Dirk	Jaeger	University of Freiburg	dirk.jaeger_at_fobawi.uni-freiburg.de
Anke	Jentsch	University of Bayreuth	anke.jentsch_at_uni-bayreuth.de
Hubert	Jochheim	Leibniz-Centre for Agricultural Landscape Research (ZALF)	hubert.jochheim_at_zalf.de
Marion	Karmann	Forest Stewardship Council – FSC International	m.karmann_at_fsc.org
Asia	Khamzina	University of Bonn	asia.khamzina_at_uni-bonn.de
Elisabeth Ingeborg	Kindler	University of Goettingen	elisabeth.kindler_at_forst.uni-goettingen.de
Christoph	Kleinn	University of Goettingen	ckleinn_at_gwdg.de
Michael	Koehl	University of Hamburg	michael.koehl_at_uni-hamburg.de
Ulrich	Kohnle	Forest Research Institute of Baden-Württemberg	ulrich.kohnle_at_forst.bwl.de
Konstantin	Krutovsky	University of Goettingen	kkrutov_at_gwdg.de
Joerg	Kunz	University of Freiburg	joerg.kunz_at_waldbau.uni-freiburg.de
Sina	Leipold	University of Freiburg	sina.leipold_at_ifp.uni-freiburg.de
Na	Lin	University of Goettingen	na.lin_at_forst.uni-goettingen.de
Karla Estela	Locher Krause	Helmholtz Centre for Environmental Research	karlalocher_at_gmail.com
Jacqueline	Logmani	University of Goettingen	jlogman_at_gwdg.de
Martin	Lorenz	Thünen Institute	martin.lorenz_at_ti.bund.de
Mustafa	Mahmoud El-Abbas	TU Dresden	mmelabbas_at_hotmail.com
Andreas	Manuel	University of Freiburg	andreas.manuel_at_fobawi.uni-freiburg.de
Rainer	Matyssek	TU Munich	matyssek_at_wzw.tum.de
Simeon	Max		simeon.max_at_yale.edu
Katharina	Meyer	University of Goettingen	katharina.meyer_at_forst.uni-goettingen.de
David	Montwé	University of Freiburg	david.montwe_at_iww.uni-freiburg.de

Torsten Bernhard	Möllmann	University of Goettingen	torstenmoellmann_at_posteo.de
Patrick	Opoku	TU Dresden	opoku_patrick_at_yahoo.com
César	Pérez-Cruzado	University of Goettingen	cperez_at_gwdg.de
Anakarina	Perez Oropeza	Forest Stewardship Council A.C.	a.perezoropeza_at_fsc.org
Daniel	Plugge	University of Hamburg	daniel.plugge_at_uni-hamburg.de
Benno	Pokorny	University of Freiburg	benno.pokorny_at_waldbau.uni-freiburg.de
Patrick	Pyttel	University of Freiburg	patrick.pyttel_at_waldbau.uni-freiburg.de
Klaus	Richter	TU Munich	richter_at_hfm.tum.de
Alexander	Röll	University of Goettingen	aroell_at_gwdg.de
Somidh	Saha	University of Freiburg	somidh.saha_at_waldbau.uni-freiburg.de
Udo H.	Sauter	Forest Research Institute of Baden-Württemberg	udo.sauter_at_forst.bwl.de
Michael	Scherer-Lorenzen	University of Freiburg	michael.scherer_at_biologie.uni-freiburg.de
Thomas	Scheuschner	OEKO-DATA GmbH	thomas.scheuschner_at_oekodata.com
Franziska	Schier	University of Natural Resources and Life Sciences (BOKU)	schier.franziska_at_googlemail.com
Daniel	Schoenig	University of Freiburg	daniel.schoenig_at_gmx.net
Melanie	Schulte	International Forestry Students' Association (IFSA)	schulte.melanie_at_ymail.com
Christina	Schumann	Weihenstephan-Triesdorf University of Applied Sciences	christina.schumann_at_hswt.de
Eva	von Schoenebeck	International Forestry Students' Association (IFSA)	eva_schoenebeck_at_yahoo.de
Frank	Setzer	Erfurt University of Applied Sciences	frank.setzer_at_fh-erfurt.de
Julia Annick	Sohn	University of Freiburg	julia.sohn_at_waldbau.uni-freiburg.de
Metodi	Sotirov	University of Freiburg	metodi.sotirov_at_ifp.uni-freiburg.de
Stefan M.	Stängle	Forest Research Institute Baden-Württemberg	stefan.staengle_at_forst.bwl.de
Konstantin	von Teuffel	Forest Research Institute Baden-Württemberg	konstantin.teuffel_at_forst.bwl.de
Johanna	Wehkamp	Mercator Research Institute on Global Commons and Climate Change (MCC)	wehkamp_at_mcc-berlin.net
Jan Carl	Welzholz	University of Goettingen	jan.welzholz_at_forst.uni-goettingen.de
Nico	Wilms-Posen	University of Copenhagen	n.wilmsposen_at_gmail.com
Georg	Winkel	University of Freiburg	georg.winkel_at_ifp.uni-freiburg.de

Bin	You	University of Freiburg	Bin.You_at_Forst.bwl.de
Rasoul	Yousefpour	Max Planck Institute for Meteorology	rasoul.yousefpour_at_mpimet.mpg.de

GHANA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Mary	Apetorgbor	Forestry Research Institute of Ghana	mapetorgbor57_at_gmail.com
Emmanuel	Appiah-Kubi	Forestry Research Institute of Ghana	appiahkemma_at_yahoo.com
William	Baah		baahwilliam_at_yahoo.com
Blankson	Baffo	Volta River Authority	baffoblankson_at_gmail.com
Paul P.	Bosu	Forestry Research Institute of Ghana	paul_bosu_at_yahoo.com
Emmanuel	Danquah	Kwame Nkrumah University of Science and Technology	emmanueldanquah_at_yahoo.com
Beatrice	Darko Obiri	Forestry Research Institute of Ghana	bdobiri_at_yahoo.com
Ernest	Foli	Forestry Research Institute of Ghana	efoli_at_hotmail.com
Kwame Antwi	Oduro	Forestry Research Institute of Ghana	kwameoduro_at_gmail.com
Emmanuel	Opuni Frimpong	Forestry Research Institute of Ghana	eopunifr_at_mtu.edu
Edward Debrah	Wiafe	Presbyterian University College	edward.wiafe_at_presbyuniversity.edu.gh

GREECE

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Yannis	Raftoyannis	Central Greece University of Applied Sciences	rafto_at_teilam.gr
Moschos	Vogiatzis	Greek Ministry of Environment	MVOGIATZ_at_KTIMATOLOGIO.GR

HONDURAS

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Melvin Geovanny	Cruz Melendez	Fundacion MaderaVerde	melendezcruzm_at_gmail.com
Mirian	Molina	Fundacion MaderaVerde	ymolina_at_maderaverde.org.hn

HUNGARY

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Balázs	Garamszegi	Eötvös Loránd University	balazs.garamszegi_at_gmail.com
Ferenc	Horvath		Horvath.ferenc_at_okologia.mta.hu
Géza	Király	University of West Hungary	kiraly.geza_at_emk.nyme.hu
Balint	Meszaros	University of West Hungary	m.baalint_at_gmail.com
Katalin	Tuba	University of West Hungary	tubak_at_emk.nyme.hu

INDIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Meena	Bakshi	Forest Research Institute	bakshim123_at_gmail.com
Divakara	Baragur	Indian Council of Forestry Research and Education (ICFRE)	bndsira_at_gmail.com
Dhanya	Bhaskar	University of Agricultural Sciences	krupaias_at_gmail.com
Padam	Bhojvaid	Forest Research Institute	ppbhoj_at_icfre.org
Shruti Sharma	Chachra	Indian Council of Forestry Research and Education (ICFRE)	shrutiddn_at_gmail.com
Swati	Chaliha	Foundation for Ecological Security	swatichaliha_at_gmail.com
Sanjeev	Chauhan	Punjab Agricultural University	chauhanpau_at_pau.edu
Modhumita	Dasgupta	Institute of Forest Genetics and Tree Breeding	modhumitaghosh_at_hotmail.com
Harish Singh	Ginwal	Forest Research Institute	ginwalhs_at_rediffmail.com
Shivanna	Honnurappa	University of Agricultural Sciences	shivanisir59_at_gmail.com
Medha	Kant	University of Delhi	medha.kant_at_gmail.com
Promode	Kant	Institute of Green Economy	promode.kant_at_gmail.com
Ravinder	Kohli	DAV University	rkkohli45_at_yahoo.com
Remadevi	Othumbamkat	Institute of Wood Science and Technology	okremadevi_at_gmail.com
Ishtiyak Ahmad	Peerzada	Shere Kashmir University of Agriculture Sciences & Technology	drishtiyak_at_gmail.com
Sundararaj	Ramachandran	Institute of Wood Science and Technology	rsundariwst_at_gmail.com
Yasodha	Ramasamy	Institute of Forest Genetics and Tree Breeding	yasodharaja_at_yahoo.com

Anita	Rawat	Forest Research Institute	anitasrawat_at_gmail.com
Delphy	Rocha	College of Forestry	delphycof_at_gmail.com
Vindhya Prasad	Tewari	Indian Council of Forestry Research and Education (ICFRE)	vptewari_at_yahoo.com
Kunhamu	Thanduparakkal Kottarakkad	Kerala Agricultural University	kunhamutk_at_gmail.com
Manisha	Thapliyal	Forest Research Institute	manishapasbola_at_rediffmail.com
Sasidharan	Theeyan Chari Othayoth	Ashoka Trust for Research in Ecology and the Environment	tosasi_at_atree.org
Anita	Tomar	Centre for Social Forestry and Eco-Rehabilitation	anitatomar_at_icfre.org
VP	Uniyal	Wildlife Institute of India	uniyalvp_at_wii.gov.in

INDONESIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Iis	Alviya Abdul Manap	Forestry Research and Development Agency (FORDA)	iisalviya_at_yahoo.com
Mani Ram	Banjade	Center for International Forestry Research (CIFOR)	mrbanjade_at_gmail.com
Bimbika	Basnett	Center for International Forestry Research (CIFOR)	b.basnett_at_cgiar.org
Carol	Colfer	Center for International Forestry Research (CIFOR)	c.colfer_at_cgiar.org
Ellyn Kathalina	Damayanti	Bogor Agricultural University	e11yn.d4mayanti_at_gmail.com
Ade Ayu	Dewayani	International Forestry Students' Association (IFSA)	monica.dorothea_at_gmail.com
Meti	Ekayani	Bogor Agricultural University	metieka_at_yahoo.com
Adi	Gangga	International Forestry Students' Association (IFSA)	gangga.gangga_at_gmail.com
Kurniatun	Hairiah	World Agroforestry Centre (ICRAF)	K.Hairiah_at_cgiar.org
Beria Leimona	Hairu	World Agroforestry Centre (ICRAF)	L.Beria_at_cgiar.org
Hety	Herawati	Center for International Forestry Research (CIFOR)	h.herawati_at_cgiar.org
Kristell	Hergoualc'h	Center for International Forestry Research (CIFOR)	k.hergoualch_at_cgiar.org
Yuliati	Indrayani	Tanjungpura University	mandaupermai_at_yahoo.com
Sitti	Latifah Endang Sunarya	University of Mataram	slatifa23_at_yahoo.com
Budi	Leksono	Center for Forest Biotechnology and Tree Improvement	boedyleksono_at_yahoo.com

Sudaryati Nining	Liswanti	Center for International Forestry Research (CIFOR)	n.liswanti_at_cgiar.org
Nina	Mindawati	Forestry Research and Development Agency (FORDA)	ninapulp_at_yahoo.co.id
Sasa Sofyan	Munawar	Center for Innovation, Indonesian Institute of Science (LIPI)	sasasofyanm_at_biomaterial.lipi.go.id
Daniel	Murdiyarso	Center for International Forestry Research (CIFOR)	D.MURDIYARSO_at_CGIAR.ORG
Budi Hadi	Narendra	Forestry Research and Development Agency (FORDA)	budihadin_at_yahoo.co.id
Robert	Nasi	Center for International Forestry Research (CIFOR)	r.nasi_at_cgiar.org
Meine	van Noordwijk	World Agroforestry Centre (ICRAF)	m.vannoordwijk_at_cgiar.org
Dodik Ridho	Nurrochmat	Bogor Agricultural University	dnrochmat_at_yahoo.com
Pablo	Pacheco	Center for International Forestry Research (CIFOR)	p.pacheco_at_cgiar.org
Putera	Parthama	Forestry Research and Development Agency (FORDA)	p_parthama_at_yahoo.com
Sebastian	Persch	Center for International Forestry Research (CIFOR)	s.persch_at_cgiar.org
Herry	Purnomo	CIFOR / IPB	h.purnomo_at_cgiar.org
Syed	Rahman	Center for International Forestry Research (CIFOR)	sumonsociology_at_yahoo.com
Susan	Salosa	Forestry Research and Development Agency (FORDA)	susan_3sa_at_yahoo.com
Corryanti	Sambodo	Forestry State Owned Enterprise (perum perhutani)	corrysambodo_at_yahoo.com
Yusuf Bahtimi	Samsudin	International Forestry Students' Association (IFSA)	yusuf.bahtimi_at_gmail.com
Dewi Sonya	Santoso	World Agroforestry Centre (ICRAF)	S.Dewi_at_cgiar.org
Manahan Parlindungan	Saragih	Bandung Institute of Technology	manahan_at_sbm-itb.ac.id
Martha Ekawati	Siahaya	Samarinda State Polytechnic for Agriculture	marthasiahaya_at_yahoo.co.id
Binsar Liem	Sihotang	Gadjah Mada University	godbless.binsar_at_gmail.com
Ulfah Juniarti	Siregar	Bogor Agricultural University	siregaruj_at_gmail.com
Herwasono	Soedjito	Indonesian Institute of Sciences	herwasonosoedjito_at_yahoo.com
Terry	Sunderland	Center for International Forestry Research (CIFOR)	t.sunderland_at_cgiar.org
Riko	Wahyudi	Forestry and Climate Change Division, Article 33 Indonesia	yudi_ikhwah_at_yahoo.co.id
Nayu Nuringdati	Widianingsih	University of Copenhagen	nayu_at_foi.ku.dk

Enny	Widyati		enny_widyati_at_yahoo.com
Vivi	Yuskianti	Center for Forest Biotechnology and Tree Improvement	vivi_yuskianti_at_yahoo.com

IRAN

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Reza	Akhavan	Research Institute of Forests and Rangelands, Iran	akhavan_at_rifr-ac.ir
Maryam	Bakhshi	Free University Berlin	mary_bakhshi_at_yahoo.com
Jalal	Henareh Khalyani	University of Tehran	jhenareh_at_gmail.com
Maryam	Salehi	University of Tehran	m.salehi89_at_ut.ac.ir

IRELAND

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Seline	Meijer	World Agroforestry Centre (ICRAF)	seline_meijer_at_hotmail.com
Nuala	Ni Fhlaithbheartaigh	Teagasc	nuala.nifhlatharta_at_teagasc.ie
Maarten	Nieuwenhuis	University College Dublin	maarten.nieuwenhuis_at_ucd.ie
Cormac	O'Callaghan	University College Cork	109555285_at_umail.ucc.ie

ISRAEL

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Zvi	Mendel	Agricultural Research Organization	zmendel_at_volcani.agri.gov.il
Ira	Mor	Forest Department of the KKL – Land Development Authority	irah_at_kkl.org.il
Jacov	Mor	Forest Department of the KKL– Land Development Authority	KobiM_at_kkl.org.il

ITALY

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Frederic	Achard	Institute for Environment and Sustainability	frederic.achard_at_jrc.ec.europa.eu

Mauro	Agnoletti	University of Florence	mauro.agnoletti_at_unifi.it
Anna	Barbati	University of Tuscia	barbati.sisfor_at_unitus.it
Andrea	Battisti	University of Padova	andrea.battisti_at_unipd.it
Enrico Corrado	Borgogno Mondino	University of Turin	enrico.borgogno_at_unito.it
Martina	Cambi	University of Florence	martina.cambi_at_unifi.it
Raffaele	Cavalli	University of Padova	raffaele.cavalli_at_unipd.it
Ariadna	Chavarria Resendez	University of Padua	ariadna.chavarria_at_gmail.com
Piermaria	Corona	University of Tuscia	piermaria.corona_at_unitus.it
Riccardo	Da Re	University of Padova	riccardo.dare_at_unipd.it
Alessandra	De Marco	Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)	alessandra.demarco_at_enea.it
Mario	Elia	University of Bari	mario.elia_at_uniba.it
Massimo	Faccoli	University of Padova	massimo.faccoli_at_unipd.it
Antonio	Frattari	University of Trento	antonio.frattari_at_unitn.it
Matteo	Garbarino	Marche Polytechnic University	m.garbarino_at_univpm.it
Paolo	Gonthier	University of Turin	paolo.gonthier_at_unito.it
Giacomo	Grassi	Joint Research Centre, European Commission	giacomo.grassi_at_jrc.ec.europa.eu
Thomas	Hofer	FAO	thomas.hofer_at_fao.org
Nicola	La Porta	The EFI Project Centre on Mountain Forests, Edmund Mach Foundation	nicola.laporta_at_fmach.it
Raffaele	Lafortezza	University of Bari	raffaele.lafortezza_at_uniba.it
Andrea	Laschi	University of Florence	andrea.laschi_at_unifi.it
Alessandro	Leonardi	University of Padova	alessandro.leonardi_at_unipd.it
Emanuele	Lingua	University of Padova	emanuele.lingua_at_unipd.it
Fabio	Lombardi	Italian Academy of Forest Sciences	fabio.lombardi_at_unimol.it
Judith Ardyce	Loo	Bioversity International	j.loo_at_cgiar.org
Nicola	Luchi	Institute of Plant Protection, National Research Council	n.luchi_at_ipp.cnr.it
Kenneth	MacDicken	FAO Forestry	Kenneth.MacDicken_at_fao.org

Biljana	Macura	University of Padova	biljana.macura_at_studenti.unipd.it
Marco	Marchetti	Italian Academy of Forest Sciences	marchettimarco_at_unimol.it
Enrico	Marchi	University of Florence	enrico.marchi_at_unifi.it
Raffaella	Marzano	University of Turin	raffaella.marzano_at_unito.it
Fabio	Meloni	University of Turin	fabio.meloni_at_unito.it
Marina	Miovska	University of Padua	mmiovska_at_gmail.com
Renzo	Motta	University of Turin	renzo.motta_at_unito.it
Carlo	Murer	University of Copenhagen	carlo.murer_at_yahoo.com
Elena	Paoletti	Institute of Plant Protection, National Research Council	e.paoletti_at_ipp.cnr.it
Anssi	Pekkarinen	FAO Forestry	anssi.pekkarinen_at_fao.org
Alessia L.	Pepori	Institute of Plant Protection, National Research Council	a.pepori_at_ipp.cnr.it
Francesca	Pierobon	University of Padua	francesca.pierobon_at_gmail.com
Francesco	Ripullone	University of Basilicata	francesco.ripullone_at_unibas.it
Rolando	Rizzolo	University of Padova	rolando.rizzolo_at_studenti.unipd.it
Eduardo	Rojas-Briales	FAO	fo-adg_at_fao.org
Fabio	Salbitano	University of Florence	fabio.salbitano_at_unifi.it
Giovanni	Sanesi	University of Bari	giovanni.sanesi_at_uniba.it
Massimiliano	Sanfilippo	COSPE NGO	massi_ag_at_yahoo.it
Alberto	Santini	Institute of Plant Protection	a.santini_at_ipp.cnr.it
Shiroma Kumudini	Sathyapala	FAO	sony1028_at_gmail.com
Giuseppe	Scarascia Mugnozza	University of Tuscia	gscaras_at_unitus.it
Raffaele	Spinelli	Trees and Timber Institute, National Research Council	spinelli_at_ivalsa.cnr.it
Roberto	Tognetti	Italian Academy of Forest Sciences	tognetti_at_unimol.it
Emmeline	Topp	Erasmus Mundus Masters Sustainable Forest and Nature Management	emmytrees_at_gmail.com
Giorgio	Vacchiano	University of Turin	giorgio.vacchiano_at_unito.it
Andrea	Vannini	University of Tuscia	vannini_at_unitus.it
Anna Maria	Vettraino	University of Tuscia	vettrain_at_unitus.it

Enrico	Vidale	University of Padova	enrico.vidale_at_unipd.it
Peter	Vogt	Joint Research Centre, European Commission	peter.vogt_at_jrc.ec.europa.eu

JAPAN

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Ei	-	Kyoto University	ei641986_at_gmail.com
Hisashi	Abe	Forestry and Forest Products Research Institute	abeq_at_affrc.go.jp
Nobuhiro	Akashi	Hokkaido Research Organization	akashi-nobuhiro_at_hro.or.jp
Ji Young	An	Kyoto University	jiyoung.an.63c_at_st.kyoto-u.ac.jp
Kazuhiro	Aruga	Utsunomiya University	aruga_at_cc.utsunomiya-u.ac.jp
Azita	Binti Ahmad Zawawi	Kagoshima University	azitazawawi_at_gmail.com
Yaw Agyeman	Boafo	United Nations University	yaboafo_at_yahoo.co.uk
Nyein	Chan	Kyoto University	nchan08_at_gmail.com
Yoshiyuki	Chinen	University of the Ryukyus	akamayaa_at_yahoo.co.jp
Chen-Wei	Chiu	Kyushu University	ccwei97_at_gmail.com
Wil	de Jong	Kyoto University	dejongwil_at_gmail.com
Maya	Fujiwara	Tokyo University of Agriculture and Technology	fujiwara_at_fe.rn.tuat.ac.jp
Kenji	Fukuda	University of Tokyo	fukuda_at_k.u-tokyo.ac.jp
Yukina	Funasaka	Nagoya University	funasaka.yukina_at_f.mbox.nagoya-u.ac.jp
Takuya	Furukawa		Tfurukawa_at_affrc.go.jp
Takashi	Gomi	Tokyo University of Agriculture and Technology	gomit_at_cc.tuat.ac.jp
Mie	Gomyo	University of Tokyo	gomyo_at_uf.a.u-tokyo.ac.jp
Jun'ichi	Gotou	Kochi University	gotou_at_fs.kochi-u.ac.jp
Shiwei	Gou	Kyoto University	shiwei.gou_at_gmail.com
Kazuhiro	Harada	Nagoya University	harada_at_agr.nagoya-u.ac.jp
Yasumasa	Hirata	Forestry and Forest Products Research Institute	hirat09_at_affrc.go.jp

Yuko	Hishiyama	Forestry and Forest Products Research Institute	yukot_at_ffpri.affrc.go.jp
Hayato	Iijima	Yamanashi Forest Research Institute	hayato.iijima_at_gmail.com
Mariko	Inoue	Forestry and Forest Products Research Institute	imariko_at_ffpri.affrc.go.jp
Satoshi	Ito	University of Miyazaki	s.ito_at_cc.miyazaki-u.ac.jp
Taiichi	Ito	University of Tsukuba	ito.taiichi.ft_at_u.tsukuba.ac.jp
Masahiro	Iwaoka	Tokyo University of Agriculture and Technology	iwaoka_at_cc.tuat.ac.jp
Marcin Pawel	Jarzebski	University of Tokyo	marcin.jarzebski_at_yahoo.com
Noor	Jemali	Kagoshima University	idiana0303_at_yahoo.com
Koichiro	Kuraji	University of Tokyo	kuraji_koichiro_at_uf.a.u-tokyo.ac.jp
Takahide	Kagawa	Forestry and Forest Products Research Institute	kagawa_at_ffpri.affrc.go.jp
Naoto	Kamata	University of Tokyo	kamatan_at_uf.a.u-tokyo.ac.jp
Chiho	Kamiyama	United Nations University	chihokamiyama_at_gmail.com
Tsutomu	Kanasashi	Nagoya University	kanasashi.tsutomu_at_g.nagoya-u.jp
Shinji	Kaneko	Forestry and Forest Products Research Institute	kanekos_at_ffpri.affrc.go.jp
Yasushi	Katayama (Suzuki)	Kochi University	ysuzuki_at_kochi-u.ac.jp
Akira	Kato	Chiba University	akiran_at_faculty.chiba-u.jp
Etsushi	Kato	National Institute for Environmental Studies	kato.etsushi_at_nies.go.jp
Sumire	Kawamoto	Forestry and Forest Products Research Institute	sumire_at_affrc.go.jp
Mari	Kawase	Kyoto University	kawase.mari.75x_at_st.kyoto-u.ac.jp
Fumiaki	Kitahara	FFPRI	bunsho_at_ffpri.affrc.go.jp
Ryo	Kohsaka	KANAZAWA University	tomiyoshi_at_staff.kanazawa-u.ac.jp
Yuji	Kurahara	Forestry and Forest Products Research Institute	yujikura_at_affrc.go.jp
Manabu	Kurita	Forestry and Forest Products Research Institute	mkuri_at_affrc.go.jp
Takashi	Masaki	Forestry and Forest Products Research Institute	masaki_at_ffpri.affrc.go.jp
Misa	Masuda	University of Tsukuba	masuda.misa.gm_at_u.tsukuba.ac.jp
Yasushi	Mitsuda	Miyazaki University	mitsuda_at_cc.miyazaki-u.ac.jp

Satoru	Miura	Forestry and Forest Products Research Instituie	miura_at_ffpri.affrc.go.jp
Takafumi	Miyama	Department of Meteorological Environment	tmiyama_at_affrc.go.jp
Kanji	Mizutani	Forestry and Forest Products Research Institute	mizutani_at_ffpri.affrc.go.jp
Ryohei	Morimoto	Nagoya University	morimoto.ryouhei_at_a.mbox.nagoya-u.ac.jp
Hiroko	Muneoka	Forestry and Forest Products Research Institute	hirokomuneoka_at_affrc.go.jp
Kazuyo	Nagahama	University of Tokyo	kazuyona_at_zpost.plala.or.jp
Chika	Nakajima	Nagoya University	nakajima.chika_at_d.mbox.nagoya-u.ac.jp
Tadashi	Nakashiima	Kyoto University	tnakashi_at_kais.kyoto-u.ac.jp
Masahiko	Nakazawa	Forestry and Forest Products Research Institute	naka1978_at_ffpri.affrc.go.jp
Masaaki	Naramoto	Shizuoka University	amnaram_at_ipc.shizuoka.ac.jp
Toshio	Nitami	University of Tokyo	nitami_at_fr.a.u-tokyo.ac.jp
Yukihito	Ochiai	Forestry and Forest Products Research Institute	yukihito_at_affrc.go.jp
Hideki	Ogawa	Tokyo Metropolitan University	ogawa_hideki_01_at_pref.fukushima.lg.jp
Mizue	Ohashi	University of Hyogo	ohashi_at_shse.u-hyogo.ac.jp
Masashi	Ohsawa	Yamanashi Forest Research Institute	oosawa-ujk_at_pref.yamanashi.lg.jp
Kimiko	Okabe	Forestry and Forest Products Research Institute	kimikook_at_ffpri.affrc.go.jp
Isamu	Okochi	Forestry and Forest Products Research Institute	ohkou04_at_ffpri.affrc.go.jp
Tetsuji	Ota	Kyushu University	chochoji1983_at_gmail.com
Toshiaki	Owari	University of Tokyo	owari_at_uf.a.u-tokyo.ac.jp
Masashi	Saito	Shinshu University	m_saito_at_shinshu-u.ac.jp
Hideo	Sakai	University of Tokyo	sakaih_at_fr.a.u-tokyo.ac.jp
Yoshito	Sasaki	Japan Atomic Energy Agency	sasaki.yoshito_at_jaea.go.jp
Noriko	Sato	Kyushu University	sato.noriko.842_at_m.kyushu-u.ac.jp
Masami	Shiba	University of The Ryukyus	mshiba_at_agr.u-ryukyu.ac.jp
Kaori	Shiga	University of Tokyo	shiga_at_anesc.u-tokyo.ac.jp
Hideyuki	Shimizu	National Institute for Environmental Studies	hshimizu_at_nies.go.jp

Hiroaki	Shirasawa	Kyoto University	shira_at_kais.kyoto-u.ac.jp
Hiroshi	Suyama	Shimane Prefecture Mountainous Region Research Center	suyama-hiroshi_at_pref.shimane.lg.jp
Asako	Suzuki	Forestry and Forest Products Research Institute	asakom_at_ffpri.affrc.go.jp
Masamichi	Takahashi	Forestry and Forest Products Research Institute	masamiti_at_affrc.go.jp
Masayoshi	Takahashi	Forestry and Forest Products Research Institute	martaka_at_ffpri.affrc.go.jp
Yukiko	Takahashi	University of Tokyo	ytakah_at_gmail.com
Tsutomu	Takano	Forestry and Forest Products Research Institute	ttakano_at_ffpri.affrc.go.jp
Fugo	Takasu	Nara Women's University	takasu_at_ics.nara-wu.ac.jp
Shinya	Takeda	Kyoto University	takeda_at_asafas.kyoto-u.ac.jp
Hisatomo	Taki	Forestry and Forest Products Research Institute	htaki_at_affrc.go.jp
Ichiro	Tamaki	Gifu Academy of Science and Culture	garageit_at_gmail.com
Akemi	Tamaki (Itaya)	Mie University	itaya_at_bio.mie-u.ac.jp
Nobuhiko	Tanaka	Tokai University School of Tourism	tanaka_nobuhiko_at_tokai-u.jp
Toru	Terada	University of Tokyo	terada_at_k.u-tokyo.ac.jp
Jun	Teshirogi	Organization for Landscape and Urban Green Infrastructure	teshirogi_at_urbangreen.or.jp
Thinn	Thinn	Kyoto University	thinn07_at_gmail.com
Miki	Toda	University of Tsukuba	miki_at_elstyle.jp
Masato	Torii	Mie University	masa10torii_at_gmail.com
Keisuke	Toyama	University of Tokyo	toyama_at_uf.a.u-tokyo.ac.jp
Iwao	Uehara	Tokyo University of Agriculture	bigrock1964_at_hotmail.com
Mitsutoshi	Umemura	Nagoya University	i040013b_at_yahoo.co.jp
Ken	Watanabe	Forestry and Forest Products Research Institute	kenwatanabe_at_affrc.go.jp
Ryosuke	Watanabe	Nagoya University	rsf49233_at_gmail.com
Ugai	Watanabe	Chiba Institute of Technology	ugai.watanabe_at_it-chiba.ac.jp
Tsuyoshi	Yamada	Forestry and Forest Products Research Institute	yamadan_at_ffpri.affrc.go.jp
Yozo	Yamada	Nagoya University	yozo_at_agr.nagoya-u.ac.jp

Hirokazu	Yamamoto	University of Tokyo	yama_at_k.u-tokyo.ac.jp
Ping	Yang	International Wood Culture Society	yangping_at_educ.kumamoto-u.ac.jp
Hirohisa	Yoshida	Tokyo Metropolitan University	yoshida-hirohisa_at_tmu.ac.jp
Mika	Yoshida	University of Tokyo	yoshida_at_fr.a.u-tokyo.ac.jp
Mayumi	Yoshimura	Forestry and Forest Products Research Institute	yoshi887_at_ffpri.affrc.go.jp

KENYA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Paolo Omar	Cerutti	Center for International Forestry Research (CIFOR)	p.cerutti_at_cgiar.org
Ben	Chikamai	Kenya Forestry Research Institute	director_at_kefri.org
Joram Kimenju	Kagombe	Kenya Forestry Research Institute	jokagombe_at_yahoo.com
Elizabeth	Kahurani	World Agroforestry Centre (ICRAF)	e.kahurani_at_cgiar.org
Naomi Njoki	Kangyugo	World Agroforestry Centre (ICRAF)	NKanyugo_at_cgiar.org
Joyce Mulekye	Kasyoki	World Agroforestry Centre (ICRAF)	J.KASYOKI_at_CGIAR.ORG
Margaret Mattu	Kroma	World Agroforestry Centre (ICRAF)	c.gathoni_at_cgiar.org
Larwanou	Mahamane	African Forest Forum	M.Larwanou_at_CGIAR.ORG
Maimbo Mabanga	Malesu	World Agroforestry Centre (ICRAF)	M.Malesu_at_cgiar.org
Oscar	Mayunzu	Kenya Forestry Research Institute	omayunzu_at_gmail.com
Sheila	Mbiru	Kenya Forestry Research Institute	sheilambiru_at_gmail.com
Peter	Minang	World Agroforestry Centre (ICRAF)	a.minang_at_cgiar.org
Meshack	Muga	Kenya Forestry Research Institute	meshackmuga_at_hotmail.com
Josephine Kamene	Musyoki	Kenya Forestry Research Institute	josephinemusyoki_at_yahoo.com
Catherine Wangari	Muthuri	World Agroforestry Centre (ICRAF)	c.muthuri_at_cgiar.org
Eston	Mutitu	Kenya Forestry Research Institute	estonmutitu_at_gmail.com
Sara	Namirembe	World Agroforestry Centre (ICRAF)	S.Namirembe_at_cgiar.org
Stephen	Ndung'u	Kenya Forestry Research Institute	stephenmn06_at_gmail.com
Henry	Neufeldt	World Agroforestry Centre (ICRAF)	H.Neufeldt_at_cgiar.org

Hellen	Ochieng	World Agroforestry Centre (ICRAF)	h.ochieng_at_cgiar.org
Nellie	Oduor	Kenya Forestry Research Institute	nelliecoduor_at_yahoo.com
James	Onchieku	Kenya Forestry Research Institute	jonchiekukefri_at_yahoo.com
Phosiso	Sola	Center for International Forestry Research (CIFOR)	p.sola_at_cgiar.org
Paul	Stapleton	World Agroforestry Centre (ICRAF)	p.stapleton_at_cgiar.org
Catharine	Watson	World Agroforestry Centre (ICRAF)	C.watson_at_cgiar.org
Chemuku	Wekesa	Kenya Forestry Research Institute	chemukukefri_at_gmail.com

KOREA, PDR

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Fekadu Tarekegne	Teshale	Seoul National University	ftarekegne_at_yahoo.com

KOREA, REPUBLIC OF

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Jae Soo	Bae	Korea Forest Research Institute	forestory_at_forest.go.kr
Hanna	Chang	Korea University	wkdgkssk59_at_naver.com
Wonwoo	Cho	Dongguk University	valkyre_at_naver.com
Hyung Tae	Choi	Korea Forest Research Institute	choih_at_forest.go.kr
Jungkee	Choi	Kangwon National University	jungkee_at_kangwon.ac.kr
Se Kyung	Chong	Korea Forest Research Institute	skchong_at_korea.kr
SeungHyun	Han	Korea University	aryian_at_naver.com
Xiaohuan	Hu	Seoul National University	huxiaohuan1989_at_gmail.com
Jaehong	Hwang	Korea Forest Research Institute	jhwang_at_forest.go.kr
Hyeonsoo	Jang	Dongguk University	jang870331_at_naver.com
You Lim	Jang	Seoul National University	wkddbfla1209_at_naver.com
Hyun-Kil	Jo	Kangwon National University	jhk_at_kangwon.ac.kr
Minjoeng	Jo	Korea Forest Research Institute	auroramin_at_forest.go.kr

Ho Sang	Kang	Seoul National University	silvi_at_chol.com
Hoduck	Kang	Dongguk University	hdk0225_at_dongguk.edu
Kyu-Suk	Kang	Seoul National University	kangks84_at_snu.ac.kr
Inkyin	Khaine	University of Seoul	inkyinkhainefd_at_gmail.com
Joon soon	Kim	Chungnam National University	jskim_at_kangwon.ac.kr
Kyongha	Kim	Korea Forest Research Institute	kkyha_at_forest.go.kr
Mee Sook	Kim	Kookmin University	mkim_at_kookmin.ac.kr
Moonil	Kim	Korea University	windy7up_at_naver.com
Myung Kil	Kim	Korea Forest Research Institute	mkkim_at_forest.go.kr
Se Bin	Kim	Korea Forest Research Institute	sbkim_at_cnu.ac.kr
Myeong Ja	Kwak	University of Seoul	016na8349_at_hanmail.net
Munkhnasan	Lamchin	Korea University	naska_l_at_yahoo.com
Changwoo	Lee	Korea Research Institute	leecw_at_forest.go.kr
Daesung	Lee	Kangwon National University	zpt753_at_gmail.com
Don Koo	Lee	Seoul National University	leedk_at_snu.ac.kr
Eun Jung	Lee	Korea University	leeej1212_at_korea.ac.kr
Jeonghee	Lee	Korea Forest Research Institute	jeong86_at_forest.go.kr
Oh-Kyu	Lee	Korea Forest Research Institute	oklee_at_forest.go.kr
Sora	Lee	Dongguk University	ssora4rang_at_nate.com
Yohan	Lee	Yeungnam University	yohanlee76_at_gmail.com
UK	Lee	Korea Forest Research Institute	rich26_at_forest.go.kr
Woo Kyun	Lee	Korea University	leewk_at_korea.ac.kr
Jong Hwan	Lim	Korea Forest Research Institute	limstree_at_hanmail.net
Byung Bae	Park	Chungnam National University	bbpark_at_cnu.ac.kr
Hye-Mi	Park	Kangwon National University	bhm63_at_kangwon.ac.kr
Ji-Hyun	Park	Korea Forest Research Institute	jhpark110_at_gmail.com
Joo-Saeng	Park	Korea Forest Research Institute	jusang_at_forest.go.kr

Jung-Hwan	Park	Korea Forest Research Institute	hwanpark_at_forest.go.kr
Pil Sun	Park	Seoul National University	pspark_at_snu.ac.kr
Yeong Dae	Park	Daegu University	parkyd_at_daegu.ac.kr
Yonggun	Park	Seoul National University	gunny007_at_snu.ac.kr
Youngki	Park	Korea Forest Research Institute	ykpark_at_forest.go.kr
Yeongwan	Seo	Kangwon National University	ywseo_at_kangwon.ac.kr
Yowhan	Son	Korea University	yson_at_korea.ac.kr
Cholho	Song	Korea University	cholhosong_at_korea.ac.kr
Phyo	Thu	Seoul National University	phyothu_at_snu.ac.kr
Kwan-Soo	Woo	Korea Forest Research Institute	woo9431_at_forest.go.kr
Su-Young	Woo	University of Seoul	wsy_at_uos.ac.kr
Hwanmyeong	Yeo	Seoul National University	hyeo_at_snu.ac.kr
Yeo-Chang	Youn	Seoul National University	youn_at_snu.ac.kr
Cheong Ho	Yi	Korea University	yicheongho_at_korea.ac.kr
Mihae	Yoon	Korea University	lovemihae_at_gmail.com
Young Kyoon	Yoon	Korea Forest Research Institute	yyk57_at_forest.go.kr
Byung Oh	You	Korea Forest Research Institute	boyoofri_at_forest.go.kr
Sojin	Youn	Seoul National University	youn.susan.sojin_at_gmail.com

LATVIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Guntis	Brumelis	University of Latvia	guntis.brumelis_at_lu.lv
Ilze	Jankovska	University of Latvia	ilze.jankovska_at_llu.lv

LITHUANIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Marius	Aleinikovas		m.aleinikovas_at_mi.lt

Ingrida	Augustaitiene	Aleksandras Stulginskis University	iaugustaitiene_at_gmail.com
Algirdas	Augustaitis	Aleksandras Stulginskis University	algirdas.augustaitis_at_asu.lt
Marius	Kavaliauskas	Aleksandras Stulginskis University	marius.kavaliauskas_at_gmail.com
Vitas	Marozas	Aleksandras Stulginskis University	vitas.marozas_at_asu.lt
Diana	Mizaraite	Lithuanian Research Centre for Agriculture and Forestry	ekonsk_at_mi.lt
Stasys	Mizaras	Lithuanian Research Centre for Agriculture and Forestry	stasys.mizaras_at_gmail.com
Gintautas	Mozgeris	Aleksandras Stulginskis University	gintautas.mozgeris_at_asu.lt
Gediminas	Capkauskas	Lithuanian Research Centre for Agriculture and Forestry	gediminas.capkauskas_at_gmail.com
Povilas	Žemaitis	Lithuanian Research Centre for Agriculture and Forestry	povilaszemaitis_at_gmail.com

MACEDONIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Peter	Kampen	Connecting Natural Value & People Foundation	peter.kampen_at_cnvp-eu.org

MADAGASCAR

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Harifidy	Rakoto Ratsimba	University of Antananarivo	rrharifidy_at_moov.mg
Bruno Salomon	Ramamonjisoa	University of Antananarivo	bruno.ramamonjisoa_at_gmail.com
Tahiana	Ramananantoandro	University of Antananarivo	ramananantoandro_at_gmail.com

MALAYSIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Mohd Zaki	Abdullah	Forest Research Institute Malaysia (FRIM)	zaky_at_frim.gov.my
Mohd Zulhilmy	Abdullah	Tropical Peat Research Laboratory Unit	mdzoolhillmy_at_gmail.com
Ismariah	Ahmad	Forest Research Institute Malaysia (FRIM)	ismariah_at_frim.gov.my
Y. C. Arthur	Chung	Sabah Forestry Department	arthur.chung_at_sabah.gov.my
Kee Seng	Gan	Forest Research Institute Malaysia (FRIM)	ganks_at_frim.gov.my

Seca	Gandaseca	University Putra Malaysia	seca_at_upm.edu.my
Md. Aktar	Hossain	University Putra Malaysia	aktar_forestry_at_hotmail.com
Rosdi	Koter	Forest Research Institute Malaysia (FRIM)	rosdi_at_frim.gov.my
Chai Ting	Lee	Forest Research Institute Malaysia (FRIM)	leechait_at_frim.gov.my
Su See	Lee	Forest Research Institute Malaysia (FRIM)	leess_at_frim.gov.my
Kang Chiang	Liew	University Malaysia Sabah	liewkc_at_ums.edu.my
Sreetheran	Maruthaveeran	University of Copenhagen	sree_at_life.ku.dk
Lulie	Melling	Tropical Peat Research Laboratory Unit	luliemelling_at_gmail.com
Nor Azah Binti	Mohamad Ali	Forest Research Institute Malaysia (FRIM)	norazah_at_frim.gov.my
Salleh	Mohd. Nor	IUFRO Past President	salleh.mohdnor_at_gmail.com
Ahmad Ainuddin Bin	Nuruddin	University Putra Malaysia	ainuddin_at_upm.edu.my
Hamdan	Omar	Forest Research Institute Malaysia (FRIM)	hamdanomar_at_frim.gov.my
Muhammad Amar	Shaaruddin	Forest Research Institute Malaysia (FRIM)	mohdfarid_at_frim.gov.my
Huei Shing	Sik	Forest Research Institute Malaysia (FRIM)	sik_at_frim.gov.my
Mohd Nazip	Suratman	University Teknologi MARA	nazip_at_salam.uitm.edu.my
Jeyanny	Vijayanathan	Forest Research Institute Malaysia (FRIM)	jeyanny_at_frim.gov.my
Andrew Han Hoy	Wong	University Malaysia Sarawak	awong.unimas_at_gmail.com
Guan Xhuan	Wong	Tropical Peat Research Laboratory Unit	jiaxiang31_at_hotmail.com

MEXICO

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Oscar Alberto	Aguirre Calderón	Autonomous University of Nuevo León	oscar.aguirrecl_at_uanl.edu.mx
Victor	Avila-Akerberg	Autonomous University of the State of Mexico	vicaviak_at_gmail.com
Erickson	Basave	Higher Technological Institute of Venustiano Carranza	erbavi_88_at_hotmail.com
Antonio	Bernabe-Antonio	Universidad Autonoma Del Estado De Morelos	bernabe_aa_at_hotmail.com
Julia	Calderon Cendejas		ju.huehuetlatolli_at_gmail.com
Celi Gloria	Calixto	Higher Technological Institute of Venustiano Carranza	celi86_2_at_hotmail.com

Mariana Xanat	Cantu Fernandez	National Autonomous University of Mexico	mcantulca_at_gmail.com
Israel	Cantu Silva	Autonomous University of Nuevo León	icantu59_at_gmail.com
Oswaldo Ismael	Carrillo Negrete	National Forestry Commission	oswaldisma_at_gmail.com
Natalia	Castelan Munoz	Agricultural Sciences Graduate College, Montecillo	nayaritzin_at_yahoo.com.mx
José Javier	Corral Rivas	Juarez University of the State of Durango	jcorral_at_ujed.mx
Francisco	Dominguez Hernandez	Meritorious Autonomous University of Puebla	forestal_umar_at_hotmail.com
Guadalupe Geraldine	García Espinoza	Universidad Michoacana de San Nicolás de Hidalgo	lyera_1623_at_hotmail.com
J. Jesús	García Magaña		elparachogen23_at_hotmail.com
Humberto	Gonzalez Rodriguez	Autonomous University of Nuevo León	humberto.gonzalezrd_at_uanl.edu.mx
Manuel de Jesús	González-Guillén	Colegio de Postgraduados	manuelg_at_colpos.mx
Patricia	Hernández de la Rosa	Colegio de Postgraduados	pathr_at_colpos.mx
José Ciro	Hernández-Díaz	Juarez University of the State of Durango	jciroh_at_ujed.mx
Martha Isabel	Ruiz Corzo	Viva Sierra Gorda	Ruiz_at_iufro.org
Javier	Jimenez	Autonomous University of Nuevo León	jjimenez20_at_gmail.com
Pablito Marcelo	Lopez Serrano	Juarez University of the State of Durango	inglopez_13_at_hotmail.com
Concepcion	Lujan	Autonomous University of Chihuahua	clujan12_at_hotmail.com
Carlos Antonio	López-Sánchez	Juarez University of the State of Durango	calopez_at_ujed.mx
Héctor Leonardo	Martínez Torres	National Autonomous University of Mexico	lmartinez_at_cieco.unam.mx
Jose	Medina Mora De Leon	National Forestry Commission	jose.medinamora_at_conafor.gob.mx
Martin	Mendoza	Colegio de Postgraduados	martinmendoza_at_yahoo.com
Sergio	Nicasio	National Autonomous University of Mexico	snicasio_at_cieco.unam.mx
Marcela	Olguín Alvarez	National Forestry Commission	olguin.conafor_at_gmail.com
Jaime	Paneque Gálvez	CIGA-UNAM & ICTA-UAB	jpanequegalvez_at_gmail.com
Laura	Perez-Arce	Viva Sierra Gorda	sierragordareserve_at_yahoo.com
Gustavo	Perez-Verdin	National Polytechnic Institute	guperezv_at_ipn.mx
Miguel Angel	Pulgarin Gamiz	Juarez University of the State of Durango	Mpulgarin_at_ujed.mx
Diego	Pérez Salicrup	National Autonomous University of Mexico	diego_at_cieco.unam.mx

Sandra	Rodriguez	Autonomous University of Chihuahua	sandra_osu_at_yahoo.com
Jose Antonio	Sierra Huelsz	University of Florida	jasierra_at_ufl.edu
Margaret	Skutsch	National Autonomous University of Mexico	mskutsch_at_ciga.unam.mx
Raul	Solís	Juarez University of the State of Durango	rsolis_at_ujed.mx
Germán	Suárez-Béjar	Universidad Michoacana de San Nicolás de Hidalgo	gezzoster_at_gmail.com
Eduardo Javier	Treviño Garza	Autonomous University of Nuevo León	eduardo.trevinogr_at_uanl.edu.mx
Oscar Armando	Ugartechea Salmerón		960.oscar_at_gmail.com
Benedicto	Vargas-Larreta	Instituto Tecnológico de El Salto. DGEST DGEST	bvargas_at_itelsalto.edu.mx
Alejandra Yunuen	Zaragoza Hernandez	Colegio de Postgraduados	zara407_at_hotmail.com

MOLDOVA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Valeriu	Caisin	Forest Research and Management Institute (ICAS)	valeriu.caisin_at_enpi-fleg.org
Dumitru	Galupa	Forest Research and Management Institute (ICAS)	dgalupa_at_yahoo.com

MONGOLIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Khaulenbek	Akhmadi	Institute of Geoecology	khaulenbek_at_yahoo.com
Tsogtbaatar	Jamsran	Mongolian Academy of Sciences	tsogtbaatarj_at_magicnet.mn
Batkhuu	Nyam-Osor	National University of Mongolia	bnyamosor_at_yahoo.com
Enkhchimeg	Tsedensodnom	Institute of Geoecology	enkhii_smile_at_yahoo.com

MOZAMBIQUE

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Takuya	Homma		takuya.homma_at_gmail.com
Fatima	Kanji Bonete		fkanjibonete_at_yahoo.com.br

Joaquim	Macuacua		joaquimmacuacua_at_gmail.com
Almeida	Sitoe	Eduardo Mondlane University	almeidasitoe_at_gmail.com

MYANMAR (BURMA)

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Cho Cho Win	Win	Forest Research Institute	chochosnow1_at_gmail.com

NAMIBIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Selma Ndemutila	Elago	Ministry of Agriculture, Water and Forestry	selmaelago06_at_gmail.com

NEPAL

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Shankar	Adhikari	Ministry of Forests and Soil Conservation / University of Melbourne	adhikarishankar_at_gmail.com
Madhu Devi	Ghimire	Ministry of Forests and Soil Conservation	ghimire.madhu_at_gmail.com
Bharat	Gotame	ForestAction Nepal	bgotame_at_gmail.com
Rajan	Kotru	International Centre for Integrated Mountain Development (ICIMOD)	Rajan.Kotru_at_icimod.org
Dhananjaya	Lamichhane	Ministry of Forests and Soil Conservation	dlamichhane_at_gmail.com
Ram Prasad	Lamsal	Ministry of Forests and Soil Conservation	ramplamsal_at_gmail.com
Him Lal	Shrestha	Kathmandu University	hlshrestha_at_gmail.com
Dharam Raj	Uprety	Multi Stakeholder Forestry Programme (MSFP)	dharam.uprety_at_gmail.com

NETHERLANDS

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Lucy	Amissah	Wageningen University / CSIR-Forestry Research Institute of Ghana	ewurakua.amissah_at_gmail.com
Mali	Boomkens	AgroParisTech – ENGREF	mali.boomkens_at_gmail.com

Lisa Karina	Broekhuizen	International Forestry Students' Association (IFSA)	ifsow.sylvatica_at_gmail.com
Theresia	de Kruijff	Wageningen University	thirza.dekruijff_at_wur.nl
Alexander	Engel	Wageningen University	alex.engel_at_wur.nl
Bob	Hendrikx	Wageningen University	bob.hendrikx_at_wur.nl
Geerten	Hengeveld	Wageningen University, Alterra	geerten.hengeveld_at_wur.nl
Martin	Herold	Wageningen University	martin.herold_at_wur.nl
Yousif	Hussin	University of Twente	y.a.hussin_at_utwente.nl
Gerardus	Nabuurs	Wageningen University, Alterra	gert-jan.nabuurs_at_wur.nl
Melissa Gwendolyn	Onwezen	Wageningen University	melissa.onwezen_at_wur.nl
Mart-Jan	Schelhaas	Wageningen University, Alterra	MartJan.Schelhaas_at_wur.nl
Johannes	van Dijk	African Studies Centre	han.vandijk_at_wur.nl
Ingrid	Visseren-Hamakers	Wageningen University	ingrid.visseren_at_wur.nl

NEW ZEALAND

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Stanley	Bellgard	Landcare Research, Ltd.	BellgardS_at_landcareresearch.co.nz
Eckehard	Brockerhoff	Scion (New Zealand Forest Research Institute)	eckehard.brockerhoff_at_scionresearch.com
Andrew	Buchanan	University of Canterbury	andy.buchanan_at_canterbury.ac.nz
Peter	Clinton	Scion (New Zealand Forest Research Institute)	Peter.Clinton_at_scionresearch.com
Thomas	Paul	Scion (New Zealand Forest Research Institute)	thomas.paul_at_scionresearch.com
Timothy	Payn	Scion (New Zealand Forest Research Institute)	tim.payn_at_scionresearch.com
Stefania	Pizzirani	Scion (New Zealand Forest Research Institute)	stefania.pizzirani_at_scionresearch.com
Toni	Withers	Scion (New Zealand Forest Research Institute)	toni.withers_at_scionresearch.com

NICARAGUA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Angela Cristina	Paredes Alvarado	University of Freiburg	angelaparedes_at_gmail.com
Sheila Edith	Zamora Lopez	University of Hamburg	szamora.lopez_at_gmail.com

NIGERIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Ene Augustine	Abi	Forestry Research Institute of Nigeria (FRIN)	eneabi2008_at_yahoo.com
Musifat	Abosede Kolapo	University of Ibadan	rarebee_31_at_yahoo.co.uk
Gideon	Adedayo	Federal University of Technology Akure	gideonadedayo_at_yahoo.com
Olajide Rasaq	Adejoba	Forestry Research Institute of Nigeria (FRIN)	dejob_j_at_yahoo.com
Olubunmi Pauline	Adejoh	Forestry Research Institute of Nigeria (FRIN)	bumexd_at_yahoo.com
Victor Ajibola Jimoh	Adekunle	Federal University of Technology	adekunlevaj_at_rediffmail.com
Aladesanmi Daniel	Agbelade	Federal University of Technology	aladesanmi2008_at_gmail.com
Oluyinka	Akintunde	Federal University of Technology	akol_ak_at_yahoo.com
Adejoke	Akinyele	University of Ibadan	akinyelejo_at_yahoo.co.uk
Abiola	Amao	Forestry Research Institute of Nigeria (FRIN)	funkebee2002_at_yahoo.com
Gloria Titi	Anguruwa	Forestry Research Institute of Nigeria (FRIN)	glo.vision_at_yahoo.com
Oghenekevwe Joy	Arabomen	Forestry Research Institute of Nigeria (FRIN)	arabomenkevwe2009_at_yahoo.com
Oluwayemisi Grace	Arowosoge	Department of Forestry, Wildlife and Fisheries Management	yemisoge_at_yahoo.co.uk
Uyi	Asemota	International Forestry Students Association	uyi.ifsa_at_gmail.com
Felix	Aya	University of Calabar	ayafelix_at_yahoo.co.uk
Adedunmola Abosede	Ayomide	Forestry Research Institute of Nigeria (FRIN)	adedunmolalala_at_yahoo.com
Tolulope	Daramola	University of British Columbia	t.daramola_at_yahoo.com
Kelechi	Eleanya	Federal University of Ducima	kele802001_at_yahoo.com
Agbolahan Ayodeji	Hassan		lawalmojeed10_at_yahoo.com

Olayinka	Iroko	Forestry Research Institute of Nigeria (FRIN)	yinkairoko_at_gmail.com
Ekeoba Matthew	Isikhuemen	University of Benin	ekeoba.isikhuemen_at_uniben.edu
Opeyemi	Jegede	Forestry Research Institute of Nigeria (FRIN)	opeyemijegede20_at_yahoo.com
Adebayo John	Julius	Forestry Research Institute of Nigeria (FRIN)	talktobayo247_at_yahoo.com
Kikelomo	Kola-Oladiji	Forestry Research Institute of Nigeria (FRIN)	kikdiji_at_yahoo.com
Oluseun	Ogunade	Forestry Research Institute of Nigeria (FRIN)	seunogunade_at_yahoo.com
Adekunle	Oladele	University of Port Harcourt	adekunle.oladele_at_uniport.edu.ng
Samuel Olalekan	Olajuyigbe	University of Ibadan	lekito2001_at_yahoo.com
Olufunke Olubusayo	Olayode	Ekiti State University	funkefaboy_at_yahoo.com
Abel	Olorunnisola	University of Ibadan	abelolorunnisola_at_yahoo.com
Oluseyi Olutoyin	Olugbire	Forestry Research Institute of Nigeria (FRIN)	olugbireolutoyin_at_gmail.com
Jonathan Chukwujekwu	Onyekwelu	Federal University of Technology	onyekwelujc_at_yahoo.co.uk
Mac-Anthony	Onyema	Federal University of Technology	mac-anthony.onyema_at_futo.edu.ng
Ioryisa	Verinumbe	University of Agriculture Makurdi	iverinumbe_at_yahoo.com

NORWAY

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Rasmus	Astrup	Norwegian Forest and Landscape Institute (NFLI)	rasmusastrup_at_gmail.com
Arne	Bardalen	Norwegian Forest and Landscape Institute (NFLI)	arb_at_skogoglandskap.no
Isabella	Borja	Norwegian Forest and Landscape Institute (NFLI)	isabella.borja_at_skogoglandskap.no
Johannes	Breidenbach	Norwegian Forest and Landscape Institute (NFLI)	job_at_skogoglandskap.no
Kristian	Bysheim	Norwegian Institute of Wood Technology	kristian.bysheim_at_treteknisk.no
Nicholas	Clarke	Norwegian Forest and Landscape Institute (NFLI)	nicholas.clarke_at_skogoglandskap.no
Lise	Dalsgaard	Norwegian Forest and Landscape Institute (NFLI)	lid_at_skogoglandskap.no
Tron Haakon	Eid	Norwegian University of Life Sciences	tron.eid_at_nmbu.no
Jon-Anders	Frank	Norwegian University of Life Sciences	jon.frank_at_nmbu.no

Gro	Hylen	Norwegian Forest and Landscape Institute (NFLI)	gro.hylen_at_skogoglandskap.no
Olaug Janne	Kjønaas	Norwegian Forest and Landscape Institute (NFLI)	janne.kjonaas_at_skogoglandskap.no
Paal	Krokene	Norwegian Forest and Landscape Institute (NFLI)	krp_at_skogoglandskap.no
Sasikumar	Kumarasamy	Norwegian University of Science and Technology	sasi451_at_yahoo.com
Holger	Lange	Norwegian Forest and Landscape Institute (NFLI)	holger.lange_at_skogoglandskap.no
Berit Hauger	Lindstad	Norwegian University of Life Sciences	berit.lindstad_at_nmbu.no
Nina Elisabeth	Nagy	Norwegian Forest and Landscape Institute (NFLI)	nina.nagy_at_skogoglandskap.no
Erlend	Nybakk	Norwegian Forest and Landscape Institute (NFLI)	nye_at_skogoglandskap.no
Line	Nybakken	Norwegian University of Life Sciences	line.nybakken_at_nmbu.no
Erik	Næsset	Norwegian University of Life Sciences	erik.naesset_at_nmbu.no
Tonje	Økland	Norwegian Forest and Landscape Institute (NFLI)	tonje.okland_at_skogoglandskap.no
Jorund	Rolstad	Norwegian Forest and Landscape Institute (NFLI)	jorund.rolstad_at_skogoglandskap.no
Hanne K.	Sjølie	Norwegian University of Life Sciences	hanne.sjolie_at_nmbu.no
Aaron	Smith	Norwegian Forest and Landscape Institute (NFLI)	aaron.smith_at_skogoglandskap.no
Birger	Solberg	Norwegian University of Life Sciences	birger.solberg_at_umb.no
Svein	Solberg	Norwegian Forest and Landscape Institute (NFLI)	sos_at_skogoglandskap.no
Ellen	Soldal	Norwegian University of Life Sciences	ellen.soldal_at_nmbu.no
Jogeir N.	Stokland	Norwegian Forest and Landscape Institute (NFLI)	jogeir.stokland_at_skogoglandskap.no
Ken Olaf	Storaunet	Norwegian Forest and Landscape Institute (NFLI)	stk_at_skogoglandskap.no
Christian Bianchi	Strømme	Norwegian University of Life Sciences	christian.stromme_at_nmbu.no
Magne	Sætersdal	Norwegian Forest and Landscape Institute (NFLI)	sem_at_skogoglandskap.no

PANAMA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Carlos	Navarro	Azuero Earth Project	carlos_at_azueroearthproject.org

PAPUA NEW GUINEA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Gewa	Gamoga	FAO	gamogagewa_at_gmail.com
Bruno	Kuroh	Papua New Guinea Forest Authority	Bkroh_at_fri.pngfa.gov.pg

PARAGUAY

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Manuel Marino	Enciso Gomez	Universidad Nacional de Asuncion	manuelenci_at_yahoo.com
Maria Lis	Garcia	Universidad Nacional de Asuncion	marialisgarcia_at_gmail.com
Maria Laura	Quevedo Fernandez	Universidad Nacional de Asuncion	lauraqbp_at_gmail.com

PERU

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Ronner Ivan	Alvarado Rengifo		ronner86_at_hotmail.com
Germán	Correa	Universidad Nacional Amazónica de Madre de Dios	biologo.geo_at_yahoo.com
Farrah Indira	Galindo Jara	Universidad Nacional Agraria de la Molina	indira_galindo_jara_at_hotmail.com
Manuel	Guariguata	Center for International Forestry Research (CIFOR)	m.guariguata_at_cgiar.org
Anne	Larson	Center for International Forestry Research (CIFOR)	a.larson_at_cgiar.org
Carmen	Osorio	Independent	marcela.mosorio_at_gmail.com
Valentina	Robiglio	World Agroforestry Centre (ICRAF)	v.robiglio_at_cgiar.org
Jorge Gustavo	Suarez de Freitas Calmet	Ministry of Environment, Peru	gsuarezdefreitas_at_minam.gob.pe
Alipse	Valera	WWF Peru	alipse.valera_at_wwfperu.org
Renzo Carlos	Vergara Arellano	Ministry of Agriculture and Irrigation, Peru	rvergara_at_minagri.gob.pe

PHILIPPINES

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Romulo	Aggangan	Forest Products Research and Development Institute	rtaggangan_at_gmail.com

Nathaniel	Bantayan	University of Philippines Los Baños	ncbantayan_at_gmail.com
Leonida	Bugayong	Forestry Development Center, UPLB-CFNR	lenlab82_at_gmail.com
Jose Alan	Castillo	Ecosystems Research and Development Bureau	allan536_at_yahoo.com
Marilyn	Combalicer	University of the Philippines Los Baños	msc1330_at_gmail.com
Jan Joseph	Dida	University of the Philippines Los Baños	jjvdida_at_gmail.com
Angelito	Exconde	Ecosystems Research and Development Bureau	angelitoexconde_at_yahoo.com.ph
Janelle Bianca Cueno	Fernandez	University of the Philippines Los Baños	ja_isfranticallydizzy_at_yahoo.com
Aida	Lapis	Ecosystems Research and Development Bureau	acbl2002_at_yahoo.com
Nelson Manguiat	Pampolina	University of the Philippines Los Baños	nelsonmanguiatpampolina_at_yahoo.com
Floribel	Paras	University of the Philippines	fdparas_at_gmail.com
Rose Jane	Peras	University of the Philippines Los Baños	rjjperas_at_gmail.com
David	Rodolfo	Apayao State College	flynrodolfo_at_yahoo.com
Crusty	Tinio	University of the Philippines Los Baños	crusty.estoque_at_yahoo.com
Rizza Karen	Veridiano	University of the Philippines Los Baños	karen.ffiphilippines_at_gmail.com

POLAND

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Radomir	Balazy	Forest Research Institute	R.Balazy_at_ibles.waw.pl
Szymon Lech	Bijak	Warsaw University of Life Sciences	szymon.bijak_at_wl.sggw.pl
Karol	Bronisz	Warsaw University of Life Sciences	karol.bronisz_at_wl.sggw.pl
Agnieszka	Bronisz	Warsaw University of Life Sciences	Agnieszka.Bronisz_at_wl.sggw.pl
Janusz	Czerepko	Forest Research Institute	j.czerepko_at_ibles.waw.pl
Dorota	Dobrowolska	Forest Research Institute	d.dobrowolska_at_ibles.waw.pl
Arkadiusz	Gruchała	Warsaw University of Life Sciences	arekg_at_wl.sggw.pl
Witold Wiesław	Grzywiński	Poznań University of Life Sciences	witold.grzywinski_at_up.poznan.pl
Adam	Lubera	Polish State Forests	adamlubera_at_wp.pl
Stanisław	Małek	University of Agriculture in Krakow	rlmalek_at_cyf-kr.edu.pl

Stanislaw	Miscicki	Warsaw University of Life Sciences	stanislaw.miscicki_at_wl.sggw.pl
Piotr	Paschalis-Jakubovicz	Warsaw University of Life Sciences	Piotr.Paschalis_at_wl.sggw.pl
Maciej	Skorupski	Poznań University of Life Sciences	maskorup_at_up.poznan.pl
Janusz	Sowa	University of Agriculture in Krakow	rlsowa_at_cyf-kr.edu.pl
Pawel	Staniszewski	Warsaw University of Life Sciences	pawel.staniszewski_at_wl.sggw.pl
Krzysztof	Stereńczak	Forest Research Institute	K.Sterenczak_at_ibles.waw.pl
Adam	Wasiak	Polish State Forests	sekretariat_at_lasy.gov.pl
Andrzej	Węgiel	Poznań University of Life Sciences	wegiel_at_up.poznan.pl
Michał	Zasada	Warsaw University of Life Sciences	Michal.Zasada_at_wl.sggw.pl
Tomasz	Zawila-Niedzwiecki	Polish State Forests	tomasz.zawila_at_lasy.gov.pl

PORTUGAL

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Jose	Borges	Technical University of Lisbon	joseborges_at_isa.utl.pt
Miguel	Bugalho	Technical University of Lisbon / WWF Mediterranean Program	mbugalho_at_wwfmedpo.org
Nuno Manuel	Cabral de Almeida Ribeiro	University of Evora	nribeiro_at_uevora.pt
Teresa de Jesus	Fidalgo Fonseca	University of Trás-os-Montes and Alto Douro	tfonseca_at_utad.pt
Luis	Fontes	Technical University of Lisbon	luisfontes_at_isa.ulisboa.pt
Jordi	Garcia-Gonzalo	Technical University of Lisbon	jordigarcia_at_isa.utl.pt
Susana	Miguel Barreiro	Technical University of Lisbon	smb_at_isa.utl.pt
Luis	Neves Silva	WWF International	lnsilva_at_wwfint.org
João HN	Palma	Technical University of Lisbon	joaopalma_at_isa.ulisboa.pt
Margarida	Tomé	Technical University of Lisbon	magatome_at_isa.ulisboa.pt

ROMANIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Ioan Vasile	Abrudan	Transilvania University of Brașov	abrudan_at_unitbv.ro

Nicolae Ovidiu	Badea	Forest Research and Management Institute (ICAS)	obadea_at_icas.ro
Stelian Alexandru	Borz	Transilvania University of Brașov	stelian.borz_at_unitbv.ro
Alexandru Lucian	Curtu	Transilvania University of Brașov	lucian.curtu_at_unitbv.ro
Simon	Diana-Cristina	Transilvania University of Brașov	f-sef_at_unitbv.ro
Gheorghe	Ignea	Transilvania University of Brașov	igneagh_at_unitbv.ro
Stefan	Neagu	Forest Research and Management Institute (ICAS)	stefanneagu_at_yahoo.com
Valeriu-Norocel	Nicolescu	Transilvania University of Brașov	nvnicolescu_at_unitbv.ro
Ionel	Popa	Forest Research and Management Institute (ICAS)	popaicas_at_gmail.com
Neculae	Sofletea	Transilvania University of Brașov	nic.sofletea_at_unitbv.ro
Romică	Tomescu	Forest Research and Management Institute (ICAS)	biometrie_at_icas.ro

RUSSIAN FEDERATION

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Galina	Antonova	Sukachev Institute of Forest	antonova_cell_at_mail.ru
Viacheslav	Kharuk	Sukachev Institute of Forest	kharuk_at_ksc.krasn.ru
Elena	Muratova	Sukachev Institute of Forest	elena-muratova_at_ksc.krasn.ru
Vladimir V.	Nikitin	Moscow State Forest University	nick_at_mgul.ac.ru
Victor	Sanaev	Moscow State Forest University	box534_at_mail.ru
Valentin	Shalaev	Moscow State Forest University	shalaev_at_mgul.ac.ru
Nadezhda	Tchebakova	Sukachev Institute of Forest	ncheby_at_ksc.krasn.ru
Dmitry	Zamolodchikov	Russian Academy of Science	dzamolod_at_mail.ru

SAUDI ARABIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Thobayet	Alshahrani	King Saud University	thobayet_at_yahoo.com

SENEGAL

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Faye	Laurice Codou	Institut Des Sciences	queenlaurice19_at_yahoo.fr

SERBIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Vladislav	Vejnovic	International Forestry Students Association	vladislav.ifsa_at_gmail.com

SINGAPORE

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Ruolei	Zhu	National University of Singapore	a0086261_at_nus.edu.sg

SLOVAKIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Yvonne	Brodrechtova	Technival University in Zvolen	brodrechtova_at_tuzvo.sk
Tomáš	Bucha	National Forest Center Zvolen	bucha_at_nlcsk.org
Ľubica	Ditmarová	Slovak Academy of Sciences	ditmarova_at_sav.savzv.sk
Daniel	Halaj	Technical University in Zvolen	halaj_at_tuzvo.sk
Katarina	Merganicova	Technical University in Zvolen	merganicova_at_tuzvo.sk
Martin	Moravcik	National Forest Centre	moravcik_at_nlcsk.org
Hubert	Palus	Technical University in Zvolen	palus_at_tuzvo.sk
Milan	Sarvas	National Forest Centre	sarvas_at_nlcsk.org
Zuzana	Sarvasova	National Forest Centre	sarvasova_at_nlcsk.org
Katarina	Strelcova	Technical University in Zvolen	strelcova_at_tuzvo.sk
Rastislav	Sulek	Technical University in Zvolen	rastislav.sulek_at_tuzvo.sk
Jaroslav	Šálka	Technical University Zvolen	salka_at_tuzvo.sk

SLOVENIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Jurij	Beguš	Slovenia Forest Service	jurij.begus_at_zgs.gov.si
Anže	Japelj	Slovenian Forestry Institute	anze.japelj_at_gozdis.si
Špela	Pezdevšek Malovrh	University of Ljubljana	spela.pezdevsek.malovrh_at_bf.uni-lj.si
Ales	Poljanec	University of Ljubljana	ales.poljanec_at_bf.uni-lj.si
Lidija	Zadnik (Stirn)	University of Ljubljana	lidija.zadnik_at_bf.uni-lj.si

SOUTH AFRICA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Peter O.	Adesoye	University of Ibadan	adesoyepet_at_yahoo.com
Folaranmi Dapo	Babalola	University of Pretoria / University of Ilorin	Fola.Babalola_at_up.ac.za
Paxie	Chirwa	University of Pretoria	paxie.chirwa_at_up.ac.za
Casparus	Crous	Forestry and Agricultural Biotechnology Institute (FABI)	casper.crous_at_fabi.up.ac.za
Jeffrey	Garnas	Forestry and Agricultural Biotechnology Institute (FABI)	jeff.garnas_at_fabi.up.ac.za
Coert	Geldenhuys	Stellenbosch University	cgelden_at_mweb.co.za
Izette	Greyling	Forestry and Agricultural Biotechnology Institute (FABI)	izette.greyling_at_fabi.up.ac.za
Ronald	Heath	Forestry South Africa	ronald_at_forestrysouthafrica.co.za
Brett	Hurley	Forestry and Agricultural Biotechnology Institute (FABI)	brett.hurley_at_up.ac.za
Keith	Little	Nelson Mandela Metropolitan University	keith.little_at_nmmu.ac.za
Tatenda	Mapeto	International Forestry Students' Association (IFSA)	tatendamapeto_at_gmail.com
Chidiebere	Ofoegbu	University of Pretoria	u13415205_at_tuks.co.za
Fiona	Paumgarten	University of the Witwatersrand	fi.paumgarten_at_gmail.com
Jolanda	Roux	Forestry and Agricultural Biotechnology Institute (FABI)	jolanda.roux_at_fabi.up.ac.za
Sheona	Shackleton	Rhodes University / CIFOR	s.shackleton_at_ru.ac.za

Bernard	Slippers	Forestry and Agricultural Biotechnology Institute (FABI)	Bernard.Slippers_at_fabi.up.ac.za
Louis	Titshall	Institute for Commercial Forestry Research (ICFR)	louis.titshall_at_icfr.ukzn.ac.za
Sally	Upfold	Institute for Commercial Forestry Research (ICFR)	sally.upfold_at_icfr.ukzn.ac.za
Michael	Wingfield	Forestry and Agricultural Biotechnology Institute (FABI)	mike.wingfield_at_fabi.up.ac.za
Brenda	Wingfield	University of Pretoria	Brenda.Wingfield_at_up.ac.za

SPAIN

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Rocío de la Macarena	Alonso del Amo	CIEMAT	rocio.alonso_at_ciemat.es
Ismael	Aranda García	Instituto Nacional de Investigaciones y Tecnologia Agraria y Alimentaria (INIA)	seccifor_at_inia.es
Carmen	Aviles	Technical University of Madrid	cavilesp_at_gmail.com
Antonio D	Del Campo	Polytechnic University of Valencia	ancamga_at_upv.es
Luis	Diaz Balteiro	Technical University of Madrid	luis.diaz.balteiro_at_upm.es
Julio Javier	Diez-Casero	University of Valladolid	jdcasero_at_pvs.uva.es
Alberto	García Prats	Polytechnic University of Valencia	agprats_at_upvnet.upv.es
Juan Carlos	Gimenez	Research Group "Economics for a Sustainable Environment"	jcfernan_at_unex.es
Maria	Hernandez Rodriguez	University of Valladolid	mariahr_at_pvs.uva.es
Sonia	Quiroga	University of Alcalá	sonia.quiroga_at_uah.es

SRI LANKA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Mangala	De Zoysa	University of Ruhuna	mangalaxyz_at_yahoo.com
Bandara Ariyaratna	Kangane Mudiyanselage	Forest Conservation Department	research.badulla_at_yahoo.com
Bandumala	Suduhakuruge	Forest Conservation Department	bandumala03_at_yahoo.com

SUDAN

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Tarig	Elsheikh Mohamoud Elfaki	University of Kordofan	tarigcom_at_gmail.com
Hassan	Mofadel	Kenana Sugar Company	hassan.mofadel_at_kenana.com

SWEDEN

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Martin	Ahlström	Swedish University of Agricultural Sciences	martin.a.ahlstrom_at_slu.se
Staffan	Åkerblom	Swedish University of Agricultural Sciences	staffan.akerblom_at_slu.se
Tea	Ammunét	Swedish University of Agricultural Sciences	tea.ammunet_at_slu.se
Olle	Anderbrant	Lund University	Olle.Anderbrant_at_biol.lu.se
Päer Krister	Angelstam	Swedish University of Agricultural Sciences	per.angelstam_at_slu.se
Erik Petter	Axelsson	Swedish University of Agricultural Sciences	petter.axelsson_at_slu.se
Aida	Bargués Tobella	Swedish University of Agricultural Sciences	aida.bargues.tobella_at_slu.se
Desiana Dwi	Barianti Ahlberg	University of Freiburg	dbarianti_at_yahoo.com
Karin	Beland Lindahl	Luleå University of Technology	karin.beland.lindahl_at_ltu.se
Salim	Belyazid	Lund University	salim_at_belyazid.com
Kevin	Bishop	Swedish University of Agricultural Sciences	kevin.bishop_at_geo.uu.se
Christer	Bjorkman	Swedish University of Agricultural Sciences	christer.bjorkman_at_slu.se
Johanna	Boberg	Swedish University of Agricultural Sciences	johanna.boberg_at_slu.se
Helena	Bylund	Swedish University of Agricultural Sciences	helena.bylund_at_slu.se
Julia	Carlsson	Swedish University of Agricultural Sciences	julia.carlsson_at_slu.se
Michelle	Cleary	Swedish University of Agricultural Sciences	Michelle.Cleary_at_slu.se
Ioannis	Dimitriou	Swedish University of Agricultural Sciences	ioannis.dimitriou_at_slu.se
Elsa Katarina	Eckerberg	Umeå University	katarina.eckerberg_at_umu.se
Peter	Edwards	Swedish University of Agricultural Sciences	peter.edwards_at_slu.se
Jeannette	Eggers	Swedish University of Agricultural Sciences	jeannette.eggers_at_slu.se

Marine	Elbakidze	Swedish University of Agricultural Sciences	marine.elbakidze_at_slu.se
Diego	Elustondo	Luleå University of Technology	diego.elustondo_at_ltu.se
Ola	Eriksson	Swedish University of Agricultural Sciences	ola.eriksson_at_slu.se
Jan	Falck	Swedish University of Agricultural Sciences	jan.falck_at_slu.se
Petra	Fransson	Swedish University of Agricultural Sciences	petra.fransson_at_slu.se
Peter	Fredman	Mid-Sweden University	peter.fredman_at_miun.se
Gustav	Friberg	SkogForsk	gufr0001_at_stud.slu.se
Jan	Fryk	SkogForsk	jan.fryk_at_skogforsk.se
Natxo	García López	Umeå University	natxogl_at_gmail.com
Pablo	Garrido	Swedish University of Agricultural Sciences	pablo.garrido_at_slu.se
Åsa	Gerger Swartling	Stockholm Environment Institute & Stockholm Resilience Centre	asa.swartling_at_sei-international.org
Malin	Gustafsson	Swedish University of Agricultural Sciences	malin.gustafsson_at_slu.se
Leif	Gustavsson	Linnaeus University	leif.gustavsson_at_lnu.se
Lena	Gustafsson	Swedish University of Agricultural Sciences	lena.gustafsson_at_slu.se
Mats	Hannerz	Silvinformation AB	mats.hannerz_at_silvinformation.se
Johan Marcus	Hedblom	Swedish University of Agricultural Sciences	marcus.hedblom_at_slu.se
Marco	Hernandez Velasco	Dalarna University	mhv_at_du.se
Joakim	Hjälten	Swedish University of Agricultural Sciences	joakim.hjalten_at_slu.se
Sara	Holmgren	Swedish University of Agricultural Sciences	sara.holmgren_at_slu.se
Ruaridh Johannes	Hägglund	Swedish University of Agricultural Sciences	ruaridh.hagglund_at_slu.se
Björn	Hånell	Swedish University of Agricultural Sciences	bjorn.hanell_at_slu.se
Lars	Högbom	SkogForsk	lars.hogbom_at_skogforsk.se
Therese	Johansson	Swedish University of Agricultural Sciences	therese.johansson_at_slu.se
Arnis	Jurevics	Swedish University of Agricultural Sciences	arnis.jurevics_at_slu.se
Eva Carina Helena	Keskitalo	Umeå University	carina.keskitalo_at_geography.umu.se
Maartje Johanna	Klapwijk	Swedish University of Agricultural Sciences	maartje.klapwijk_at_slu.se
Daniela	Kleinschmit	Swedish University of Agricultural Sciences	daniela.kleinschmit_at_slu.se

Cecil	Konijnendijk	Swedish University of Agricultural Sciences	cecil.konijnendijk_at_slu.se
Anu	Korosuo	Swedish University of Agricultural Sciences	anu.korosuo_at_gmail.com
Stig	Larsson	Swedish University of Agricultural Sciences	stig.larsson_at_slu.se
Hjalmar	Laudon	Swedish University of Agricultural Sciences	Hjalmar.Laudon_at_slu.se
Jenny	Leonardsson	University of Gothenburg	jenny.leonardsson_at_gu.se
Gun	Lidestav	Swedish University of Agricultural Sciences	gun.lidestav_at_slu.se
Rolf	Lidskog	Orebro University	rolf.lidskog_at_oru.se
Tom	Lindstrom	Innventia	toml_at_fpirc.kth.se
Johanna	Lundström	Swedish University of Agricultural Sciences	johanna.lundstrom_at_slu.se
Daniel	Lussetti	Swedish University of Agricultural Sciences	daniel.lussetti_at_slu.se
Magnus	Löf	Swedish University of Agricultural Sciences	magnus.lof_at_slu.se
Tommy	Mörling	Swedish University of Agricultural Sciences	tommy.morling_at_slu.se
Vladimir	Naumov	Swedish University of Agricultural Sciences	vladimir.naumov_at_slu.se
Diem Thi	Nguyen	Swedish University of Agricultural Sciences	diem.nguyen_at_slu.se
Hans Örjan	Nohrstedt	Swedish University of Agricultural Sciences	hans-orjan.nohrstedt_at_slu.se
Ingrid Eva-Maria	Nordström	Swedish University of Agricultural Sciences	eva-maria.nordstrom_at_slu.se
Karin	Öhman	Swedish University of Agricultural Sciences	karin.ohman_at_slu.se
Carl Olof Olle	Olsson	Stockholm Environment Institute	olle.olsson_at_sei-international.org
Johan	Pihel	Swedish University of Agricultural Sciences	johan.pihel_at_slu.se
Åsa	Ranlund	Swedish University of Agricultural Sciences	asa.ranlund_at_slu.se
Lucy	Rist	Swedish University of Agricultural Sciences	lucy.rist_at_slu.se
Jean-Michel	Roberge	Swedish University of Agricultural Sciences	Jean-Michel.Roberge_at_slu.se
Anders	Roos	Swedish University of Agricultural Sciences	anders.roos_at_slu.se
Kaj	Rosén	Marcus Wallenberg Foundation (MWF)	kaj.rosen_at_kvrkonsult.com
Jörgen	Rudolphi	Swedish University of Agricultural Sciences	jorgen.rudolphi_at_slu.se
Dick	Sandberg	Luleå University of Technology	dick.sandberg_at_ltu.se
Lisbeth	Sennerby Forsse	Swedish University of Agricultural Sciences	rector_at_slu.se

Ulf	Sikström	SkogForsk	ulf.sikstrom_at_skogforsk.se
Jens Peter	Skovsgaard	Swedish University of Agricultural Sciences	jps_at_slu.se
Goeran	Staahl	Swedish University of Agricultural Sciences	goran.stahl_at_slu.se
Jan	Stenlid	Swedish University of Agricultural Sciences	jan.stenlid_at_slu.se
Anna Maria	Sténs	Umeå University	anna.stens_at_historia.umu.se
Nicole	Suty	Swedish University of Agricultural Sciences	nicole.suty_at_slu.se
Gregor	Vulturius	Stockholm Environment Institute	gregor.vulturius_at_sei-international.org
Ida	Wallin	Swedish University of Agricultural Sciences	ida.wallin_at_slu.se
Karin Sofie Helene	Wennström	Taylor & Francis	sofie.wennstrom_at_tandf.se
Ulrika	Widman	Umeå University	ulrika.widman_at_pol.umu.se
Matilda	van den Bosch	Swedish University of Agricultural Sciences	Matilda.Van.Den.Bosch_at_slu.se

SWITZERLAND

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Michael	Alder	Bern University of Applied Sciences	alder.michael_at_bluewin.ch
Bianca	Baerlocher	Bern University of Applied Sciences	bianca.baerlocher_at_bfh.ch
Juergen	Blaser	Bern University of Applied Sciences	juergen.blaser_at_bfh.ch
Jochen Ruben	Breschan	ETH Zürich	jochen.breschan_at_usys.ethz.ch
Harald	Bugmann	ETH Zürich	harald.bugmann_at_env.ethz.ch
Ruben	Delgado Manzanedo	University of Bern	ruben.delgado_at_ips.unibe.ch
Marc	Hanewinkel	Swiss Federal Institute for Forest, Snow and Landscape Research	marc.hanewinkel_at_wsl.ch
Hans Rudolf	Heinimann	ETH Zürich	hans.heinimann_at_env.ethz.ch
Andreas	Hill	ETH Zürich	andreas.hill_at_usys.ethz.ch
Lisa	Hülsmann	Swiss Federal Institute for Forest, Snow and Landscape Research	lisa.huelsmann_at_wsl.ch
Fabian	Leu	Bern University of Applied Sciences	fabian.leu_at_gmail.com
Joëlle	Magnin-Gonze	Cantonal Botanical Museum and Gardens	joelle.magnin-gonze_at_unil.ch
David McClintock	Newbery	University of Bern	david.newbery_at_ips.unibe.ch

Julian Martin	Norghauer	University of Bern	julian.norghauer_at_ips.unibe.ch
Markus	Pfannkuch	Bern University of Applied Sciences	markus.pfannkuch_at_students.bfh.ch
Andreas	Rigling	Swiss Federal Institute for Forest, Snow and Landscape Research	andreas.rigling_at_wsl.ch
William	Street		wstreet47_at_yahoo.com
Christian	Temperli	University of Colorado	christian.temperli_at_colorado.edu
Moriz	Vohrer	The Gold Standard Foundation	m.vohreer_at_cdmgoldstandard.org

TANZANIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Pilly	Kagosi	Tanzania Forestry Research Institute (TAFORI)	pjkagosi_at_yahoo.com

THAILAND

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Sapit	Diloksumpun	Kasetsart University	sapit.d_at_ku.ac.th
Martin	Greijmans	The Center for People and Forests (RECOFTC)	martin.greijmans_at_recoftc.org
Maliwan	Haruthaithanasan	Kasetsart University	aap_at_ku.ac.th
Kanlayarat	Jantawong	Chiang Mai University	foolish_fullmoon_at_hotmail.com
Nisa	Leksungnoen	Kasetsart University	ffornsl_at_ku.ac.th
Pichit	Lumyai	Kasetsart University	fforpcl_at_ku.ac.th
Dokrak	Marod	Kasetsart University	dokrak.m_at_ku.ac.th
Surin	Onprom	Kasetsart University	fforsro_at_ku.ac.th
Jephraim	Oro	The Center for People and Forests (RECOFTC)	jephraim.oro_at_recoftc.org
Regan	Pairojmahakij	The Center for People and Forests (RECOFTC)	regan_at_recoftc.org
Pasuta	Sunthornhao	Kasetsart University	fforpts_at_ku.ac.th
Yongyut	Trisurat	Kasetsart University	fforyyt_at_ku.ac.th
Kobsak	Wanthongchai	Kasetsart University	fforksw_at_ku.ac.th

TOGO

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Fousseni	Folega	Beijing Forestry University	ffolega_at_yahoo.fr
Hodabalo	Pereki	University of Lome and Hamburg University of Applied Sciences	pereki_at_daad-alumni.de
Nassifatou Koko	Tittikpina	University of Lomé	Knassifa_at_yahoo.fr

TRINIDAD AND TOBAGO

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Marc	Garcia	The University of the West Indies	marc.garcia_at_sta.uwi.edu

TUNISIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Abdelhamid	Khaldi	National Research Institute of Rural Engineering, Water and Forests (INRGREF)	khalditn_at_yahoo.fr
Arbia	Labidi Ben Slimane	National Research Institute of Rural Engineering, Water and Forests (INRGREF)	arbia.labidi_at_hotmail.com
Faten	Mezni	National Research Institute of Rural Engineering, Water and Forests (INRGREF)	faten-mez_at_hotmail.com

TURKEY

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Ustuner	Birben	Cankiri Karatekin University	birben_at_karatekin.edu.tr
Tugba	Dogmus-Lehtijarvi	Süleyman Demirel University	tugbadogmus_at_sdu.edu.tr
Kemalettin Bahattin	Gurboy	Istanbul University	gurboyb_at_istanbul.edu.tr
Ferhat	Gökbulak	Istanbul University	fgokbulak_at_istanbul.edu.tr
Muhittin	Inan	Istanbul University	inan_at_istanbul.edu.tr
Zerrin	Inan	Yeditepe University	zerrinan_at_gmail.com
Gulnur	Mertoglu Elmas	Istanbul University	mertoglug_at_istanbul.edu.tr
Mehmed Said	Özçelik	Istanbul University	msaid.ozcelik_at_istanbul.edu.tr

Öznur	Özden	Istanbul University	ozdeno_at_istanbul.edu.tr
Pinar	Pamukcu	Istanbul University	pinarpamukcu86_at_hotmail.com
Yusuf	Serengil	Istanbul University	yserengil_at_yahoo.com
Betül	Uygur	Istanbul University	uygurb_at_istanbul.edu.tr

UGANDA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Angella	Naava	Uganda Environmental Education Foundation (UEEF)	senyonjonicholas_at_gmail.com
Arthur	Owiny	Makerere University & University of Eastern Finland	owinyiarthur_at_yahoo.com

UKRAINE

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Anatolii	Karpuk	National University of Life and Environmental Sciences of Ukraine	Olyamy_at_yandex.ru
Petro	Lakyda	National University of Life and Environmental Sciences of Ukraine	lakyda_at_nubip.edu.ua
Stryamets	Nataliya	Swedish University of Agricultural Sciences	Natalie.Stryamets_at_slu.se
Sergiy	Zibtsev	National University of Life and Environmental Sciences of Ukraine	sergiy.zibtsev_at_nubip.edu.ua

UNITED KINGDOM

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Hector Fabio	Archila Santos	World Bamboo Organization	hector_archila_at_yahoo.com
Simon	Atherton	University of Bangor	bsp408_at_bangor.ac.uk
Malcolm	Beatty	Forest Service of Northern Ireland	malcolm.beatty_at_dardni.gov.uk
Euan	Bowditch	University of the Highlands & Islands	euan.bowditch.ic_at_uhi.ac.uk
Richard	Bradshaw	University of Liverpool	Richard.Bradshaw_at_liv.ac.uk
Jeffery	Burley	Past-President, IUFRO, University of Oxford	jeff.burley_at_plants.ox.ac.uk
Stuart	Fraser	University of Aberdeen	sfraser_at_abdn.ac.uk

Peter	Freer-Smith	United Kingdom Forestry Commission	peter.freer-smith_at_forestry.gsi.gov.uk
Wilma	Harper	United Kingdom Forestry Commission	wilma.harper_at_forestry.gsi.gov.uk
Peter	Hobson	Writtle College	peter.hobson_at_writtle.ac.uk
Valerie	Kapos	UNEP-WCMC	val.kapos_at_unep-wcmc.org
Jean	Lindsay	United Kingdom Forestry Commission	jean.lindsay_at_forestry.gsi.gov.uk
Tommaso	Locatelli	University of Edinburgh	t.locatelli_at_sms.ed.ac.uk
Mariella	Marzano	United Kingdom Forestry Commission	mariella.marzano_at_forestry.gsi.gov.uk
Bill	Mason	United Kingdom Forestry Commission	bill.mason_at_forestry.gsi.gov.uk
Constance	McDermott	University of Oxford	constance.mcdermott_at_ouce.ox.ac.uk
John	McLean	United Kingdom Forestry Commission	paul.mclean_at_forestry.gsi.gov.uk
Andreas	Ottitsch	University of Cumbria	Andreas.Ottitsch_at_a1.net
Gillian	Petrokofsky	University of Oxford	gillian.petrokofsky_at_zoo.ox.ac.uk
Christopher	Quine	United Kingdom Forestry Commission	chris.quine_at_forestry.gsi.gov.uk
Arbi James	Sarkissian	Bangor University	arbi.sarkissian27_at_gmail.com
Graeme	Shaw	University of Nottingham	george.shaw_at_nottingham.ac.uk
Gail	Taylor	University of Southampton	G.E.Isaacs_at_soton.ac.uk
Bhaskar	Vira	University of Cambridge	bv101_at_cam.ac.uk
Joan	Webber	United Kingdom Forestry Commission	joan.webber_at_forestry.gsi.gov.uk
Steve	Woodward	University of Aberdeen	s.woodward_at_abdn.ac.uk

UNITED STATES

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Kamran	Abdollahi	Southern University and A&M College	kamrana664_at_cs.com
Oscar Javier	Abelleira	University of Idaho and CATIE	ojabelleira_at_gmail.com
Gifty	Acquah	Auburn University	gea0002_at_auburn.edu
Cheyenne	Adamonis	Northern Arizona University	ca746_at_nau.edu
Henry	Adams	Los Alamos National Laboratory	adamshd_at_lanl.gov
Julius	Adewopo	University of Florida	adewopo_at_ufl.edu

David	Affleck	University of Montana	david.affleck_at_umontana.edu
Matthew	Aghai	University of Washington	aghai_at_uw.edu
Francisco	Aguilar	University of Missouri	aguilarf_at_missouri.edu
Sean	Aksentowitz	Michigan Technological University	smaksent_at_mtu.edu
Janaki	Alavalapati	Virginia Polytechnic Institute and State University	suesnow_at_vt.edu
Timothy	Albaugh	Virginia Polytechnic Institute and State University	tim_albaugh_at_vt.edu
Craig D.	Allen	United States Geological Survey (USGS)	craig_allen_at_usgs.gov
James	Allen	Northern Arizona University	James.Allen_at_nau.edu
Ralph	Amateis	Virginia Polytechnic Institute and State University	ralph_at_vt.edu
Mark	Ambrose	North Carolina State University	mambrose_at_fs.fed.us
Lord	Ameyaw	University of Washington	lkameyaw_at_uw.edu
Christopher	Anderson	Auburn University	andercj_at_auburn.edu
Hans-Erik	Andersen	US Forest Service	handersen_at_fs.fed.us
Nathaniel	Anderson	US Forest Service	nathanielmanderson_at_fs.fed.us
Paul	Anderson	US Forest Service	pdanderson_at_fs.fed.us
Carissa	Aoki	Dartmouth College	carissa.aoki_at_dartmouth.edu
Ulrich	Apel	Global Environment Facility	uapel_at_thegef.org
Martin	Apple	Council of Scientific Society Presidents	mapple_at_sciencepres.org
Phil	Araman	US Forest Service	paraman_at_vt.edu
Althea	ArchMiller	Auburn University	aaa0013_at_auburn.edu
Alba	Argerich	Oregon State University	alba.argerich_at_oregonstate.edu
James	Arney	Forest Biometrics Research Institute	JDArney_at_forestbiometrics.com
Heidi	Asbjornsen	University of New Hampshire	heidi.asbjornsen_at_unh.edu
Eric	Aubert	Washington State DNR	eric.aubert_at_dnr.wa.gov
Jackson	Audley	University of Tennessee	jaudley_at_utk.edu
Brian	Aukema	University of Minnesota	bhaukema_at_umn.edu
David	Auty	Northern Arizona University	david.auty_at_nau.edu

Burak	Avcioglu	Auburn University	b_avcioglu_at_hotmail.com
Matthew	Ayres	Dartmouth College	matt.ayres_at_dartmouth.edu
Angelina	Baca	US Forest Service	abaca_at_fs.fed.us
Andrew	Bailey	US Forest Service	Andrew_Bailey_at_nps.gov
Rob	Bailis	Yale University	robert.bailis_at_yale.edu
John	Ball	US Forest Service	
Enis	Baltaci	Auburn University	ezb0027_at_auburn.edu
Natan	Barbosa Rodrigues	University of Idaho	natanbarbosar_at_gmail.com
Jaime	Barbour	US Forest Service	jbarbour01_at_fs.fed.us
Thomas	Baribault	Forest Solutions, Inc.	tom_at_hawaiiforest.com
Martina	Barnes	US Forest Service	
Brian	Barrett	California Department of Forestry and Fire Protection	barrett.brian10_at_gmail.com
Stanley	Bartkowiak	Auburn University	smb0056_at_auburn.edu
Lauren	Bartl	State University of New York	lebartl_at_syr.edu
Ann	Bartuska	USDA – National Institute of Food and Agriculture	ann.bartuska_at_osec.usda.gov
Mohammad	Bataineh	University of Arkansas	Bataineh_at_uamont.edu
Michael	Battaglia	US Forest Service	mbattaglia34_at_gmail.com
Tessa	Bauman	Forestry and Agricultural Biotechnology Institute (FABI)	tessa.bauman_at_hotmail.com
David	Baumgartner	Washington State University	baumgartner_at_wsu.edu
Mitchell	Beach	Michigan Technological University	mgbeach_at_mtu.edu
Dennis R.	Becker	University of Minnesota	drbecker_at_umn.edu
Ryer	Becker	University of Idaho	beck0667_at_vandals.uidaho.edu
Beth	Bee		beeb_at_ecu.edu
Conor	Bell	University of Idaho	bell8535_at_vandals.uidaho.edu
Keith	Belli	University of Tennessee	kbelli_at_utk.edu
Fabio Jose	Benez Secanho	Oklahoma State University	fabio.bene_secanho_at_okstate.edu
Christopher	Bentley		

Barbara	Bentz	US Forest Service	bbentz_at_fs.fed.us
Richard	Bergman	US Forest Service	rbergman_at_fs.fed.us
Vicki	Berrett	US Forest Service	vberrett_at_fs.fed.us
Eric	Betts	KLS-TV	ebetts_at_ksl.com
Edward	Bilek	US Forest Service	tbilek_at_fs.fed.us
Daniel	Binkley	Colorado State University	dan.binkley_at_colostate.edu
Richard	Birdsey	US Forest Service	rbirdsey_at_fs.fed.us
Sarah	Bisbing	California Polytechnic State University	sbisbing_at_calpoly.edu
Tanushree	Biswas	US Forest Service	tbiswas_at_fs.fed.us
Tom	Black	US Forest Service	tblack_at_fs.fed.us
Jock	Blackard	US Forest Service	jblackard_at_fs.fed.us
Elizabeth	Blanchard	University of Cambridge	blanchard.libby_at_gmail.com
Tamara	Blett	National Park Service	tamara_blett_at_nps.gov
Antra	Boca	Utah State University	ntr_at_inbox.lv
Zachary	Boerman	Society of American Foresters	zmboerma_at_syr.edu
Scott	Boling	Northern Arizona University	sboling_at_nau.edu
William	Bollinger	SWP Media Inc.	whb47_at_earthlink.net
Barbara	Bomfim	University of California Davis	bdbomfim_at_ucdavis.edu
Pierluigi	Bonello	The Ohio State University	bonello.2_at_osu.edu
Robert R.	Bonnie	USDA - National Resources Conservation Service	amanda.lockwood_at_osec.usda.gov
Erik	Boren	Student	erikjame_at_gmail.com
Luigi	Boschetti	University of Idaho	luigi_at_uidaho.edu
James	Boulger	Oregon State University	james.boulger.ifsa_at_gmail.com
James	Boulger	Society of American Foresters	boulgerja_at_onid.orst.edu
Charles	Bowers	University of Washington	taitb_at_uw.edu
James	Boyle	Oregon State University	forsol40_at_comcast.net
Don	Bragg	US Forest Service	dbragg_at_fs.fed.us

David	Bray	Florida International University	brayd_at_fiu.edu
Michelle	Brill	Michigan Technological University	mcisz_at_mtu.edu
Becky	Brinkerhoff	Western Life Radio	becky_at_backcountrynetwork.com
Brian	Brinkerhoff	Western Life Radio	radio_at_backcountrynetwork.com
Justin	Britton	Utah State University	jbritton57_at_gmail.com
Kirk	Broders	University of New Hampshire	kirk.broders_at_unh.edu
Nicholas	Brokaw	University of Puerto Rico-Rio Piedras	nvbrokaw_at_ites.upr.edu
Randy	Brooks	University of Idaho	rbrooks_at_uidaho.edu
Patrick	Brose	US Forest Service	pbrose_at_fs.fed.us
Laura	Brown	Northern Arizona University	leb239_at_nau.edu
Perry	Brown	University of Montana	sky.mckeever_at_umontana.edu
Thomas	Brown	US Forest Service	tcbrown_at_fs.fed.us
Thomas	Buchholz	University of Vermont & Spatial Informatics Group LLC	tbuchholz_at_sig-gis.com
Catherine	Bukowski	Virginia Polytechnic Institute and State University	cjbukows_at_vt.edu
Harold	Burkhart	Virginia Polytechnic Institute and State University	burkhart_at_vt.edu
Owen	Burney	New Mexico State University	oburney_at_nmsu.edu
Dawnee	Burson	Society of American Foresters	dawneelb_at_gmail.com
Julia	Burton	Oregon State University	julia.burton_at_oregonstate.edu
Brett	Butler	US Forest Service	bbutler01_at_fs.fed.us
Andrzej	Bytnerowicz	US Forest Service	abytnerowicz_at_fs.fed.us
Cassandra	Cairns	US Forest Service	cfcairns_at_fs.fed.us
Philip	Cannon	US Forest Service	pcannon_at_fs.fed.us
Eric	Carbaugh	Virginia Polytechnic Institute and State University	ecarbaug_at_vt.edu
Emily	Carter	US Forest Service	eacarter_at_fs.fed.us
Vachel	Carter	University of Utah	vachel.carter_at_gmail.com
Benjamin	Cashore	Yale University	benjamin.cashore_at_yale.edu
Sabine	Castagnet	Castagnet Dumeon SA	sabine.castagnet_at_dataphysics.com

Tuukka	Castrén	World Bank	tcastren_at_worldbank.org
Nicole	Cavender	The Morton Arboretum	ncavender_at_mortonarb.org
Ilkim	Cavus	Auburn University	izc0009_at_auburn.edu
James	Chamberlain	US Forest Service	jchamberlain_at_fs.fed.us
Allison	Chan	University of Utah	allison.chan_at_utah.edu
Diji	Chandrasekharan Behr	World Bank	dchandrasekharan_at_worldbank.org
Hou-min	Chang	North Carolina State University	hchang_at_ncsu.edu
Susan	Charnley	US Forest Service	scharnley_at_fs.fed.us
Gary	Chastagner	Washington State University	chastag_at_wsu.edu
Antony	Cheng	Colorado State University	tony.cheng_at_colostate.edu
Jeffrey	Chieppa	Auburn University	jjc0022_at_auburn.edu
Camille	Chow-Moyers	Society of American Foresters	moyersc_at_onid.oregonstate.edu
Woodam	Chung	University of Montana	woodam.chung_at_umontana.edu
Douglas	Clawson	US Forest Service	dclawson_at_fs.fed.us
David	Cleaves	US Forest Service	dcleaves_at_fs.fed.us
Adam	Coble	Michigan Technological University	apcoble_at_mtu.edu
Warren B.	Cohen	US Forest Service	warren.cohen_at_oregonstate.edu
Mark	Coleman	University of Idaho	mcoleman_at_uidaho.edu
Adam	Collins	Los Alamos National Laboratory	acollins_at_lanl.gov
Alex	Collins	Michigan Technological University	arcollin_at_mtu.edu
Sally	Collins	Rights and Resources Initiative	scollins_at_rightsandresources.org
Anna	Conrad	The Ohio State University	conrad.245_at_osu.edu
Susan	Conard	US Forest Service	sgconard_at_aol.com
Marco Antonio	Contreras Salgado	University of Kentucky	marco.contreras_at_uky.edu
Harold	Cordell	US Forest Service	haroldkcordell_at_fs.fed.us
Lorea	Coronado-Garcia	Royal Veterinary and Agricultural University	loreacg_at_gmail.com
Jazmine	da Costa	Yale University	jazmine.dacosta_at_yale.edu

Brian	Cottam	State of Utah	briancottam_at_utah.gov
John	Coulston	US Forest Service	jwcouls1_at_ncsu.edu
Stella	Cousins	University of California	stella.c_at_berkeley.edu
Samuel	Cox	University of Kentucky	spco224_at_g.uky.edu
David	Coyle	University of Georgia	drcoyle_at_uga.edu
Catherine	Craig	Washington State University	ccraig221_at_gmail.com
Janean	Creighton	Oregon State University	Janean.Creighton_at_oregonstate.edu
Nicholas	Crookston	US Forest Service	ncrookston.fs_at_gmail.com
Marissa	Cunningham	Northern Arizona University	mlc379_at_nau.edu
Tamara	Cushing	Oregon State University	tamara.cushing_at_oregonstate.edu
Matthew	Custer	Michigan Technological University	mtcuster_at_mtu.edu
Virginia	Dale	Oak Ridge National Laboratory	dalevh_at_ornl.gov
Paul	Dallara	University of California-Davis	twigdoc_at_gmail.com
Robert	Danehy	National Council for Air and Stream Improvement	bdanehy_at_ncasi.org
Kristine	Dattelbaum	Virginia Commonwealth University	kdattelbaum_at_vcu.edu
Anthony	Davis	University of Idaho	asdavis_at_uidaho.edu
Zackary	Davis	University of Idaho	davi0148_at_vandals.uidaho.edu
Robert L.	Deal	US Forest Service	rdeal_at_fs.fed.us
Darrel	DeBoer	World Bamboo Organization	Darrel_at_DeBoerArchitects.com
Cornelis	DeHoop	Louisiana State University Agricultural Center	cdehoop_at_lsu.edu
Paola Taciana	De Iazari	University of Idaho	dela6838_at_vandals.uidaho.edu
Daniel	DePinte	Northern Arizona University	ded63_at_nau.edu
Samuel	Delano	Oregon State University	Samldelano_at_aol.com
Jorge Luis	Delgado Trejo	Oregon State University	jorge.delgado_at_oregonstate.edu
Sandra	De Urioste-Stone	University of Maine	sandra.de_at_maine.edu
Justin	DeRose	US Forest Service	rjustinderose_at_gmail.com
James	Derr	Society of American Foresters	derrjam_at_onid.oregonstate.edu

Yvette	Dickinson	Colorado State University	yvette.dickinson_at_colostate.edu
Debra	Dietzman	US Forest Service	ddietzman_at_fs.fed.us
Michael	Dockry	US Forest Service	mdockry_at_fs.fed.us
Grant M	Domke	US Forest Service	gdomke_at_fs.fed.us
YingLin	Donohue Hung	International Wood Culture Society	marthahung_at_iwcs.com
Nicklos	Dudley	US Forest Service	ndudley_at_harc-hspa.com
Marlyse	Duguid	Yale University	marlyse.duguid_at_yale.edu
Kasten	Dumroese	US Forest Service	kdumroese_at_fs.fed.us
Kelsey	Dunnell	North Dakota State University	Kelsey.Dunnell_at_ndsu.edu
William	Dunning	US Forest Service	bdunning_at_fs.fed.us
Mary	Duryea	University of Florida	mlduryea_at_ufl.edu
Kathleen	Dwire	US Forest Service	kadwire_at_fs.fed.us
Puneet	Dwivedi	University of Georgia	puneetd_at_uga.edu
Toby	Eberly	Hanlon Creative	toby_at_hanloncreative.com
Kathryn	Echterling	Society of American Foresters	echterlk_at_onid.oregonstate.edu
Lori	Eckhardt	Auburn University	eckhalg_at_auburn.edu
Alan	Ek	University of Minnesota	aek_at_umn.edu
Karin	Eklöf	Penn State University	kje15_at_psu.edu
Joseph	Elkinton	University of Massachusetts	elkinton_at_ent.umass.edu
William	Elliot	US Forest Service	welliot_at_fs.fed.us
David	Ellison	Swedish University of Agricultural Sciences (SLU)	ellisondl_at_gmail.com
Marla R.	Emery	US Forest Service	marla.r.emery_at_gmail.com
Sherri	Eng	US Forest Service	sleng_at_fs.fed.us
Jan M.	Engert	US Forest Service	jengert_at_fs.fed.us
Rebecca	Epanchin-Niell	Resources for the Future	epanchin-niell_at_rff.org
Robert William	Erickson	University of Minnesota	erick117_at_umn.edu
Akif	Eskalen	University of California Riverside	Akif.Eskalen_at_ucr.edu

Isaac	Estrada	Johns Hopkins University	isaacestrada1972_at_yahoo.com
Gregory	Ettl	University of Washington	ettl_at_uw.edu
Seth	Ex	Colorado State University	Seth.Ex_at_colostate.edu
Judith	Fahys	KUER News/Utah NPR	jfahys_at_kuer.org
Habibollah	Fakhraei	Syracuse University	hfakhrae_at_syr.edu
Tiffany	Fegel	West Virginia University	T.fegel_at_aol.com
Mark	Fenn	Pacific Southwest Research Station	mfenn_at_fs.fed.us
Natalia	Ferreira dos Santos	Oklahoma State University	nferrei_at_okstate.edu
Christopher	Fettig	US Forest Service	cfettig_at_fs.fed.us
Anna	Finke	Yale University	anna.finke_at_yale.edu
Akiva	Fishman	Yale University	akiva.fishman_at_yale.edu
David	Flaspohler	Michigan Technological University	djflaspo_at_mtu.edu
Forrest	Fleischman	Texas A&M University	blackspruce_at_gmail.com
Paula	Fornwalt	US Forest Service	pfornwalt_at_fs.fed.us
Louise	Fortmann	University of California – Berkeley	louisef_at_berkeley.edu
G. Sam	Foster	US Forest Service	gfoster_at_fs.fed.us
Ian	Fox	Northern Arizona University	imf27_at_nau.edu
Susan	Fox	US Forest Service	sfox_at_fs.fed.us
Thomas	Fox	Virginia Polytechnic Institute and State University	trfox_at_vt.edu
Jessica	Frackelton	Onset Computer Corporation	Jessica_Frackelton_at_onsetcomp.com
John	Frank	US Forest Service	jfrank_at_fs.fed.us
Christopher	Free	Rutgers University	cfree14_at_gmail.com
Elizabeth	Freeman	US Forest Service	eafreeman_at_fs.fed.us
Tracey	Frescino	US Forest Service	tfrescino_at_fs.fed.us
James	Friday	University of Hawaii	jbfriday_at_hawaii.edu
Jeremy	Fried	US Forest Service	jsfried_at_fs.fed.us
Alexander	Friend	US Forest Service	afriend_at_fs.fed.us

Joao Vitor	Frigeri	University of Idaho	joaovfrigeri_at_hotmail.com
Steve	Frolking	University of New Hampshire	steve.frolking_at_unh.edu
Richard	Gabriel	Society of American Foresters	Richard.Gabriel_at_oregonstate.edu
Glenn	Galloway	University of Florida	ggalloway_at_latam.ufl.edu
Kamal	Gandhi	University of Georgia	kjgandhi_at_uga.edu
Indroneil	Ganguly	University of Washington	indro_at_uw.edu
Amy	Gannon	State of Montana Forestry Division	agannon_at_mt.gov
Matteo	Garbelotto	University of California – Berkeley	matteog_at_berkeley.edu
John	Garland	Garland & Associates	johngarland49_at_gmail.com
Elise	Gatti	University of Utah	elise.gatti_at_utah.edu
Linda	Geiser	US Forest Service	lgeiser_at_fs.fed.us
George	Gertner	University of Illinois	gertner_at_illinois.edu
Henry	Gholz	National Science Foundation	hgholz_at_nsf.gov
Samantha	Gill	Cal Poly	sgill_at_calpoly.edu
Sierra	Giraud	State University of New York	slgiraud_at_syr.edu
Tony	Gliot	City of Salt Lake	
Daniela	Goehler	World Bank	dgoehler_at_worldbank.org
Sara	Goeking	US Forest Service	sgoeking_at_fs.fed.us
Michael	Goerndt	University of Missouri	goerndtm_at_missouri.edu
Peter	Gomben	US Forest Service	pgomben_at_fs.fed.us
Chongfeng	Gong	Southern University	chongfeng.gong_at_gmail.com
Mimi	Gong	Duke University	137801043_at_qq.com
Carlos	Gonzalez-Benecke	University of Florida	cgonzabe_at_ufl.edu
Armando	González-Cabán	US Forest Service	agonzalezcaban_at_fs.fed.us
Kurt	Gottschalk	US Forest Service	kgottschalk_at_fs.fed.us
Donald	Grace	Student Member	dmgrace_at_syr.edu
Valerie	Grant	West Virginia University	vcgrant_at_mix.wvu.edu

Andrew	Gray	US Forest Service	agray01_at_fs.fed.us
Curtis	Gray	Utah State University	curtis.gray_at_aggiemail.usu.edu
Lindsay	Grayson	University of Idaho	gray7728_at_vandals.uidaho.edu
Donald	Grebner	Mississippi State University	dgrebner_at_CFR.MsState.Edu
Lisa	Green	Utah State University	lisa.green_at_aggiemail.usu.edu
Leslie	Groom	US Forest Service	lgroom_at_fs.fed.us
Naomi	Gruber	Northern Arizona University	ncg28_at_nau.edu
Nancy	Grulke	US Forest Service	ngrulke_at_fs.fed.us
Richard	Guldin	US Forest Service	rguldin_at_fs.fed.us
Jose	Gutierrez Lopez	University of New Hampshire	gutloja_at_gmail.com
Robert	Haack	US Forest Service	haack_at_msu.edu
Steven	Hacker	University of Idaho	shacker_at_uidaho.edu
Temesgen	Hailemariam	Oregon State University	hailemariam.temesgen_at_oregonstate.edu
Ann Elizabeth	Hajek	Cornell University	aeh4_at_cornell.edu
Deanna	Hammons	Society of American Foresters	hammonsd_at_onid.oregonstate.edu
Yinglei	Han	University of Idaho	han4115_at_vandals.uidaho.edu
Wendy	Hancock	Oregon State University	wahancock40_at_gmail.com
Eric	Hansen	Oregon State University	eric.hansen_at_oregonstate.edu
William	Hargrove	US Forest Service	hnw_at_geobabble.org
Rob	Harrison	University of Washington	robh_at_uw.edu
Rachel	Harrow	Northern Arizona University	rlh287_at_nau.edu
Dave	Hatch	US Forest Service	dhatch_at_fs.fed.us
Jennifer	Hayes	US Forest Service	jenniferhayes_at_fs.fed.us
Sean	Healey	US Forest Service	seanhealey_at_fs.fed.us
Kirsten	Hecht	University of Florida	kirstenhecht_at_ufl.edu
Rebecca	Heisler	Colorado State University	bforest_at_rams.colostate.edu
Carla	Heister	Yale University	carla.heister_at_yale.edu

Jonathan	Henn	Southern Center for Scientific Research (CADIC)	henn.jonathan_at_gmail.com
Heri	Hermawan	Yale University	heri.hermawan_at_yale.edu
Daniel	Herms	The Ohio State University	herms.2_at_osu.edu
Kaitlyn	Hickam	Society of American Foresters	hickamk_at_onid.oregonstate.edu
Sarah	Hines	US Forest Service	shines_at_fs.fed.us
Stacy	Hishinuma	University of California - Davis	chlorinated_at_gmail.com
Anukriti	Hittle	Washington University in St Louis	Anukriti_Hittle_at_wustl.edu
David	Hix	The Ohio State University	hix.6_at_osu.edu
Salim	Hiziroglu	Oklahoma State University	salim.hiziroglu_at_okstate.edu
Serra	Hoagland	Northern Arizona University	serrahoagland_at_gmail.com
Donald	Hodges	The University of Tennessee	dhodges2_at_utk.edu
Richard	Hofstetter	Northern Arizona University	rich.hofstetter_at_nau.edu
Steven	Hollis	Michigan Tech University	smhollis_at_mtu.edu
Jessica	Homyack	Weyerhaeuser Company	jessica.homyack_at_weyerhaeuser.com
David	Hooper	Western Washington University	David.Hooper_at_wwu.edu
Wen-Pin	Hou	International Wood Culture Society	mikehou_at_iwcs.com
Lucas	Howard	Society of American Foresters	elijah.allensworth_at_oregonstate.edu
Theodore	Howard	University of New Hampshire	ted.howard_at_unh.edu
Cory	Howes	Michigan Technological University	chowes_at_mtu.edu
Daniel	Howland	Northern Arizona University	drh89_at_nau.edu
Zoe A.	Hoyle	US Forest Service	zhoyle_at_fs.fed.us
John	Hribljan	Michigan Technological University	jahriblj_at_mtu.edu
Robert	Hubbard	United States Forest Service	rhubbard_at_fs.fed.us
William	Hubbard	Southern Regional Extension Forestry	whubbard_at_sref.info
Jason	Hubbart	University of Missouri	HubbartJ_at_missouri.edu
Kyrstan	Hubbel	University of Idaho	Hubb9764_at_vandals.uidaho.edu
Joseph	Hulbert	Oregon State University	joseph.hulbert_at_oregonstate.edu

Jiri	Hulcr	University of Florida	hulcr_at_ufl.edu
Carolyn	Hunsaker	US Forest Service	chunsaker_at_fs.fed.us
Sara	Hylton		shylton_at_calpoly.edu
Faith	Inman-Narahari	University of Hawaii	finman_at_hawaii.edu
Laura	Ivers	World Bank	Laivers_at_worldbankgroup.org
John	Jackson	Auburn University	jjack16_at_gmail.com
Michael	Jacobson	Penn State	mgj2_at_psu.edu
Ryan	Jacobson	University of Idaho	jaco0707_at_vandals.uidaho.edu
Pamela	Jagger	CIFOR/University of North Carolina	pjagger_at_unc.edu
Theresa	Jain	US Forest Service	tjain_at_fs.fed.us
Hasan	Jameel	North Carolina State University	jameel_at_ncsu.edu
Jason	James	University of Washington	jajames_at_uw.edu
Woongsoon	Jang	University of Montana	woongsoon.jang_at_umontana.edu
Melissa	Jenkins	US Forest Service	melissaljenkins_at_fs.fed.us
Derek	Johnson	Virginia Commonwealth University	dmjohnson_at_vcu.edu
Jim	Johnson	Oregon State University	jimjohnson_at_oregonstate.edu
Michael	Johnson	Northern Arizona University	mgj27_at_nau.edu
Eric	Jokela	University of Florida	ejokela_at_ufl.edu
Shibu	Jose	University of Missouri	joses_at_missouri.edu
Mahendra	Joshi	APFNet	mlj2005_at_gmail.com
Sarah	Jovan	US Forest Service	sjovan_at_fs.fed.us
Chelsea	Judy	Yale University	chelsea.judy_at_yale.edu
Dominik	Kaestner	University of Tennessee	dkaestne_at_utk.edu
Karen	Kainer	University of Florida	kkainer_at_ufl.edu
Humphrey	Kalibo	University of Nebraska – Lincoln	hwafula_at_yahoo.com
Latif	Kalin	Auburn University	latif_at_auburn.edu
Tuula	Kantola	University of Helsinki	tuula.kantola_at_helsinki.fi

Ferhat	Kara	Auburn University	ferhatom_at_gmail.com
Boone	Kauffman	Center for International Forestry Research (CIFOR)	Boone.Kauffman_at_oregonstate.edu
Kathleen	Kavanagh	Texas A&M University	katykavanagh_at_gmail.com
Robert	Keefe	University of Idaho	robk_at_uidaho.edu
Erica	Kemp	Society of American Foresters	erica.kemp_at_oregonstate.edu
Christel	Kern	US Forest Service	cckern_at_fs.fed.us
Jessica	Kessinger	Society of American Foresters	kessingj_at_onid.oregonstate.edu
Puskar	Khanal	Mississippi State University	khanalpn_at_gmail.com
Simon M	Kihia	US Forest Service	smkihia_at_fs.fed.us
John	Kim	US Forest Service	jbkim_at_fs.fed.us
Yeonsu	Kim	Northern Arizona University	ysk_at_nau.edu
Stanley	Kitchen	US Forest Service	skitchen_at_fs.fed.us
Christiana	Kittel	Society of American Foresters	kittelc_at_onid.oregonstate.edu
Kier	Klepzig	US Forest Service	kklepzig_at_fs.fed.us
Jeffrey	Kline	US Forest Service	jkline_at_fs.fed.us
Ned	Klopfenstein	US Forest Service	nklopfenstein_at_fs.fed.us
Zion	Klos	University of Idaho	zion_at_uidaho.edu
Benjamin	Knapp	University of Missouri	knappb_at_missouri.edu
Richard	Kobe	Michigan State University	Kobe_at_msu.edu
Susan	Kocher	University of California Cooperative Extension	sdkocher_at_ucanr.edu
Randall	Kolka	US Forest Service	rkolka_at_fs.fed.us
Flora Estella	Krivak-Tetley	Dartmouth College	fkt.gr_at_dartmouth.edu
Linda	Kruger	US Forest Service	lkruger_at_fs.fed.us
Steven	Kruger	Virginia Polytechnic Institute and State University	skruger_at_vt.edu
James	Labonte	Oregon Department of Agriculture	jlabonte_at_oda.state.or.us
Maria Fernanda	Laguarda Mallo	University of Minnesota	lagua006_at_umn.edu
Rachel	Landham	University of Kentucky	rachel.landham_at_uky.edu

Nina	Lany	Dartmouth College	Nina.K.Lany.GR_at_dartmouth.edu
Elizabeth	Larry	US Forest Service	eblarry_at_fs.fed.us
Joshua	Larsen	University of Idaho	lars3836_at_vandals.uidaho.edu
Leia	Larsen	Ogden Standard-Examiner	llarsen_at_standard.net
Gregory S.	Latta	Oregon State University	greg.latta_at_oregonstate.edu
Abdelaziz	Lawani	University of Kentucky	abdelawani_at_gmail.com
Daryl	Lederle	US Forest Service	drlederle_at_fs.fed.us
Laura	Leites	Penn State University	lpl3_at_psu.edu
Lingying	Li	Kangwon National University	lilingying_at_kangwon.ac.kr
Andrew	Liebhold	US Forest Service	aliebhold_at_gmail.com
Hal	Liechty	University of Arkansas	liechty_at_uamont.edu
Erik	Lilleskov	US Forest Service	elilleskov_at_fs.fed.us
Celine Jialing	Lim	Yale University	Celine.lim_at_yale.edu
Hasu	Lim	Korea Forest Research Institute	hasulim3636_at_gmail.com
Wanda	Lindquist	Utah State University	wanda.lindquist_at_usu.edu
Richard	Lindroth	University of Wisconsin-Madison	lindroth_at_wisc.edu
Timothy	Link	University of Idaho	tlink_at_uidaho.edu
Andrew	Lister	US Forest Service	alister_at_fs.fed.us
Claudia	Listopad	Faculdade de Ciencies, Universidade de Lisboa	cdlistopad_at_fc.ul.pt
Yongqiang	Liu	US Forest Service	yliu_at_fs.fed.us
Robert	Loeb	Penn State University	RXL5_at_PSU.EDU
James	Long	Utah State University	james.long_at_usu.edu
Jack	Longino		
Colby	Loucks	World Wildlife Fund	colby.loucks_at_wwfus.org
Justin	Louen	Cal Poly, San Luis Obispo	jlouen_at_calpoly.edu
Ziyi	Lu	University of Washington	luz8_at_uw.edu
Ruben	Lubowski	Environmental Defense Fund	rlubowski_at_edf.org

Susanne	Lucas	World Bamboo Organization	susannelucas_at_gmail.com
Charles	Luce	US Forest Service	cluce_at_fs.fed.us
Carl	Lucero	US Forest Service	carlflucero_at_fs.fed.us
Ariel	Lugo	US Forest Service	alugo_at_fs.fed.us
Aaron	Lund	Society of American Foresters	Alund81_at_rams.colostate.edu
Lee	MacDonald	Colorado State University	lee.macdonald_at_colostate.edu
Richard	MacKenzie	United State Forest Service	rmackenzie_at_fs.fed.us
Brian	Maffly	The Salt Lake Tribune	bmaffly_at_sltrib.com
Lauren	Magalska	Oregon State University	lauren.magalska_at_oregonstate.edu
Patrick	Mahoney	University of Idaho	maho9840_at_vandals.uidaho.edu
Luca	Marini	University of Idaho	mari3635_at_vandals.uidaho.edu
Renato	Matheus Rahal	Oklahoma State University	renatorahal_at_hotmail.com
Megan	Matonis	Colorado State University	megan.matonis_at_colostate.edu
George	Matusick III	Murdoch University	G.Matusick_at_murdoch.edu.au
Marek	Matyjasik	Weber State University	mmatyjasik_at_weber.edu
Alida	Mau	Michigan Technological University	acmau_at_mtu.edu
Cynthia	McArthur	US Forest Service	cmcarthur_at_fs.fed.us
Darren	McAvoy	Utah State University	darren.mcavoy_at_usu.edu
Moana	McClellan	University of Minnesota	moana_at_umn.edu
Michael Luke Turner	McCormack	Chinese Academy of Sciences	mltmcc_at_gmail.com
Melanie	McDermott	Rutgers University	mmcdermott_at_AESOP.Rutgers.edu
Todd	McDonnell	E&S Environmental Chemistry	todd.mcdonnell_at_esenvironmental.com
David	McGill	West Virginia University	dmcgill_at_wvu.edu
Kathleen	McGinley	US Forest Service	kmcginley_at_fs.fed.us
Cameron	McIntire	University of New Hampshire	cameron.d.mcintire_at_gmail.com
Fraser	McKee	University of Minnesota	mcke0620_at_umn.edu
Jeffrey	McKinley	Society of American Foresters	jtmckinl_at_syr.edu

Mike	Mckinney	US Forest Service	
Geoffrey Marvin	McNaughton	Utah Department of Natural Resources	Geoffmcnaughton_at_utah.gov
Steven	McNulty	US Forest Service	steve_mcnulty_at_ncsu.edu
Ron	McRoberts	US Forest Service	rmcroberts_at_fs.fed.us
John Paul	McTague	University of Georgia	mctague_at_uga.edu
Angela	Mech	University of Georgia	angmech_at_uga.edu
Kevin	Megown	US Forest Service	kamegown_at_fs.fed.us
Errol	Meidinger	University of Freiburg	e.meidinger_at_ife.uni-freiburg.de
Frederick	Meinzer	US Forest Service	rick.meinzer_at_oregonstate.edu
Andrea	Melchiorre	University of Idaho	melc2617_at_vandals.uidaho.edu
Morgan	Mendenhall	State of Utah	morganmendenhall_at_utah.gov
Marcella	Menegale	University of Washington	marcism_at_uw.edu
Stephani	Michelsen-Correa	University of Washington	smcorrea_at_uw.edu
Constance	Millar	US Forest Service	cmillar_at_fs.fed.us
Gary	Miller	US Forest Service	gwmiller_at_fs.fed.us
Raymond	Miller	Michigan State University	rmiller_at_msu.edu
Cynthia	Miner	US Forest Service	clminer_at_fs.fed.us
Karen	Mock	Utah State University	karen.mock_at_usu.edu
Phillip	Mohebalian	University of Missouri	Pmmrn3_at_mail.missouri.edu
Gretchen	Moisen	US Forest Service	gmoisen_at_fs.fed.us
Marlee	Monahan	Northern Arizona University	mkm332_at_nau.edu
Claire	Montgomery	Oregon State University	claire.montgomery_at_oregonstate.edu
Randall	Morin	US Forest Service	rsmorin_at_fs.fed.us
Morgan	Morreale	Northern Arizona University	mfm57_at_nau.edu
Alexander	Morris		
Cassandra	Moseley	University of Oregon	cmoseley_at_uoregon.edu
Warren	Moser	US Forest Service	wkmoser_at_fs.fed.us

Brian	Mumby	University of Idaho	mumb8877_at_vandals.uidaho.edu
Isabel	Munck	US Forest Service	isabelmunck_at_gmail.com
Steven	Munson	US Forest Service	smunson_at_fs.fed.us
Edward	Mutandwa	Mississippi State University	emutandwa_at_cfr.msstate.edu
Rose Marie	Muzika	University of Missouri	muzika_at_missouri.edu
Bethany	Muñoz	University of Maine	bethany.munoz_at_maine.edu
Tawny Lynn	Myers	US Forest Service	
Mark	Nlmlos	National Renewable Energy Laboratory	mark.nimlos_at_nrel.gov
Ryan	Nadel	Auburn University	ryan.nadel_at_auburn.edu
Nalini	Nadkarni	University of Utah	nalini.nadkarni_at_utah.edu
Ramachandran	Nair	University of Florida / SFRC	pknair_at_ufl.edu
Nicolas	Najdovski	Montana State University	Nicolas.najdovski_at_gmail.com
Andrew	Nelson	University of Arkansas – Monticello	nelsona_at_uamont.edu
Nathan	Nelson	US Forest Service	nnelson_at_fs.fed.us
Jami	Nettles	Weyerhaeuser Company	jami.nettles_at_weyerhaeuser.com
Max	Nickerson	University of Florida	maxn_at_flmnh.ufl.edu
Kyle	Niederer	Northern Arizona University	kn325_at_nau.edu
Zhu Hua	Ning	Southern University	Zhu_ning_at_subr.edu
Andi	Noakes	University of Notre Dame	anoakes_at_nd.edu
Navideh	Noori	Auburn University	nzn0004_at_auburn.edu
Malcolm	North	US Forest Service	mnorth_at_ucdavis.edu
Robert	Northrop	University of Florida	northrop_at_ufl.edu
David	Nowak	US Forest Service	dnowak_at_fs.fed.us
Vanessa Carolina	Nunes Biral	Oklahoma State University	nunesbi_at_okstate.edu
Gabriela	Nunez Mir	Purdue University	gnunezmi_at_purdue.edu
Amy Joi	O'Donoghue	Deseret News	amyjoi_at_deseretnews.com
Kevin	O'Hara	University of California – Berkeley	kohara_at_berkeley.edu

Elizabeth Asantewaa	Obeng	University of Missouri	amadanso_at_yahoo.co.uk
Paul	Oester	Oregon State University	paul.t.oester_at_oregonstate.edu
Sara	Ohrel	US Environmental Protection Agency Climate Change Division	Ohrel.Sara_at_epa.gov
Chadwick	Oliver	Yale University	chad.oliver_at_yale.edu
Sandra	Olney	KSL-TV	solney_at_ksl.com
Christine	Olsen	Oregon State University	christine.olsen_at_oregonstate.edu
Deanna	Olson	US Forest Service	dedeolson_at_fs.fed.us
Kim	Osborn	US Forest Service	kosborn_at_fs.fed.us
Todd	Osmundson	University of Wisconsin – La Crosse	tosmundson_at_uwlax.edu
Luke	Ostwald	University of Idaho	ostw6105_at_vandals.uidaho.edu
Sandra A	Owusu	Michigan Technological University	saowusu_at_mtu.edu
Deborah	Page-Dumroese	US Forest Service	ddumroese_at_fs.fed.us
Timothy	Paine	University of California	timothy.paine_at_ucr.edu
Brian	Palik	US Forest Service	bpalik_at_fs.fed.us
Sebastian	Palmas Perez	University of Florida	spalmas_at_ufl.edu
Alex	Pancoast	Society of American Foresters	pancoasa_at_onid.oregonstate.edu
Chandra	Pandey	Virginia Polytechnic Institute and State University	cbpandey5_at_rediffmail.com
Corwin	Parker	University of California – Davis	corwin.parker_at_gmail.com
Catherine	Parks	US Forest Service	Cparks01_at_fs.fed.us
John	Parrotta	US Forest Service	jparrotta_at_fs.fed.us
Dylan	Parry	State University of New York	dparry_at_esf.edu
Ramesh	Paudyal	University of Florida	rpaudyal_at_ufl.edu
Thomas	Payne	University of Missouri	paynet_at_missouri.edu
Charles	Pell	Auburn University	cjp0020_at_auburn.edu
Kristen	Pelz	Colorado State University	kapelz_at_gmail.com
Adam	Pepi	University of Massachusetts	apepi_at_umass.edu
Charles H.	Perry	US Forest Service	charleshperry_at_fs.fed.us

Ana	Persic	UNESCO	a.persic_at_unesco.org
Jackson	Peters	Northern Arizona University	jp864_at_nau.edu
David	Peterson	US Forest Service	peterson_at_fs.fed.us
Lauren	Pile	Clemson University	lpile_at_g.clemson.edu
Jeremiah	Pinto	US Forest Service	jpinto_at_fs.fed.us
Mark	Poffenberger	Community Forestry International	mpoffen_at_aol.com
Raju	Pokharel	Mississippi State University	rpokharel_at_cfr.msstate.edu
Michael	Pollock	National Oceanic and Atmospheric Administration	michael.pollock_at_noaa.gov
Adrian	Poloni	Fulbright-Garcia Robles / CIIDIR-IPN-Oaxaca	adrian_poloni_at_live.com
Nan	Pond	SilviaTerra / Michigan Tech	nancpond_at_gmail.com
Rodrigo	Portugal	Oregon State University	Rodrigo.portugal_at_oregonstate.edu
Kevin	Potter	North Carolina State University	kpotter_at_ncsu.edu
Kurt	Pregitzer	University of Idaho	kpregitzer_at_uidaho.edu
Joshua	Puhlick	University of Maine	joshua.puhlick_at_maine.edu
Scott	Purdue	Society of American Foresters	purdues_at_onid.oregonstate.edu
Francis	Putz	CIFOR/University of Florida	fep_at_ufl.edu
Yadong	Qi	Southern University of United States	yadong.qi_at_gmail.com
Brad	Quayle	US Forest Service	bquayle_at_fs.fed.us
Henry	Quesada	Virginia Polytechnic Institute and State University	quesada_at_vt.edu
Jose	Quintero		Toto_at_jqroofing.com
Angga	Rachmansah		angga.rachmansah_at_gmail.com
Kenneth	Raffa	University of Wisconsin	raffa_at_entomology.wisc.edu
Carlos	Ramos-Scharron	The University of Texas-Austin	cramos_at_austin.utexas.edu
Gregory	Reams	US Forest Service	greams_at_fs.fed.us
Jimmy	Reaves	US Forest Service	jreaves_at_fs.fed.us
Chandra	Reed		chandrareed_at_gmail.com
Todd	Reese	City of Salt Lake	

Keith	Reynolds	US Forest Service	kreynolds_at_fs.fed.us
Aaron	Rhodes	Brigham Young University	aaron.rhodes0_at_gmail.com
Uelison Mateus	Ribeiro	University of Idaho	ribe9882_at_vandals.uidaho.edu
Kevin	Rice	US Forest Service	
Mary	Ridout	University of Idaho	mridout_at_uidaho.edu
Lynne	Rieske-Kinney	University of Kentucky	lrieske_at_uky.edu
Kurt	Riitters	US Forest Service	kriitters_at_fs.fed.us
Joshua	Roberti	NEON	jroberti_at_neoninc.org
Peter	Robichaud	US Forest Service	probichaud_at_fs.fed.us
Kyle	Rodman	Northern Arizona University	kcr92_at_nau.edu
Valmir	Rodrigues de Andrade Neto	University of Idaho	rodr8623_at_vandals.uidaho.edu
Carlos	Rodriguez- Franco	US Forest Service	crodriguezfranco_at_fs.fed.us
Benjamin	Roe	University of Washington	Benjamin.e.roe_at_gmail.com
Thomas	Rooney	Wright State University	thomas.rooney_at_wright.edu
Howard	Rosen	US Forest Service	hrosen_at_fs.fed.us
Derek	Rosenberger	University of Minnesota	rose0675_at_umn.edu
Amy	Ross-Davis	US Forest Service	arossdavis_at_fs.fed.us
Amber	Roth	Michigan Technological University	amroth_at_mtu.edu
Mary	Rowland	US Forest Service	mrowland_at_fs.fed.us
Alejandro	Royo	US Forest Service	aroyo_at_fs.fed.us
Lauren	Rusin	Michigan Technological University	larusin_at_mtu.edu
Douglas	Rutherford	Louisiana State University	druther_at_lsu.edu
Sadie	Ryan	University of Florida	datamonkey_at_gmail.com
Eli	Sagor	University of Minnesota Extension	esagor_at_umn.edu
Ella	Salkeld	University of Idaho	salk5346_at_vandals.uidaho.edu
Lisa	Samuelson	Auburn University	samuelj_at_auburn.edu
Jose	Sanchez	US Forest Service	jsanchez_at_fs.fed.us

Yasmeen	Sands	US Forest Service	ysands_at_fs.fed.us
Hathai	Sangsupan	Oregon State University	hathai.sangsupan_at_oregonstate.edu
Erin	Saunders	Northern Arizona University	ehs8_at_nau.edu
Olivia	Saylor	University of Kentucky	olivia.saylor_at_uky.edu
MacKenzie	Schaeffer	University of Kentucky	mesc239_at_g.uky.edu
Westly	Schmidt		WestlyWSchmidt_at_yahoo.com
Marianne	Schmink	University of Florida	schmink_at_ufl.edu
Chris	Schnepf	University of Idaho	cschnepf_at_uidaho.edu
Charlie	Schrader-Patton	US Forest Service	cschrader_at_fs.fed.us
Eric	Schramm	US Forest Service	
Svetlana	Schroder	University of Washington	kushch_at_uw.edu
Todd	Schroeder	US Forest Service	tschroeder_at_fs.fed.us
Greg	Schroer	Society of American Foresters	gschroer_at_fs.fed.us
Bethany	Schulz	US Forest Service	bschulz_at_fs.fed.us
Sarah	Schwab	Stephen F. Austin State University	schwab.sarahe_at_gmail.com
Brian	Schwind	US Forest Service	bschwind_at_fs.fed.us
Mita	Sen	United Nations on Forests Secretariat	sen_at_un.org
Steven	Seybold	US Forest Service	sjseybold59_at_gmail.com
Patricia	Shanley	People and Plants International	P.Shanley_at_cgiar.org
Margaret	Shannon	SUNY Buffalo Law School	mshannon_at_buffalo.edu
David Carl	Shaw	Oregon State University	dave.shaw_at_oregonstate.edu
John	Shaw	US Forest Service	poba1_at_aol.com
Ji	She	Oregon State University	ericshe1017_at_gmail.com
Patrick Arthur	Shea	University of Utah	pas_at_patrickashea.com
Rachel	Sheridan	Northern Arizona School of Forestry	rs253_at_nau.edu
Rebecca	Sheridan	University of Idaho	sher9785_at_vandals.uidaho.edu
Barbara	Shields	ESRI	bshields_at_esri.com

David	Showalter	The Ohio State University	showalter.53_at_osu.edu
Rupesh	Shrestha	Boise State University	rupeshshrestha_at_boisestate.edu
Emily	Silver	University of Maine	emily.j.silver_at_maine.edu
Katherine	Sinacore	University of New Hampshire	ksinacore_at_gmail.com
Kanna	Siripurapu	University of Maryland at College Park	kanna_at_umd.edu
Diana	Six	University of Montana	diana.six_at_cfc.umt.edu
James	Skiera	International Society of Arboriculture	Jskiera_at_isa-arbor.com
Kenneth	Skog	US Forest Service	kskog_at_fs.fed.us
Bob	Smith	Virginia Polytechnic Institute and State University	rsmith4_at_vt.edu
Brad	Smith	US Forest Service	bsmith12_at_fs.fed.us
Nikola	Smith	US Forest Service	nikolasmith123_at_gmail.com
Stephanie	Snyder	US Forest Service	Stephaniesnyder_at_fs.fed.us
Ben	Soderquist	University of Idaho	soderquist.ben_at_gmail.com
Jaeeun	Sohng	Yale University	jaeeun.sohng_at_yale.edu
Gabriel	Sosa Perez	Colorado State University	gsosa_at_lamar.colostate.edu
Daniel	Soto	Oregon State University	daniel.soto_at_oregonstate.edu
Vanessa	Sousa da Silva	University of Idaho	Sous4378_at_vandals.uidaho.edu
Thomas A.	Spies	US Forest Service	tspies_at_fs.fed.us
Trevor	St. John	Michigan Technological University	tstjohn_at_mtu.edu
Wesley	Staats	University of Kentucky	wast223_at_uky.edu
John	Stanturf	US Forest Service	jstanturf_at_fs.fed.us
Jose	Stape	North Carolina State University	jlstape_at_ncsu.edu
Taylor	Stein	University of Florida	tstein_at_ufl.edu
John	Stella	SUNY College of Environmental Science and Forestry	stella_at_esf.edu
Henry	Stelzer	University of Missouri	stelzerh_at_missouri.edu
Frederick M.	Stephen	University of Arkansas	fstephen_at_uark.edu
Scott	Stephens	University of California - Berkeley	sstephens_at_berkeley.edu

Suzy	Stephens	US Forest Service	
Camille	Stevens-Rumann	University of Idaho	csrumann_at_uidaho.edu
Thomas	Stokes	Auburn University	stoketa_at_auburn.edu
Bogdan	Strimbu	Louisiana Tech University	strimbu_at_gmail.com
Christina	Stringer	US Forest Service	christinaestringer_at_fs.fed.us
Devin	Stuart	Society of American Foresters	stuartd_at_onid.oregonstate.edu
Mary	Stuever	Society of American Foresters	Mary.stuever_at_prescott.edu
Eric	Sucre	Weyerhaeuser Company	eric.sucre_at_weyerhaeuser.com
Guleser	Sufraci	Auburn University	gzs0012_at_auburn.edu
Ge	Sun	US Forest Service	gesun_at_ncsu.edu
Andres	Susaeta Larrain	University of Florida	asusaeta_at_ufl.edu
Angela	Tang Che Ing	Montana State University	atchiemac_at_gmail.com
Adam	Taylor	University of Tennessee	adamtaylor_at_utk.edu
Jeffrey	Taylor	NEON	jtaylor_at_neoninc.org
Lawrence	Teeter	Auburn University	teeter_at_auburn.edu
Frank	Telewski	Michigan State University	telewski_at_cpa.msu.edu
Steve	Tesch	Oregon State University	steve.tesch_at_oregonstate.edu
Wai Wai	Than	Forest Research Institute	waiwaikyaw2007_at_gmail.com
Tales	Theodoro de Freitas Silva	University of Idaho	theo0431_at_vandals.uidaho.edu
Erik	Thompson	University of Montana	et-thompson_at_mchsi.com
Lisa	Thompson	US Forest Service	Lisathompson_at_fs.fed.us
Michael	Thompson	US Forest Service	mtthompson_at_fs.fed.us
Richard	Thompson		rpthomps_at_calpoly.edu
Thomas	Tidwell	US Forest Service	tcbailey_at_fs.fed.us
Valorie	Titus	Green Mountain College	vtitus7_at_mac.com
Borys	Tkacz	US Forest Service	btkacz_at_fs.fed.us
Julio	Tobar	University of Florida	Julio.tobar_at_ufl.edu

Patrick	Tobin	University of Washington	ptobin_at_uw.edu
Adam	Trautwig	Auburn University	antrautw_at_gmail.com
Carl	Trettin	US Forest Service	ctrettin_at_fs.fed.us
Frank	Tubbs	University of Idaho	jaxes88_at_gmail.com
Andrea	Tuttle	Forest and Climate Policy	andreatuttle1_at_gmail.com
Mary	Tyrrell	Yale University	mary.tyrrell_at_yale.edu
Michael	Ulyshen	US Forest Service	mulyshen_at_hotmail.com
Matthew	Vadeboncoeur	University of New Hampshire	matt.vad_at_unh.edu
Helga	Van Miegroet	Utah State University	helga.vanmiegroet_at_usu.edu
Benjamin	Vandermyde	US Army Corps of Engineers	ben.j.vandermyde_at_usace.army.mil
Dave	Vanderzanden	US Forest Service	dvanderzanden_at_fs.fed.us
Rose I.	Verbos	University of Utah	rose.verbos_at_utah.edu
Wesley	Vestal	University of Idaho	vest8428_at_vandals.uidaho.edu
Brian	Via	Auburn University	bkv0003_at_auburn.edu
Emilio	Vilanova	University of Washington	vilanova_at_uw.edu
Caterina	Villari	University of Padova	villari.2_at_osu.edu
Richard	Vlosky	Louisiana State University	vlosky_at_lsu.edu
Alyson	Wade	Oregon State University	alyson.wade_at_oregonstate.edu
Joseph	Wagenbrenner	Michigan Technological University	jwwagenb_at_mtu.edu
Rebecca	Wallace	US Forest Service	rwallace_at_fs.fed.us
Bin	Wan	University of Florida	binwan_at_ufl.edu
Jingxin	Wang	West Virginia University	Jingxin.Wang_at_mail.wvu.edu
Xiping	Wang	US Forest Service	xiping_wang_at_hotmail.com
Yixiang	Wang	Zhejiang A & F University	w_yixiang_at_126.com
Sheila E.	Ward	Mahogany for the Future, Inc.	mahoganyforthefuture_at_gmail.com
Matthew	Warren	US Forest Service	mwwarren_at_fs.fed.us
Shannon Lea	Watkins	Indiana University	shawatki_at_indiana.edu

Gary	Watson	The Morton Arboretum	gwatson_at_mortonarb.org
James	Watson	West Virginia University	jamesvwatson6_at_gmail.com
Craig	Wayson	SilvaCarbon	cwayson.silvacarbon_at_gmail.com
Aaron	Weed	Dartmouth College	aaron.s.weed_at_dartmouth.edu
Liang	Wei	University of Idaho	liangwei_at_vandals.uidaho.edu
Mariah	Weitzenkamp	University of Minnesota	weitz072_at_umn.edu
John	Welker	American Forest Management	john.welker_at_amforem.biz
Lucas	Wells	University of Montana	lawells36_at_gmail.com
Hartwell	Welsh	US Forest Service	hwelsh_at_fs.fed.us
Cynthia	West	US Forest Service	cdwest_at_fs.fed.us
Timothy	White	University of Florida	tlwhite_at_ufl.edu
Jacob L.	Whitmore	IUFRO Honorary Member	tropifor_at_verizon.net
Thomas	Wigley	National Council for Air & Stream Improvement, Inc.	wigley_at_clemson.edu
Juliet	Wilhelm	US Forest Service	jwilhelm_at_fs.fed.us
Daniel	Williams	US Forest Service	drwilliams_at_fs.fed.us
Stephen	Williams	University of Wyoming	sewms_at_uwyo.edu
Barry Tyler	Wilson	US Forest Service	barrywilson_at_fs.fed.us
Katherine	Wilson	University of Hawaii - Manoa	kawils65_at_hawaii.edu
Natalie	Wilson	Northern Arizona University	nsw29_at_nau.edu
Sara	Wilson	US Forest Service / Oregon State University	swilson_at_fs.fed.us
Taylor	Wilson	Texas A&M	mr.tawilson_at_gmail.com
Marcella	Windmuller-Campione	Utah State University	marcella.campione_at_aggiemail.usu.edu
Chris	Witt	US Forest Service	chriswitt_at_fs.fed.us
Kathleen	Wolf	University of Washington	kwolf_at_uw.edu
Hyeyoung	Woo	University of Montana	woo.hyeyoung_at_gmail.com
Christopher	Woodall	US Forest Service	cwoodall_at_fs.fed.us
Jeff	Wright	ArborGen Inc.	patula.wright_at_gmail.com

Stephen	Wyka	University of New Hampshire	StephenWyka_at_gmail.com
Harriet	Wynn	Virginia State University	hwynn_at_vsu.edu
Randolph	Wynne	Virginia Polytechnic Institute and State University	wynne_at_vt.edu
Chonggang	Xu	Los Alamos National Laboratory	xuchongang_at_gmail.com
Ruth	Yanai	SUNY College of Environmental Science and Forestry	rdyanai_at_syr.edu
Zhiqiang	Yang	Oregon State University	zhiqiang.yang_at_oregonstate.edu
John	Yarie	University of Alaska – Fairbanks	jayarie_at_alaska.edu
Runsheng	Yin	Michigan State University	yinr_at_msu.edu
Zhen	Yu	West Virginia University	zyu_at_mix.wvu.edu
Zachary	Zabawa	International Forestry Students' Association (IFSA)	z.zabawa175_at_gmail.com
Rene Arturo	Zamora Cristales	Oregon State University	rene.zamora_at_oregonstate.edu
William	Zanotti		Billzanotti_at_utah.gov
Daowei	Zhang	Auburn University	ZHANGD1_at_auburn.edu
Xiaoping	Zhou	US Forest Service	xzhou_at_fs.fed.us
John	Zobel	University of Tennessee	jzobel_at_utk.edu
Miranti Triana	Zulkifli	Yale University	miranti.zulkifli_at_yale.edu

URUGUAY

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Zohra	Bennadji	Instituto Nacional de Investigacion Agropecuaria (INIA)	zbennadji_at_tb.inia.org.uy
Carolina	Jorge	Universidad de la Republica	carolina.jorge_at_cut.edu.uy
Gonzalo	Martinez	Instituto Nacional de Investigacion Agropecuaria (INIA)	gmartinez_at_tb.inia.org.uy
Carlos	Pérez	Universidad de la República	caperez_at_fagro.edu.uy

VENEZUELA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Néstor	Gutierrez	Universidad de Los Andes	nestorgutierrez_at_ula.ve

Pedro	Villa	Instituto Nacional de Investigacion Agropecuaria (INIA) / UFV	villautana_at_gmail.com

VIETNAM

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Hai Thi Nguyen	Hoang	Kyoto University	hai.htn_at_gmail.com
Vien Ngoc	Nam	Nong Lam University	drvnnam_at_gmail.com
Phuong	Vu Tan	Vietnamese Academy of Forest Sciences	phuong.vt_at_vafs.gov.vn

ZAMBIA

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Felix Kanungwe	Kalaba	Copperbelt University	kanungwe_at_gmail.com
Elisha	Ncube	Copperbelt University	enncube_at_yahoo.com

ZIMBABWE

GIVEN NAME	SURNAME	AFFILIATION	EMAIL ADDRESS
Lizzie	Mujuru	Bindura University	lzzmjr2009_at_gmail.com





www.iufro.org

www.iufro2014.com

IUFRO

Society of American Foresters

Canadian Institute of Forestry
Institut forestier du Canada

NAUFRP
National Association of University Forest Resources Programs
Creating Knowledge–Developing Leaders

Visit SALT LAKE