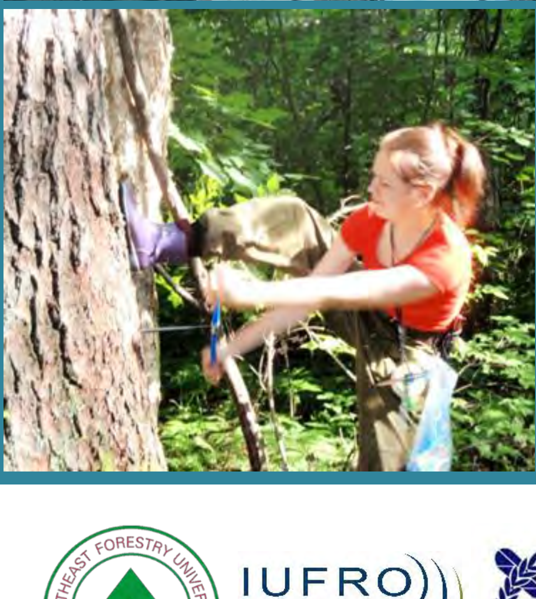
WORKSHOP PROCEEDINGS

International Workshop on Lessons Learnt and Challenges from Forest Long-term Ecological Research (LTER) in the Northeast Asian Region

20-24 September 2016 / Harbin, China



[Organized by]

Northeast Forestry University
IUFRO Working Party 1.01.13
Seoul National University

[Supported by]

Asia Pacific Association of Forestry Research Institutions
National Institute of Forest Science

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Editors
Ho Sang Kang, Miin Bang, Guangze Jin

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Fengri Li, Hee Moon Yang, Zhili Liu, Hideki Mori, Byambasuren Oyunsanaa, Anna Vozmishcheva, Jung Hwa Chun, Olga Ukhvatkina, Heok Choh Sim

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Cover photos in China and Russia

CONTENTS

[1] Dr. Olga Ukhvatkina could not join this workshop because she was stuck in the field until the first day of this workshop, where the impact of typhoon hindered her from coming back to her institute in Vladivostok. Although she could not present her research during the workshop, we would like to share her research results with other participants through adding her ppt file in this proceeding.

I. Introduction

1) Background

Forests in the Northeast Asian region are unique because of their diverse ecosystems and high biodiversity, and those ecosystems have not only stood at its dignity as itself but also provided essential and valuable services to human beings. Those forest ecosystems, however, has been under enormous pressure of deforestation and forest degradation, induced by both natural factors (i.e., climate change, fire, flood and drought) and anthropogenic factors (i.e., illegal logging, construction, land conversion for agriculture and over exploitation). Those deforestation and forest degradation have resulted in both environmental damages of soil erosion, land degradation and biodiversity loss and socioeconomic damages of insecure food, water and health, as well as the loss of cultural identity/dignity to the people. In order to mitigate and combat those emerging challenges, various levels of communities (i.e. community, domestic, regional and international) among various stakeholders (i.e. community leading group, university, research institute, government agency and international organizations) have been proceeded significant efforts for last decades.

In particular, together with international research communities, research group in forest ecology in the Northeast Asian region has contributed through conducting relatively large scale of plot-based integrated research investigating long-term responses of forest ecological dynamics to natural and human disturbances and environmental changes over broad spatial and temporal scales. Those forest dynamic plot research results have been useful in providing important information for forest structure and species composition as well as ethnobotanical data, understanding of species habitat requirements, and providing quantitative data for testing theories and hypothesis in population and community ecology. Moreover, the long-term data obtained by these forest dynamics researches over last 40 years has enabled the researchers to evaluate the nature and pace of ecological change, to interpret its effects, and to forecast the range of future biological responses to the changes through establishing relevant mid- and long-term plans in forest conservation, restoration and management, which had been unable to do only through short-term observations or experiments.

This workshop, co-organized by Northeast Forestry University and the IUFRO Working Party 1.01.13 and sponsored by Asia Pacific Association of Forestry Research Institutions (APAFRI) and National Institute of Forest Science (NIFoS) of the Republic of Korea, aims mainly at sharing knowledge and research experiences on Long-term Ecological Research (LTER) particularly in forest sector in the Northeast Asian region (i.e. China, Japan, Mongolia, Russia and Korea). As one of the series of annual workshop followed by the *2015 International Workshop on Long-term Ecological Research and Sustainable Forest Management in Northeast Asia* last year held in Yanji, China visiting the LTER site in Mt. Changbai and discussing the strategies on sustainable forest management, the 2016 workshop this year aims at discussing some lessons learnt and challenges while conducting the LTER researches as well as occurred in the practical field.

2) Objectives

The objectives of this workshop are:

i. To establish and strengthen the cooperative network in forest LTER research in the regional level among the researchers in the Northeast Asian region;

ii. To provide the platform through seminar to exchange the research experiences and results between senior and junior researchers on forest LTER research, and particularly strengthen the research capability of junior researchers in the Northeast Asian region;

iii. To conduct in-depth discussion on the specific forest LTER case in the Northeast region in China through visiting the site; and

iv. To contribute to the establishment of future strategies in the regional level on promoting forest ecological response and adaptation to the change caused by anthropogenic or natural factors, through assessment of forest ecological change and interpretation its effects.

3) Date/Venue

This workshop will be held on 20-24 September 2016, which consists of one-day seminar at the Meeting Room of School of Forestry, Northeast Forestry University in Harbin, Heilongjiang and two-day field trip to Liangshui National Reserve of Mt. Xiaoxing'an in Yichun, Heilongjiang, China.

4) Program

The workshop program by date is as follows:

Program	
20 September	
Arrival	
21 September	
Seminar at the Northeast Forestry University	
	Moderator: Dr. Ho Sang Kang
09:00-09:30	Registration
09:30-09:35	Welcome Address (Dr. Hee Moon Yang, NIFoS)
09:35-09:40	Congratulatory Remark (Dr. Heok-Choh Sim, APAFRI)
09:40-09:45	Congratulatory Remark (Prof. Fengri Li, NEFU)
09:45-10:00	Group Photo
10:00-10:30	**Presentation 1 (Prof. Zhili Liu, Northeast Forestry University, China)** Long-term ecological research progress for typical mixed broadleaved-Korean pine forest

10:30-11:00	**Presentation 2 (Mr. Hideki Mori, University of Tsukuba, Japan)** Liana distribution and community structure in an old-growth cool temperate forest of Japan - Case study in Ogawa Forest Reserve (OFR)
11:00-11:30	**Presentation 3 (Dr. Anna Vozmishcheva, Botanical Garden-Institute / Institute of Biology and Soil Sciences, Far East Branch, Russian Academy of Sciences, Russia)** Spatial structure and dynamics of northern Korean Pine - broadleaved forests
11:30-13:30	Lunch
	Moderator: Dr. Heok-Choh Sim
13:30-14:00	**Presentation 4 (Prof. Byambasuren Oyunsanaa, National University of Mongolia, Mongolia)** Climate, wildfire and forest management issues in Mongolia (Need for Forest Long-term Ecological Research)
14:00-14:30	**Presentation 5 (Dr. Jung Hwa Chun, National Institute of Forest Science, Republic of Korea)** Korean forest long-term ecological research under changing climate
14:30-15:00	Wrap-up
22 September (Field)	
Arrival and visit to the LTER site at Liangshui National Reserve (9ha (300m x 300m) permanent plot in the mixed broadleaved-Korean pine forest established in the year of 2005)	
23 September (Field)	
Visit to the LTER site at Liangshui National Reserve and back to Harbin	
24 September	
Departure	

5) List of participants

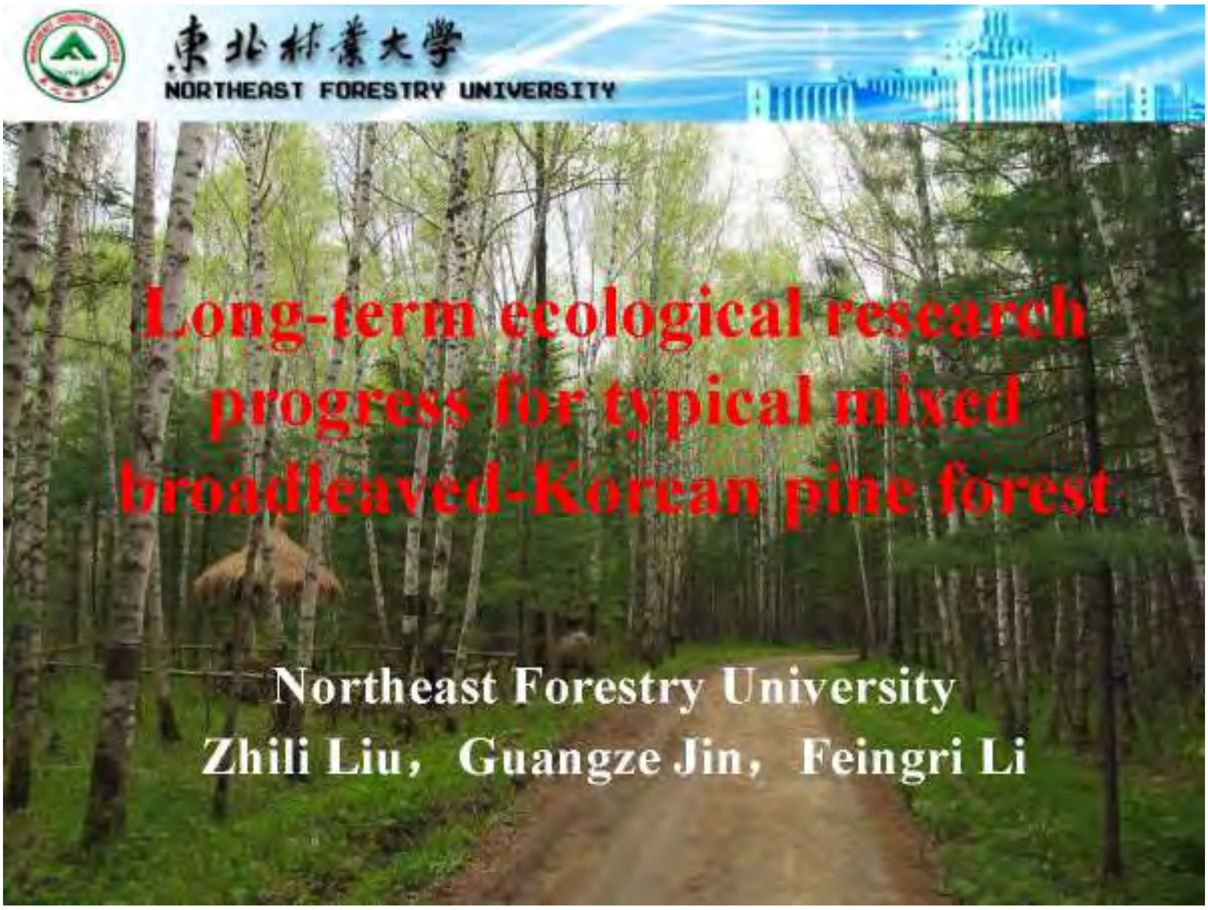
No.	Country	Name	Gender	Position, Organization
1	-	Dr. Heok Choh Sim	M	Asia Pacific Association of Forestry Research Institutions
2	China	Dr. Fengri Li	M	Dean, School of Forestry, Northeast Forestry University
3		Dr. Guangze Jin	M	Professor, School of Forestry, Northeast Forestry University
4		Dr. Zhili Liu	M	Associate Professor, School of Forestry, Northeast Forestry University
5		Mr. Yu Zhu	M	Doctoral Candidate, School of Forestry, Northeast Forestry University
6	Japan	Mr. Hideki Mori	M	Doctoral Candidate, Biosphere Resource Science and Technology Program, Graduate School of Life and Environmental Science, University of Tsukuba
7	Mongolia	Dr. Byambasuren Oyunsanaa	M	Professor, National University of Mongolia
8	Russia	Dr. Anna Vozmishcheva	F	Researcher, Botanical Garden-Institute, Far Eastern Branch, Russia Academy of Sciences
9	Korea (NIFoS)	Dr. Hee Moon Yang	M	Senior Researcher, Forest Ecology Division, Forest Conservation Department, National Institute of Forest Science
10		Dr. Jung Hwa Chun	M	Researcher, Forest Ecology Division, Forest Conservation Department, National Institute of Forest Science
11	Korea (SNU)	Dr. Ho Sang Kang	M	Deputy Coordinator, IUFRO Working Party 1.01.13 / Research Associate Professor, Seoul National University
12		Ms. Miin Bang	F	Researcher, Seoul National University

II. Presentations

1) Long-term ecological research progress for typical mixed broadleaved-Korean pine forest

Dr. Zhili Liu

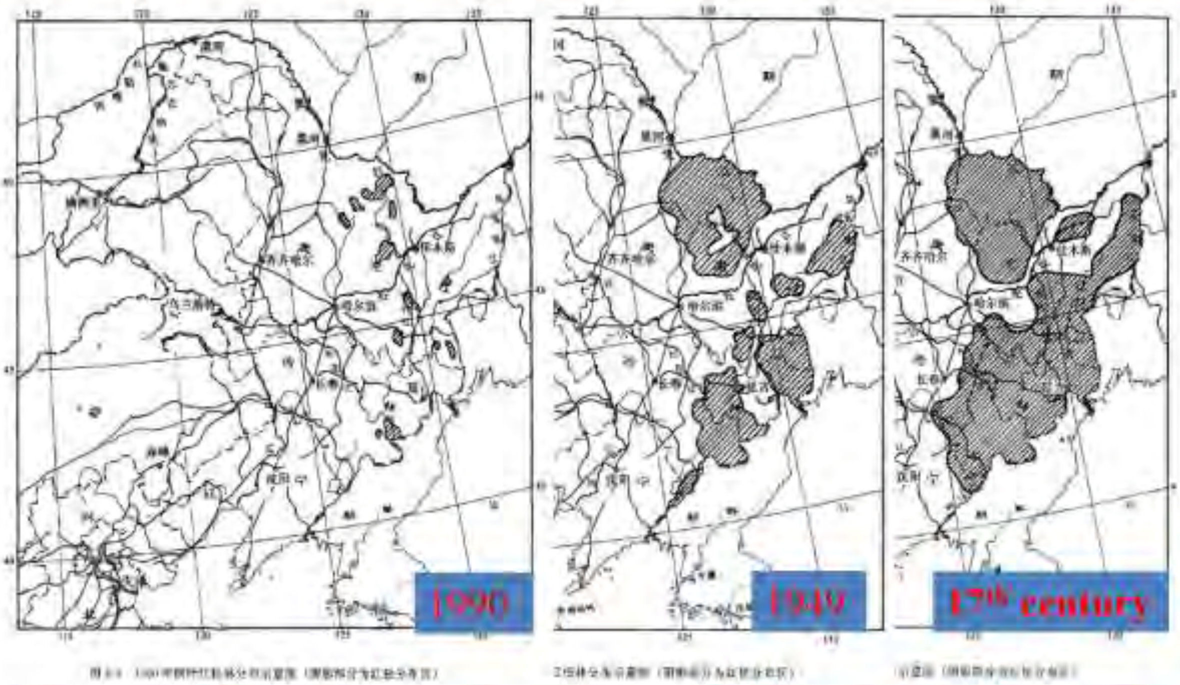
Associate Professor, School of Forestry, Northeast Forestry University



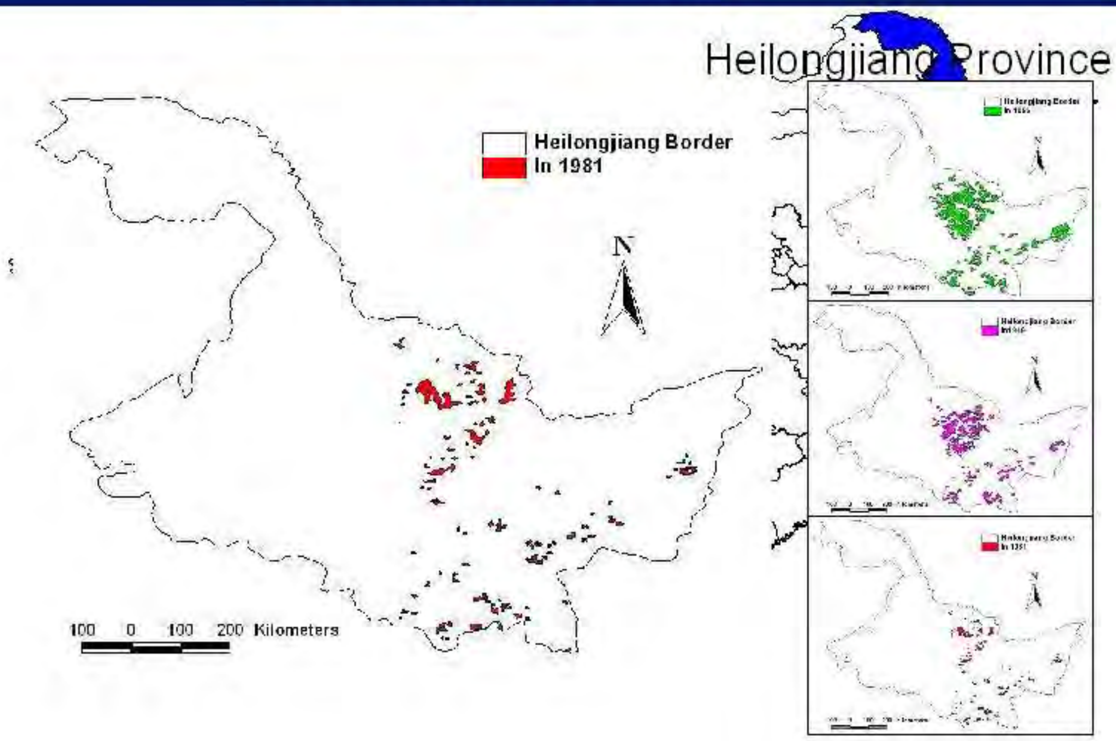
Mixed broadleaved-Korean pine forest

- Zonal forest vegetation in eastern mountainous of northeast China, and a typical representative of temperate needle and broad-leaved mixed
- Rich in species diversity (including 114 National class I and II key protected animals)
- High biomass and productivity, large carbon storage, and plays an important role in maintaining the northeast ecological security

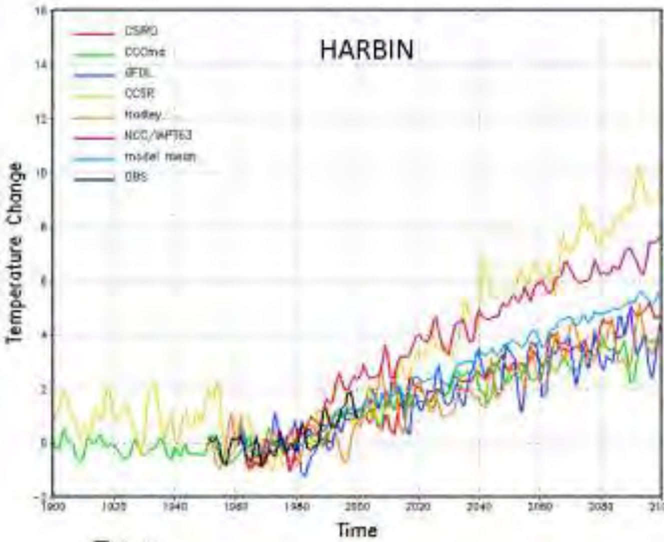
MBKP was disturbed intensely by human

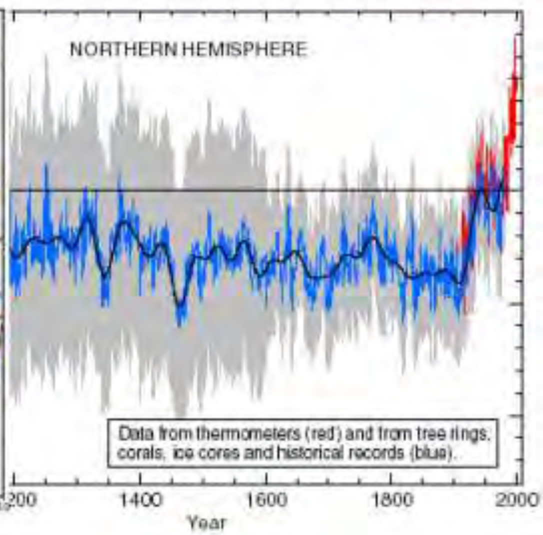


Human disturbance: forest area declined sharply in Heilongjiang Province



Climate disturbance：Warming



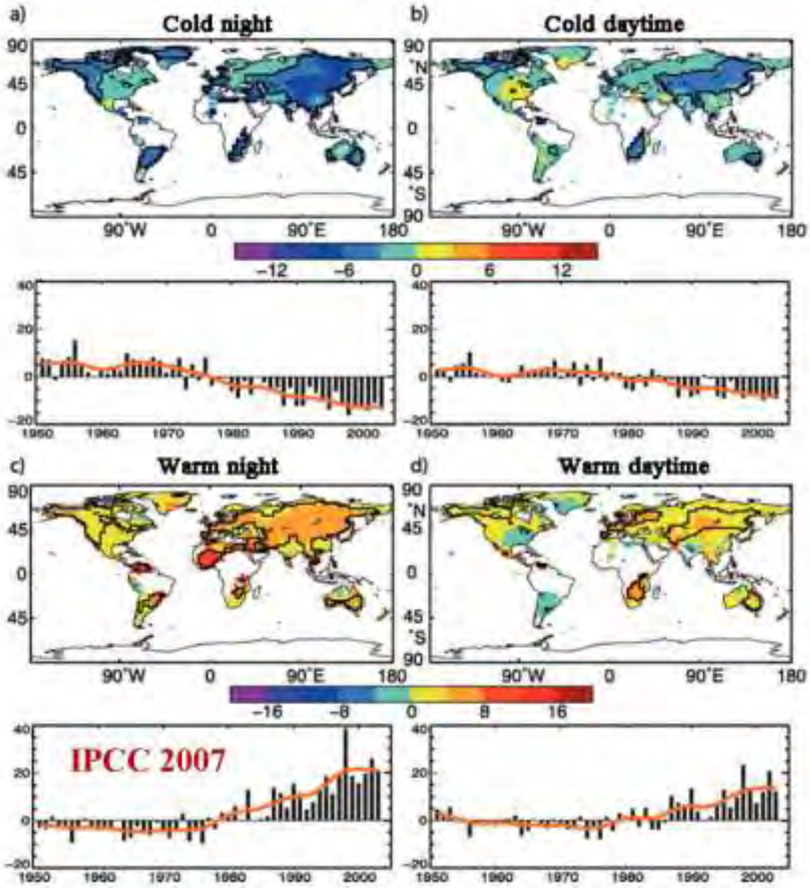


From http://www.ipcc.cma.gov.cn/cn/MapSys/htm/temp160-011.htm

From IPCC, 2001

Climate disturbance:

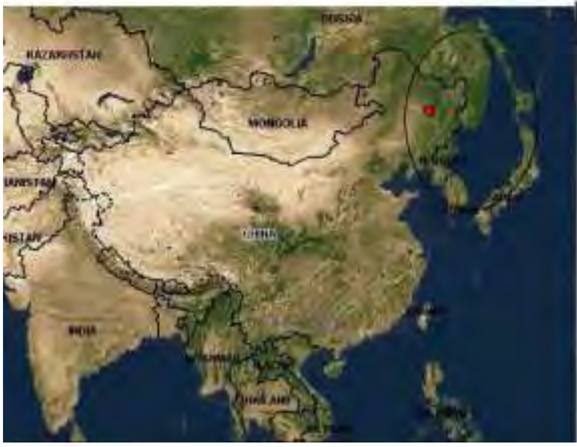
Heat waves, droughts, floods and cyclones extreme events increased



Study site: Liangshui National Reserve

General information

- Area : 12,133ha
- Location : 47°10’N, 128°53’E
- Elevation : 280-707m
- Mean annual temperature : -0.3℃
- Mean annual precipitation : 676mm

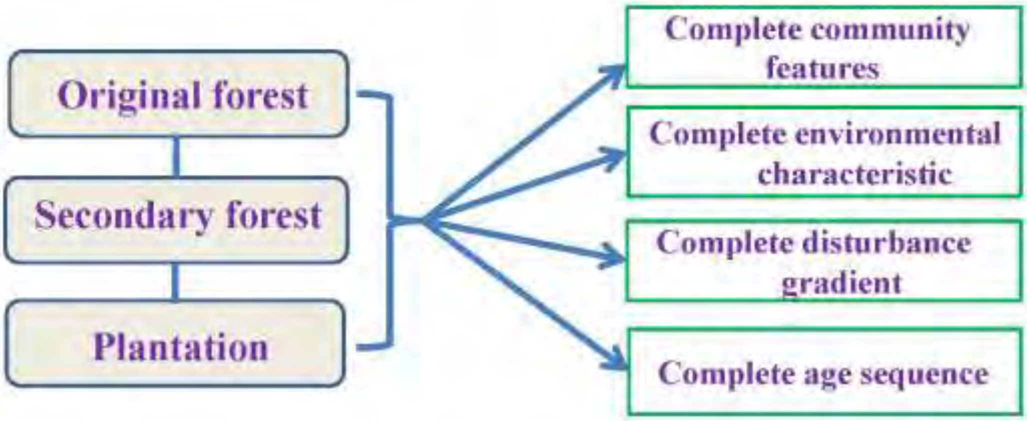


History of Liangshui National Nature Reserve

- ✓ In 1952, the second lumberyard for experiment bureau in Dailing;
- ✓ In 1958, northeast forestry school and developed experimental forest farm in Liangshui;
- ✓ In 1980, provincial natural reserve;
- ✓ In 1996, Chinese People and Biosphere Reserve Network;
- ✓ In 1997, national nature reserve;
- ✓ In 2006, national demonstration reserve.

Character of Liangshui National Nature Reserve

(1)



It is an ideal site for studying comparative ecology in space-time

Character of Liangshui National Nature Reserve

(2) Including different permanent plots for typical zonal vegetation and non-zonal vegetation, which lays a good foundation for studying ecology process and disturbance process.

(3) The permafrost distribution and sensitive area of climate change, which making this site is suitable for exploring the impact of climate change on forest ecosystems.

Forest biodiversity monitoring plot

Forest type	Area	Number	Setting time
Typical mixed broadleaved-Korean pine forest	300 m × 300 m	1	2005
Spruce-fir valley forest	380 m × 240 m	1	2006
Secondary birth forest	100 m ×100 m	1	2009
Typical mixed broadleaved-Korean pine forest	500 m × 600 m	1	2009

Forest ecological system function monitoring plot

Forest type	Area	Number	Setting time
Typical mixed broadleaved-Korean pine forest	30 m × 20 m	3	2009
Spruce-fir valley forest	30 m × 20 m	3	2009
Selection forest	30 m × 20 m	3	2009
Secondary birth forest	30 m ×20 m	3	2009
Korean pine plantation	30 m ×20 m	3	2009
Dahurian larch plantation	30 m ×20 m	3	2009

Influence of N deposition on forest ecosystem monitoring plot

Forest type	Area	Number	Setting time
Typical mixed broadleaved-Korean pine forest	20 m × 20 m	12	2007
Korean pine plantation	5 m ×20 m	20	2014

Mixed broadleaved-Korean pine forest

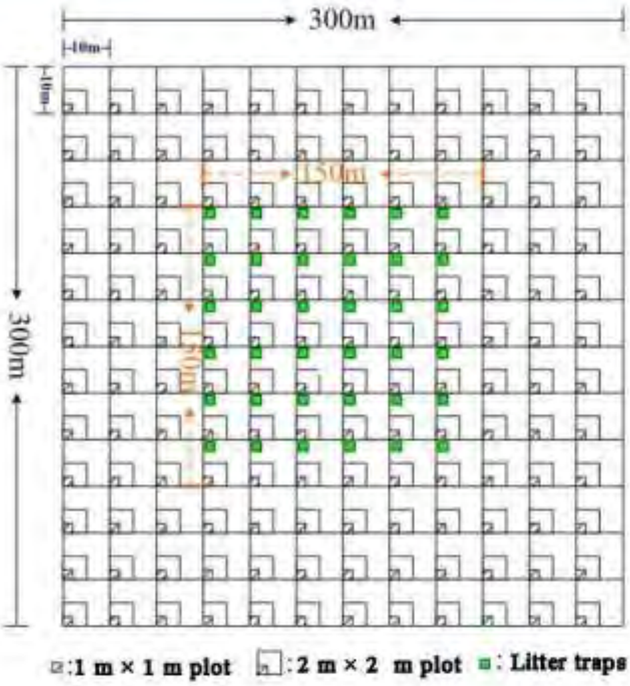
Spruce-fir valley forest

Secondary birth forest

Korean pine plantation

Dahurian larch plantation

Sampling design for mixed broadleaved-Korean pine forest



Research contents

1. Biological diversity
2. Functional traits
3. Leaf area index
4. Soil respiration
5. Simulated N deposition

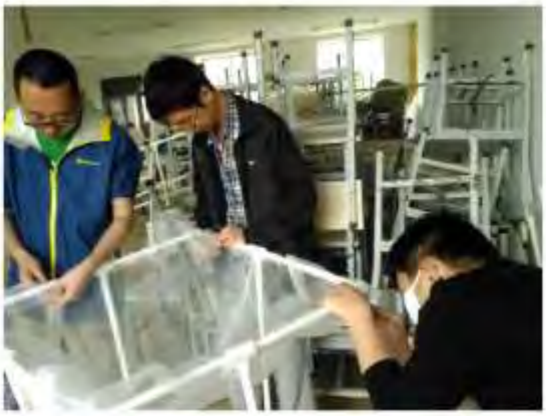
Monitoring contents-I

Biological diversity maintaining mechanism

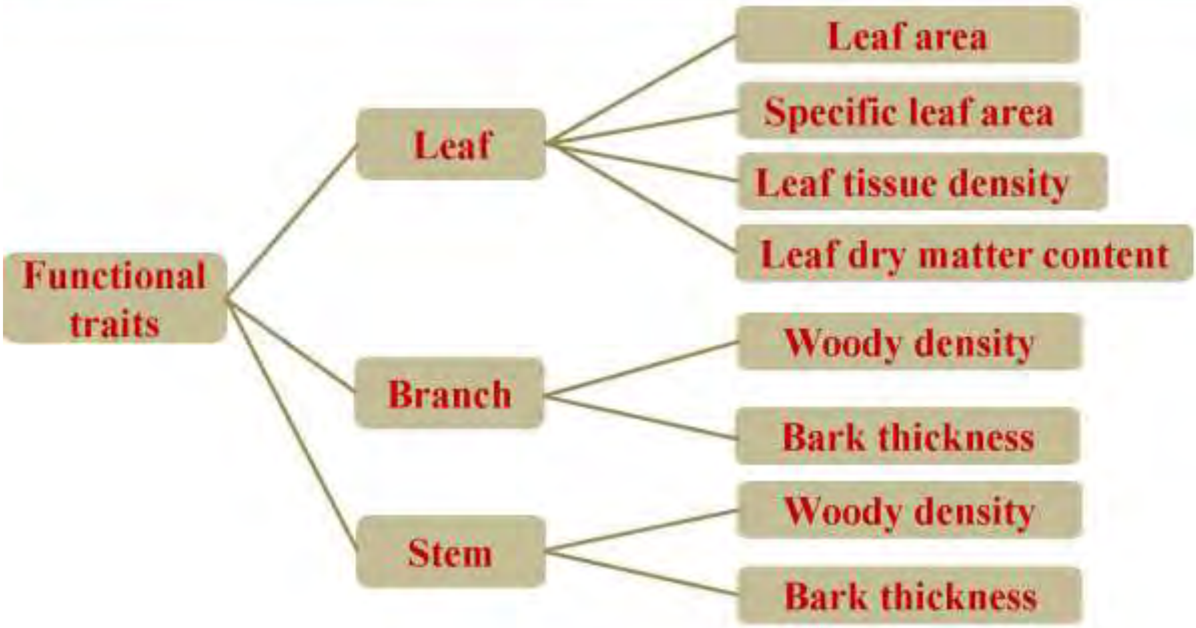
- Individuals with DBH > 1 cm were measured in 9 hm^2, 9.12 hm^2 and 30 hm^2 plots every five years
- Perennial seedings in 2 m×2 m subplots were measured in 9 hm^2 and 9.12 hm^2 plots every two years
- One year old seedlings in 1 m×1 m subplots were measured in 9 hm^2 plot every two weeks from June to mid-September
- The litter was collected every month or two weeks, and more than 400 litter traps were set in all forest plots



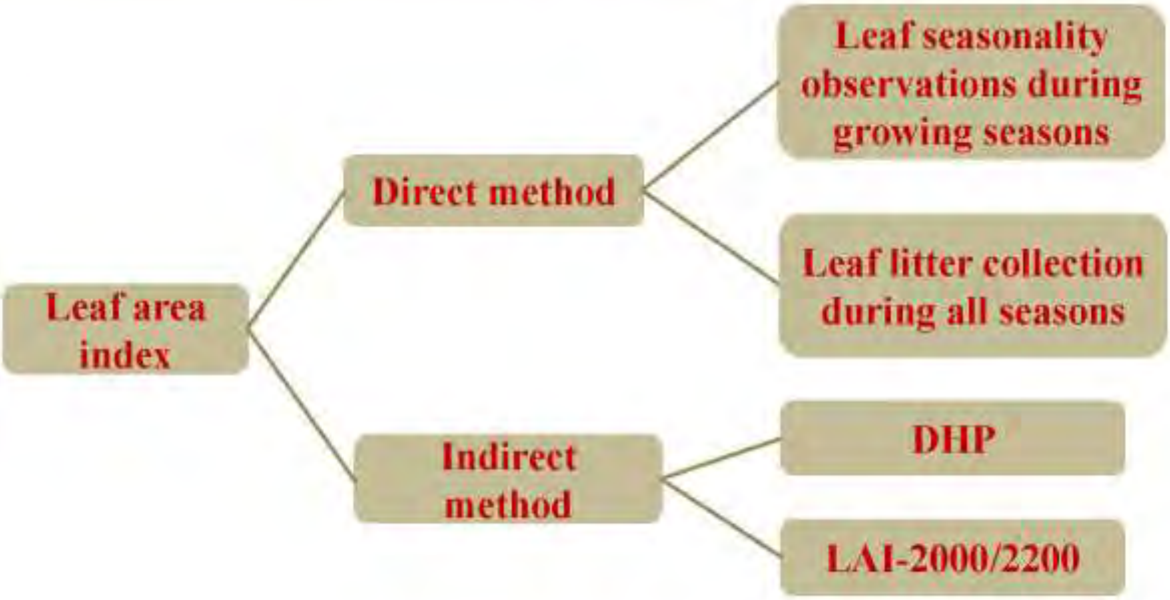


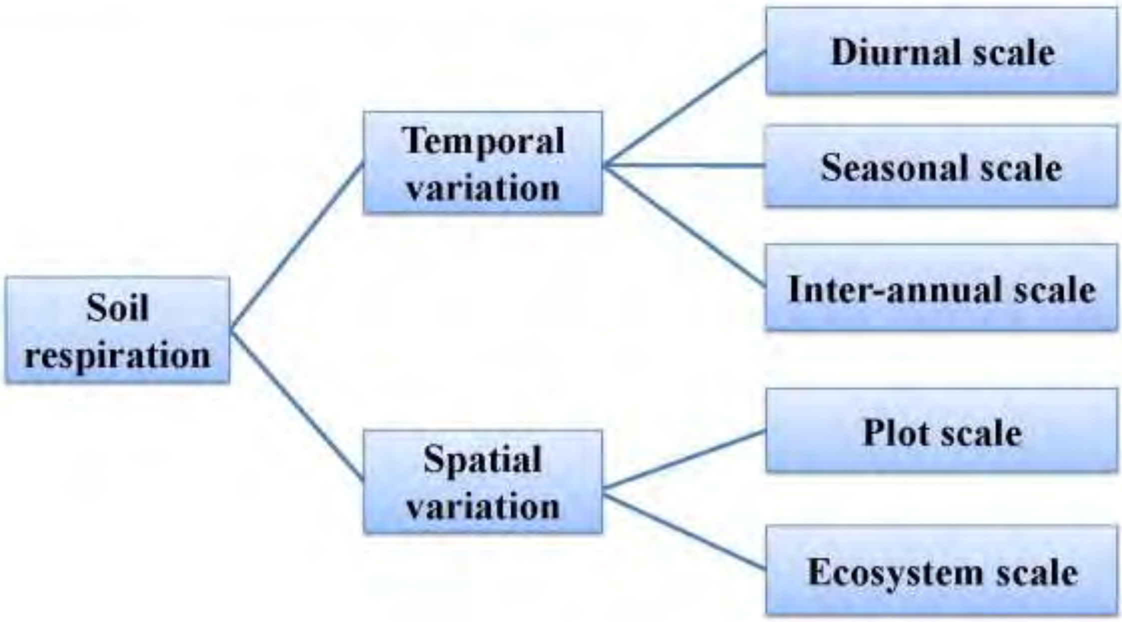
Monitoring contents-Ⅱ



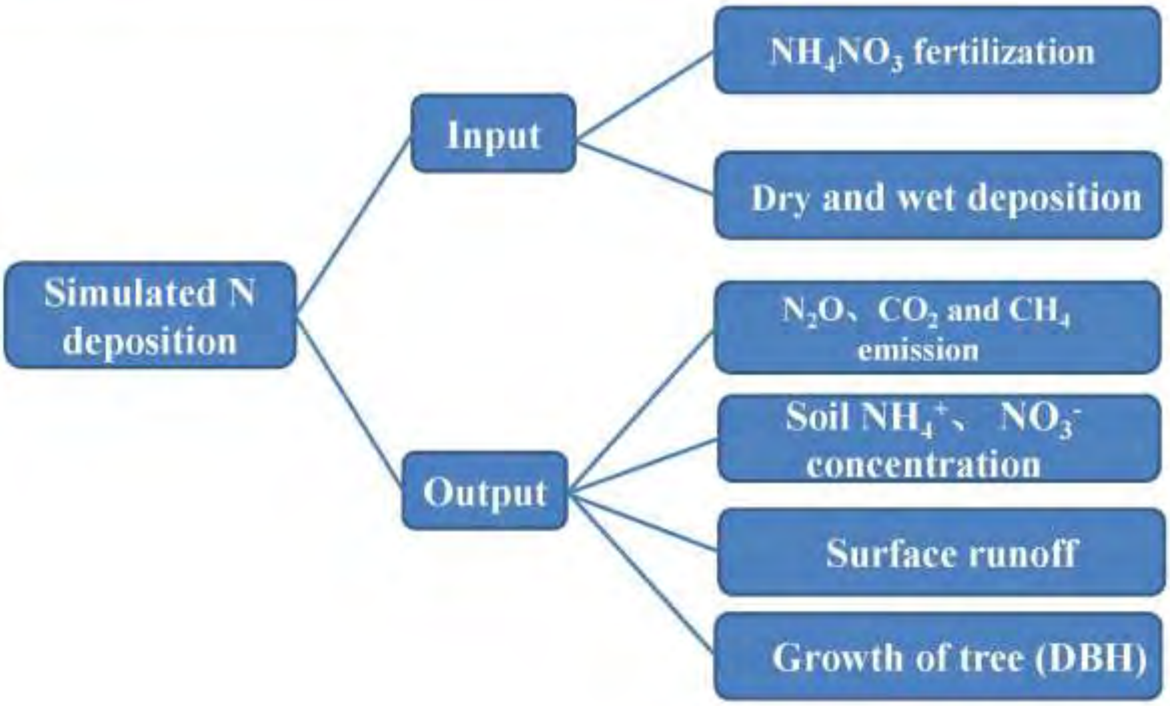
Monitoring contents-Ⅲ



Monitoring contents-Ⅳ



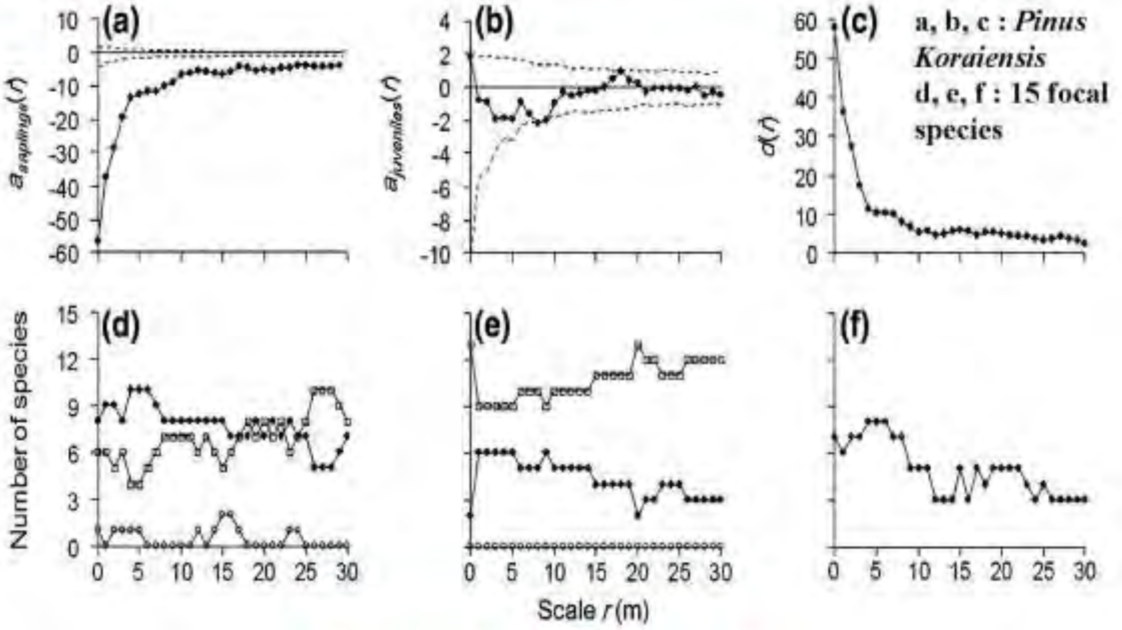
Monitoring contents-Ⅴ



Important findings

一、Biological diversity maintaining mechanism

1）Importance of negative density dependent in regulating multiple life-history stages in mixed broadleaved-Korean pine forest

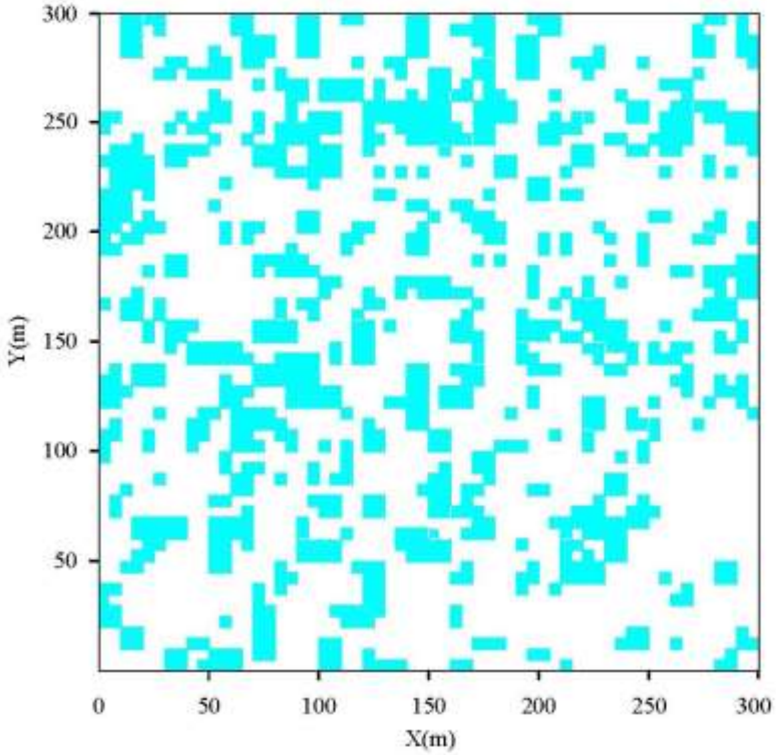


Piao et al, 2013, *Oecologia*

2）Effects of gaps on seedlings establishment in mixed broadleaved-Korean pine forest

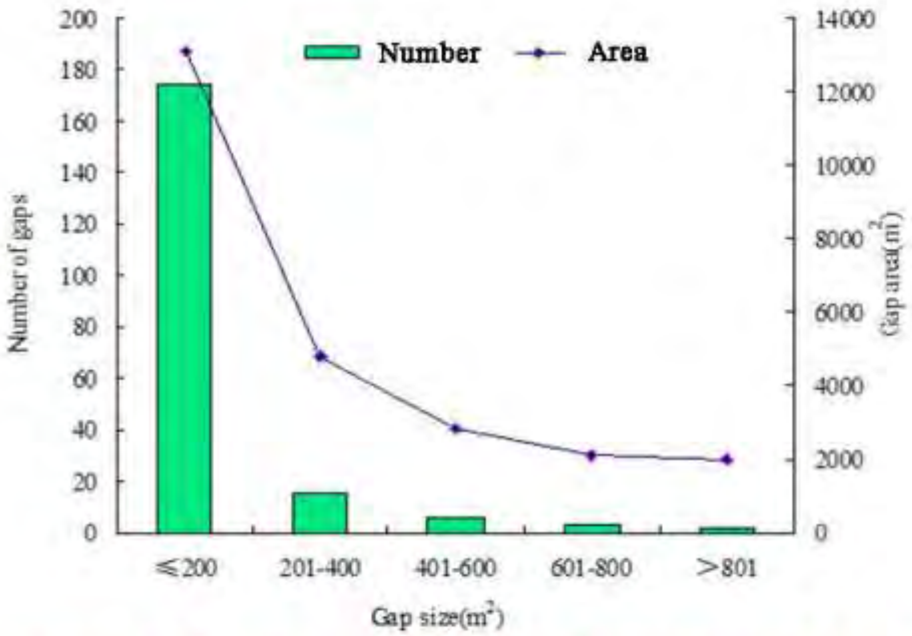
Successional cause

— *Tree fall gaps*

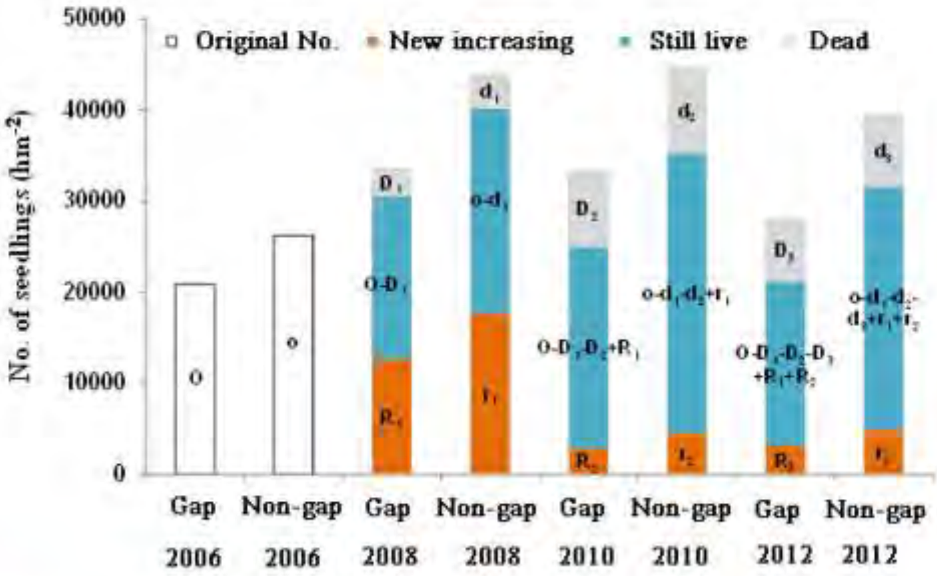


Map of gaps in mixed broadleaved-Korean pine forest

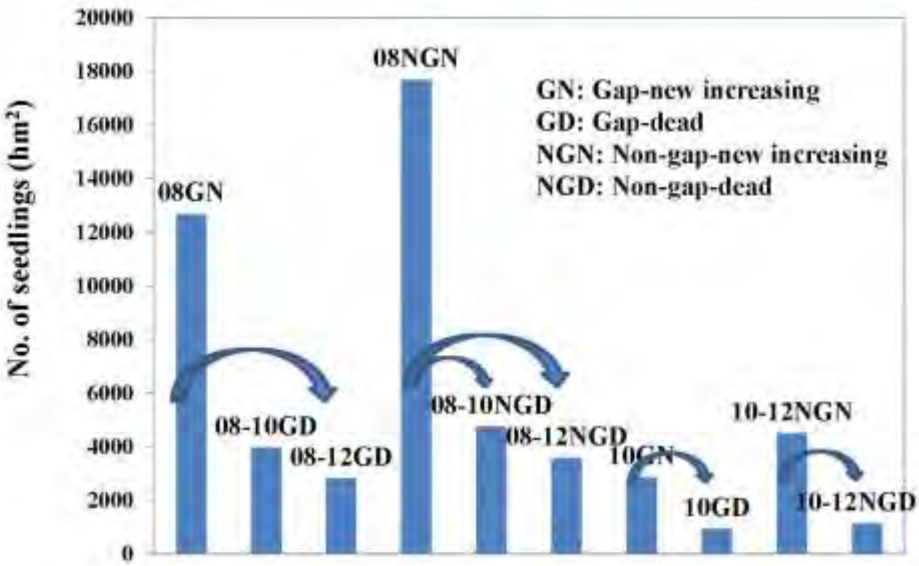
White: closed canopy; blue areas: canopy gaps



Number and area of gaps in mixed broadleaved-Korean pine forest



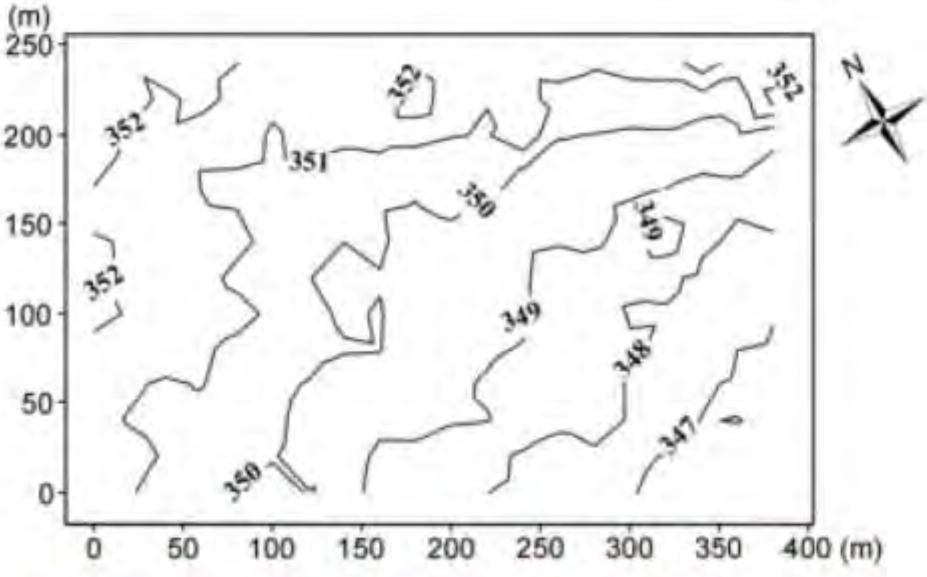
Emergence and death of seedlings in gap and non-gap situation in 2006, 2008, 2010 and 2012 in mixed broadleaved-Korean pine forest



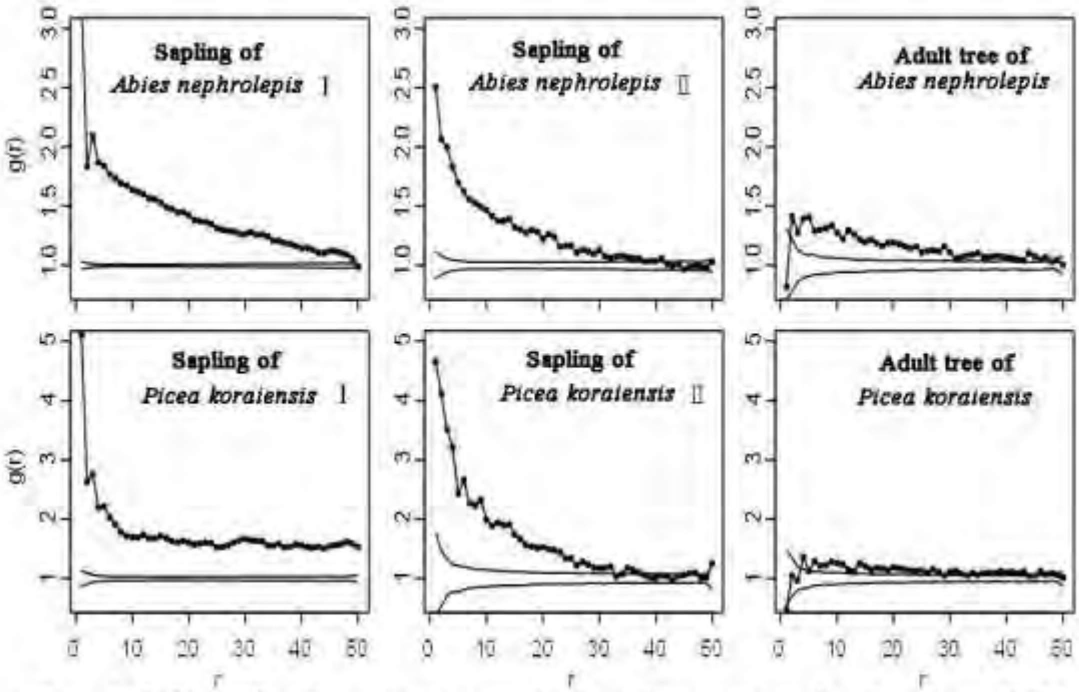
Dynamics of number of seedlings in different years

Liu et al., 2014，*Chinese Science Bulletin*

3）Spatial distribution of major species in spruce-fir valley forest



Topographic map of spruce-fir valley forest in the Xiaoxing'an Mountains, China

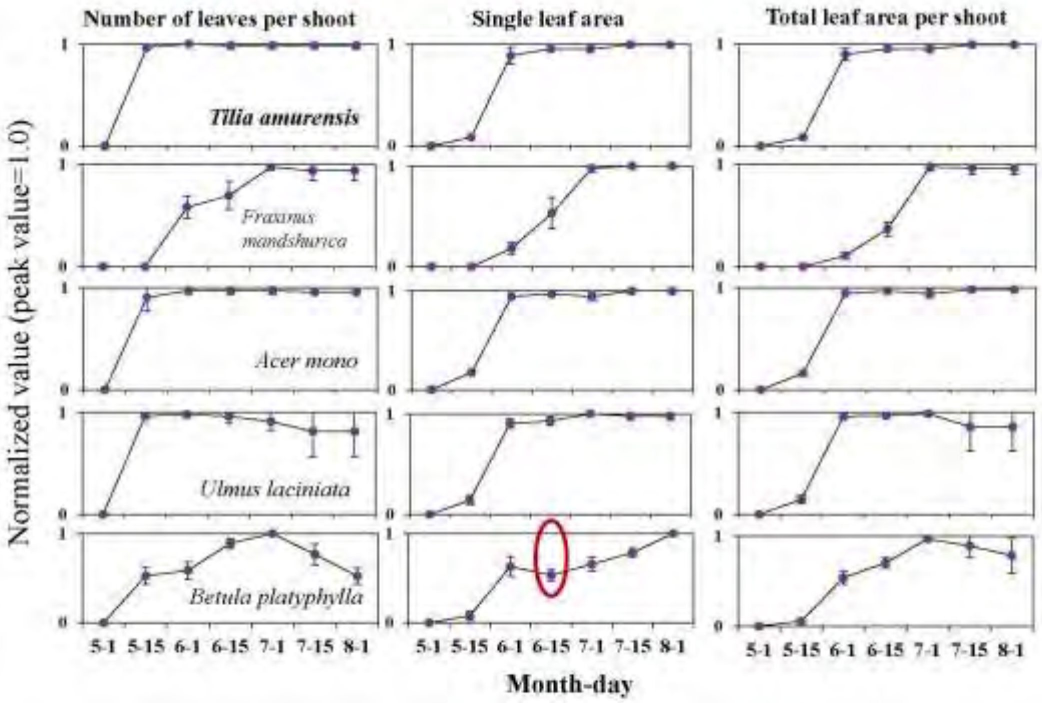


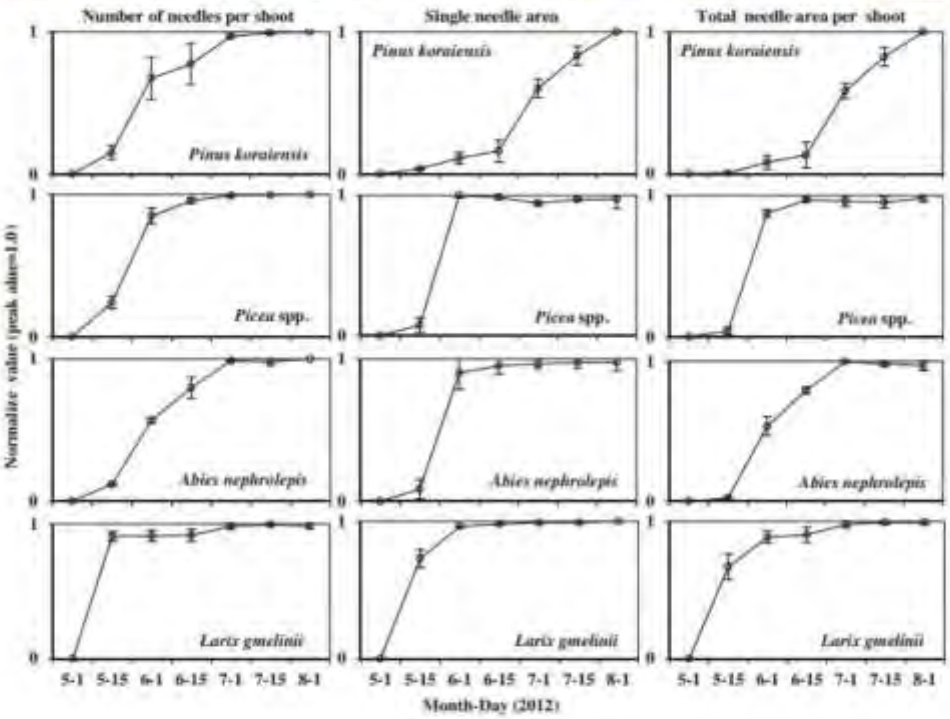
Spatial distribution pattern of dominant species in three life history stages

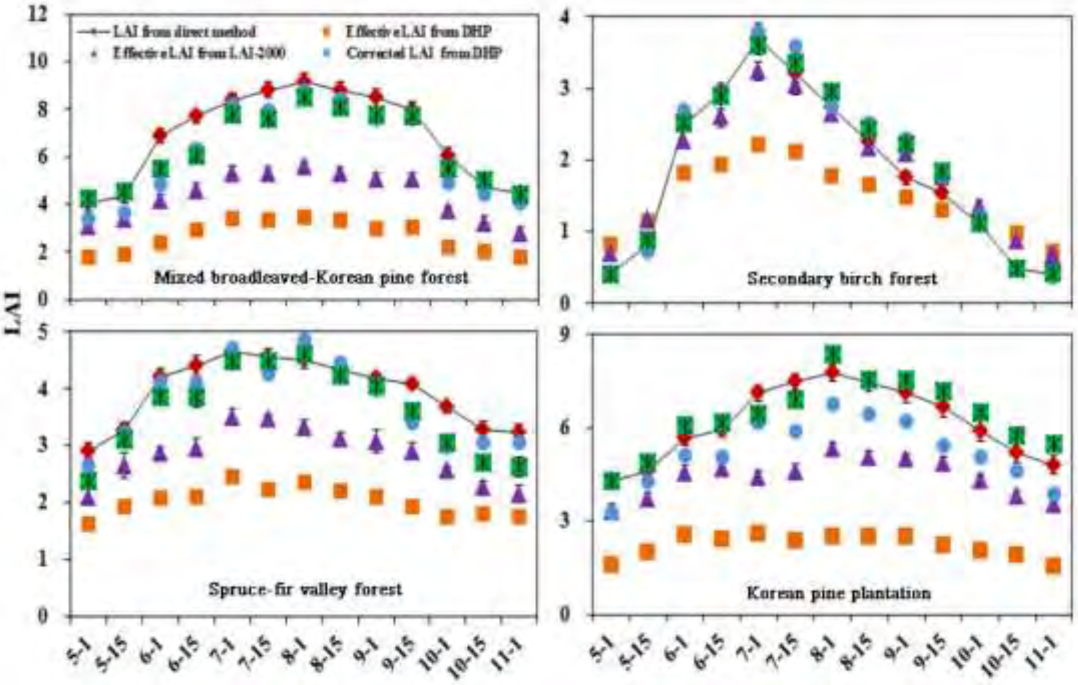
Zhang et al., 2014, *Chinese Science Bulletin*

二、Ecological system function change

1） Estimating seasonal variations of leaf area index using litterfall collection and optical methods in four mixed evergreen–deciduous forests

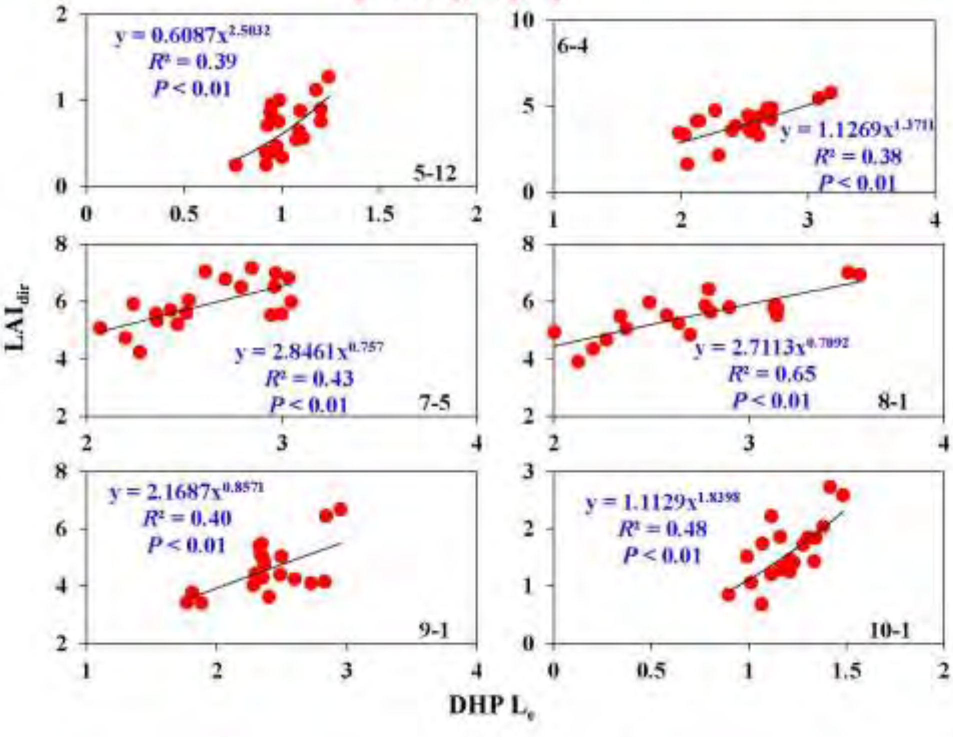


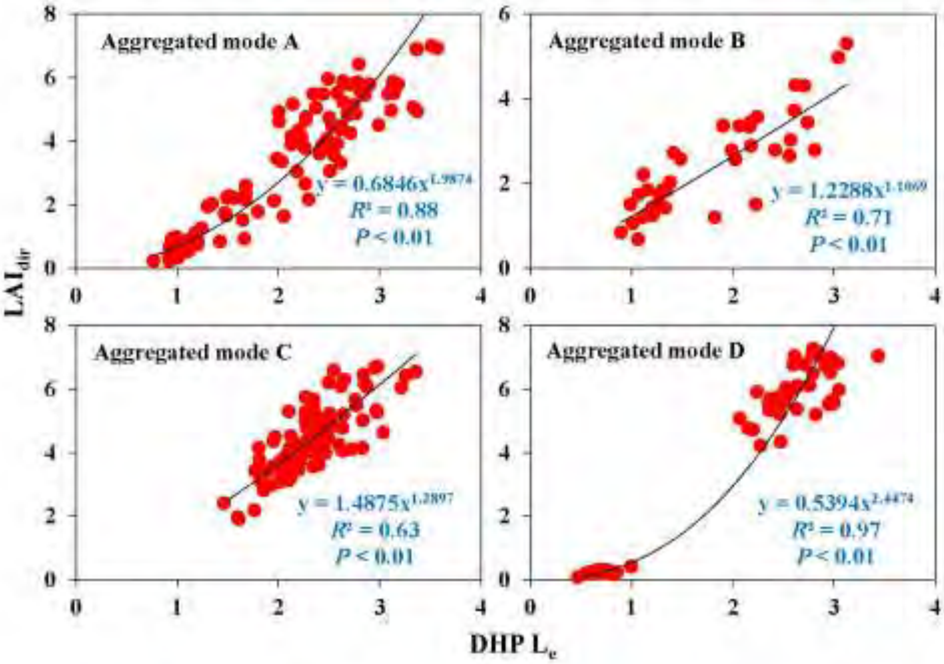




Liu et al, 2015, *Agricultural and Forest Meteorology*

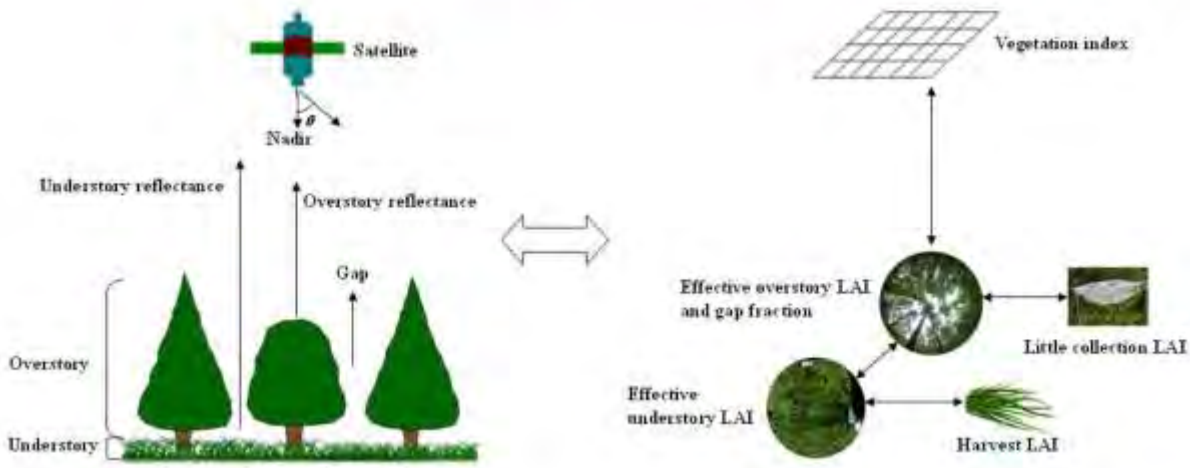
2）Empirical models for tracing seasonal changes in leaf area index in deciduous broadleaf forests by digital hemispherical photography

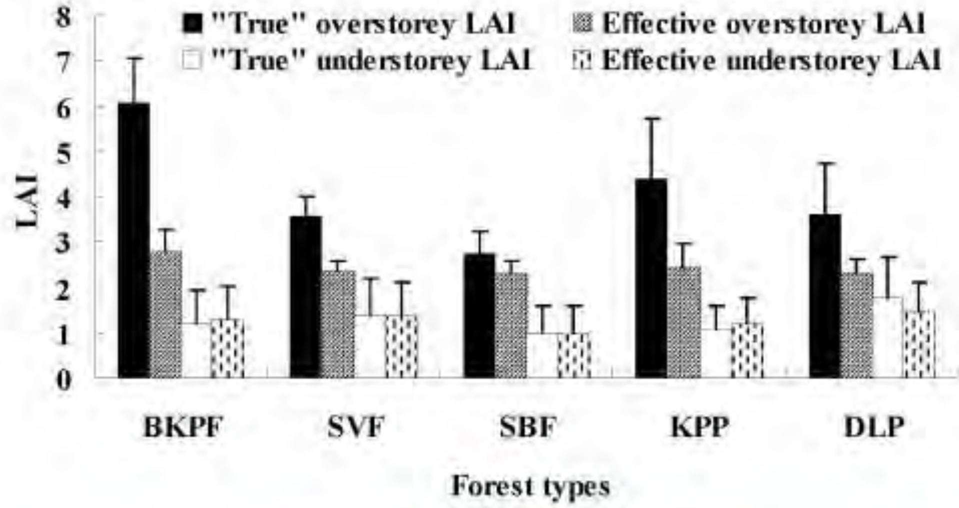




Liu et al, 2015, *Forest Ecology and Management*

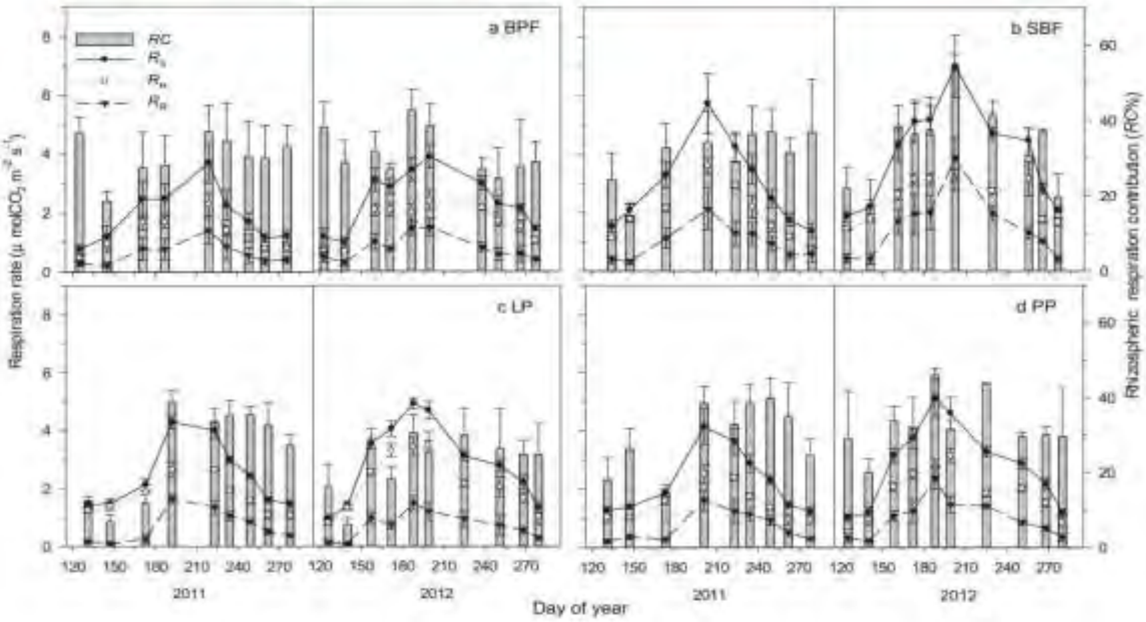
3）Impact of understorey on overstorey leaf area index estimation from optical remote sensing in five forest types in northeastern China

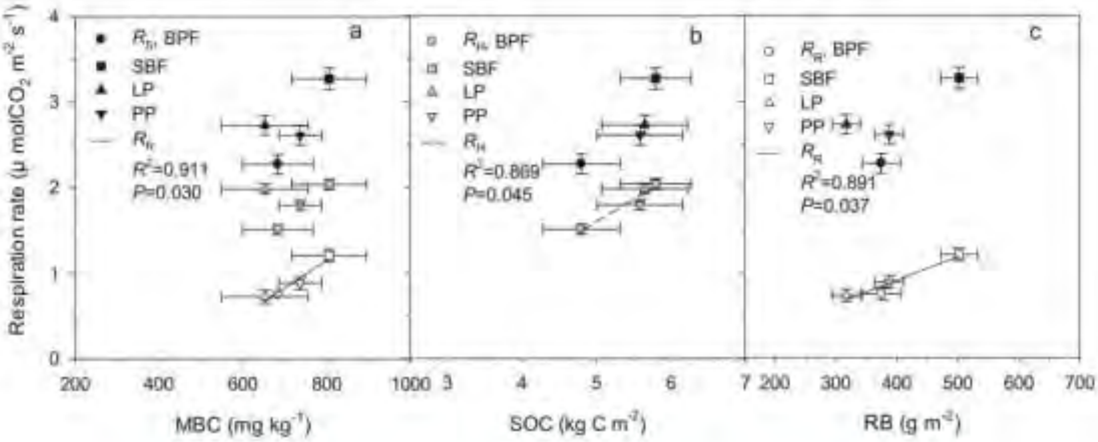




Qi et al, 2014, *Agricultural and Forest Meteorology*

4）Effects on rhizospheric and heterotrophic respiration of conversion from primary forest to secondary forest and plantations in northeast China





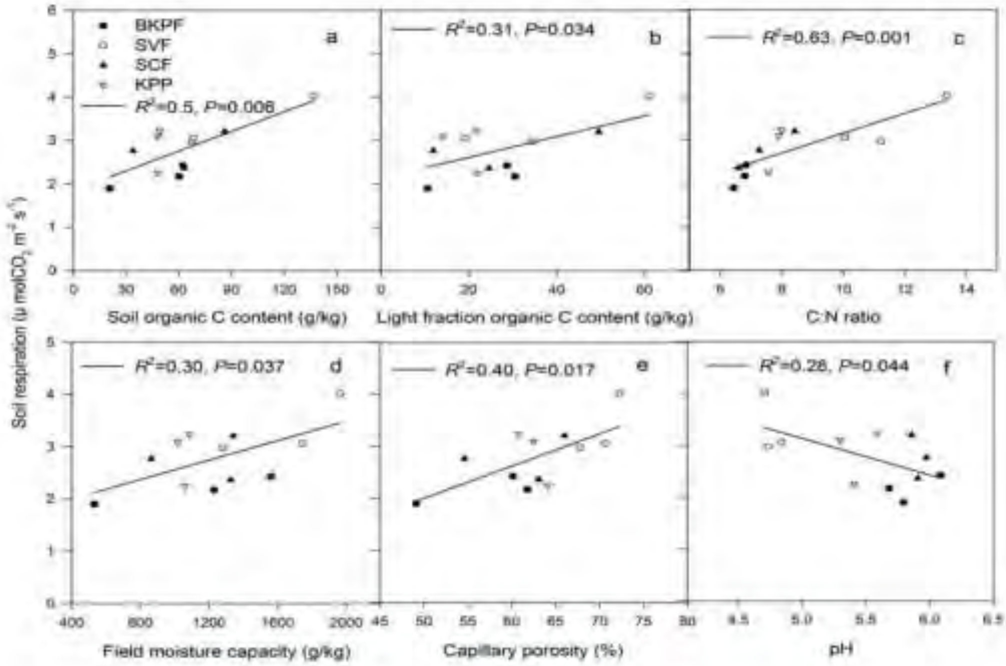
Shi et al, 2015, *European Journal of Soil Biology*

5）Variability of soil respiration at different spatial scales in temperate forests

Table 4 Model coefficients for estimating soil respiration from individual collars using stand structural parameters and soil properties within a specific forest stand

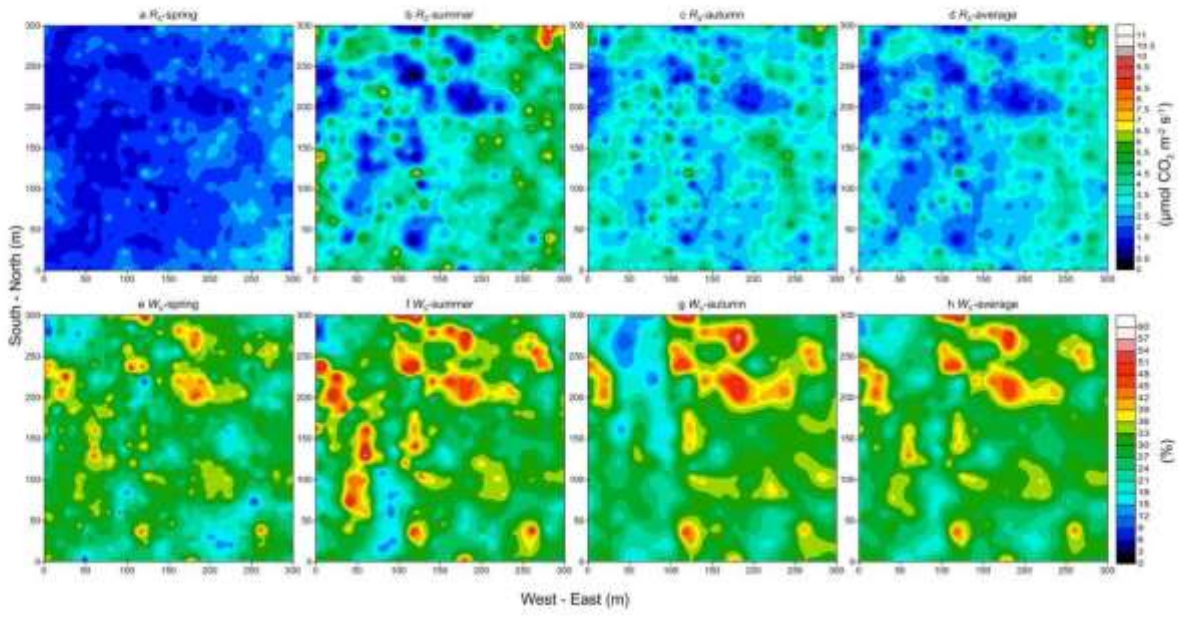
Forest type	Parameters	*B*	Beta	*P* value	Model R^2	Model-adjusted R^2
Mixed broad-leaved Korean pine forest	Constant	4.457		<0.001	0.72	0.69
	WFPS	−5.676	−0.711	<0.001		
	Mean DBH_8	0.177	0.364	0.019		
Spruce-fir valley forest	Constant	3.202		0.001	0.50	0.43
	SOC	0.011	0.507	0.016		
	Mean DBH_8	−0.199	−0.402	0.048		
Selective cutting of mixed broad-leaved Korean pine forest	Constant	−0.108		0.895	0.61	0.56
	C:N	0.339	0.525	0.008		
	BA_4	0.029	0.422	0.027		
Korean pine plantation	Constant	1.186		0.554	0.51	0.44
	Mean DBH_5	−0.129	−0.442	0.037		
	C:N	0.443	0.426	0.043		

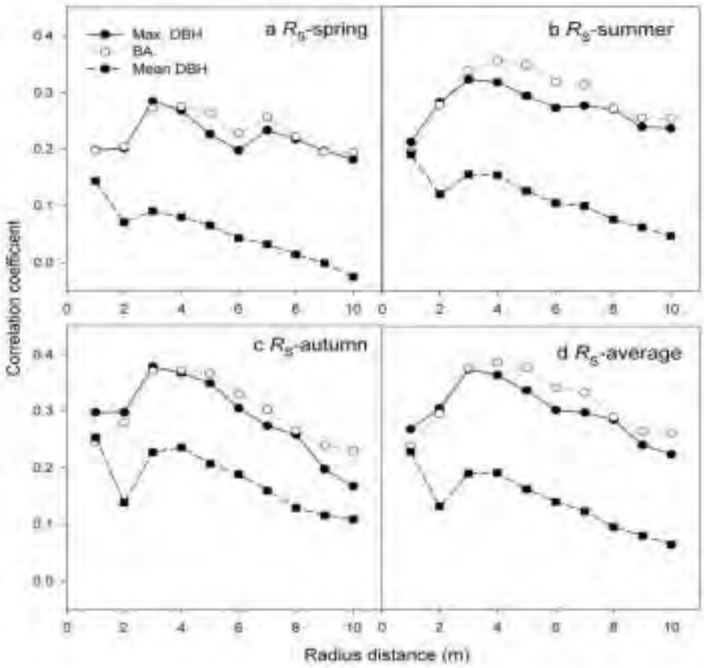
WFPS water-filled pore space, *SOC* soil organic C content, *mean DBH_5 and mean DBH_8* mean DBH for trees within 5 and 8 m (radius) of the measurement collars, *BA_4* basal area for trees within 4 m (radius) of the measurement collars



Shi et al，2016，*Biology and Fertility of Soils*

6）Spatial variation of soil respiration is linked to the forest structure and soil parameters in an old-growth mixed broadleaved-Korean pine





Shi et al，2016，*Plant and Soil*

2) Liana distribution and community structure in an old-growth cool temperate forest of Japan - Case study in Ogawa Forest Reserve (OFR)

Mr. Hideki Mori

Doctoral Candidate, Biosphere Resource Science and Technology Program,
Graduate School of Life and Environmental Science, University of Tsukuba

LTER workshop, September 21th 2016,
Northeast Forestry Univerisity, Harbin, China

Liana distribution and community structure in an old-growth cool temperate forest of Japan —Case study in Ogawa Forest Reserve (OFR)—

Hideki MORI
University of Tsukuba
Graduate School of Life and Environmental Sciences
Biosphere Environmental Science and Technology
the first year of the doctoral program

Study site: Ogawa Forest Reserve (OFR)

- LTER core site
- Old growth cool temperate forest (Fagus crenata, Quercus serrata)
- area: 6ha (300m × 200m)
- Tree inventory since 1987
- > 200 publications

Climate data (Mizugochi et al. 2002)

Annual precipitation	1910mm
Annual temperature	10.7℃
Elevation	610-660m

- Many people gather to conduct a tree inventory

Photo by Takashi Masaki

- Research station near OFR
- More than 190 people in total use this house in one year

Introduction importance of lianas

What are Lianas?

- Woody Vines
- Mechanically dependent
  - → require "Host trees"
- Attachment to the ground

- "Climbers of the Forest"
- "Climbing plants"

Photo of dominant liana species in OFR (*Wisteria floribunda*)

Introduction importance of lianas

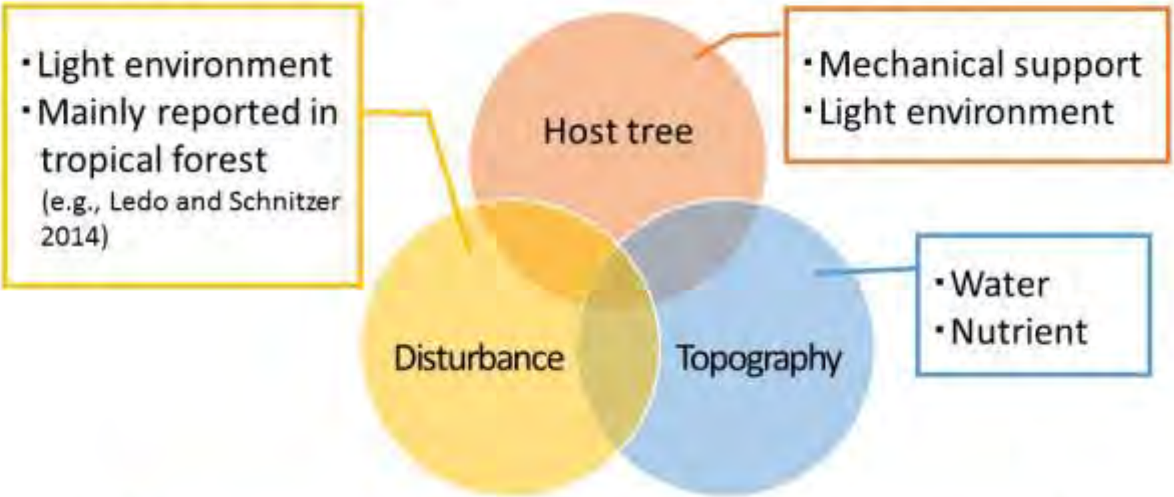
Substantial contribution to tropical and temperate forest dynamics, diversity, management and forest ecosystem function (Schnitzer et al. 2015)

Negative effects on host trees (Schnitzer et al. 2002)

- ▸ suppress tree growth in gap
- ▸ increase of host tree mortality

Introduction Spatial distribution of lianas

There are mainly three factors which determine liana distribution

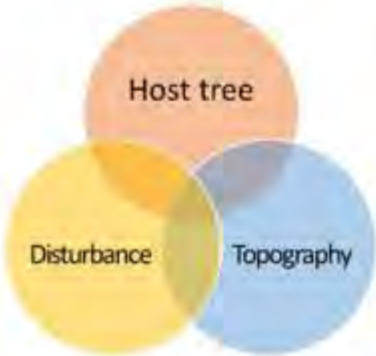


It is important to evaluate liana distribution from host trees, disturbances and topography

Previous work in OFR: Mori et al. 2016

- "Liana distribution and community structure in an old- growth temperate forest: the relative importance of past disturbances, host trees, and microsite characteristics"
- Liana survey for trees (DBH≥5cm) in 6ha plot were conducted

1. Host tree size (DBH), large-scale past disturbance (ca. 100yr ago) were important for liana occurrence
2. Microsite characteristic were not so important



Previous work in OFR: Mori et al. 2016 [Plant Ecology]

Table 5 Summary of the best models to explain liana distribution

Species	Climbing types	Class	Host tree conditions		Microsite characteristics							SAC[a]
			Host size	Shade tolerance	Slope	Soil water	Micro-scale habitat					
							Head hollow	Upper slope	Lower slope	Flood terrace	River bed	
Wisteria floribunda	ST	Small	−−−			−−						***
		Large	+++	−−								**
Euonymus fortunei	RC	Small	+++	−−								***
Schizophragama hydrangeoide	RC	Small	+++	+	−−							*
		Large	+++									
Hydrangea petioralis	RC	Small	+									*
Rhus ambigua	RC	Small	++	−								
		Large	++	−								
Vitis coignetiae	TC	Large	+									

The abbreviations for the climbing types are provided in Table 1

[a] SAC spatial autocorrelation; significance is indicated by asterisks. Plus and minus symbols indicate positive and negative coefficients, respectively, for the corresponding variables

+, −,* $p < 0.05$; ++, −−, ** $p < 0.01$; +++, −−−, *** $p < 0.001$

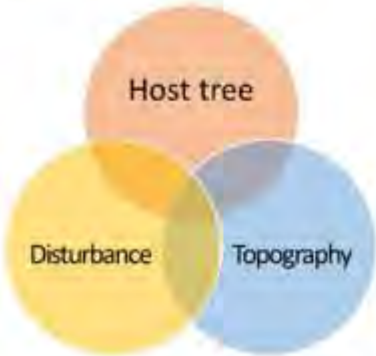
Previous work in OFR: Mori et al. 2016 [Plant Ecology]

- "Liana distribution and community structure in an old- growth temperate forest: the relative importance of past disturbances, host trees, and microsite characteristics"
- Liana survey for trees (DBH≥5cm) in 6ha plot were conducted

1. Host tree size (DBH), large-scale past disturbance (ca. 100yr ago) were important for liana occurrence
2. Microsite characteristic were not so important

- New questions:

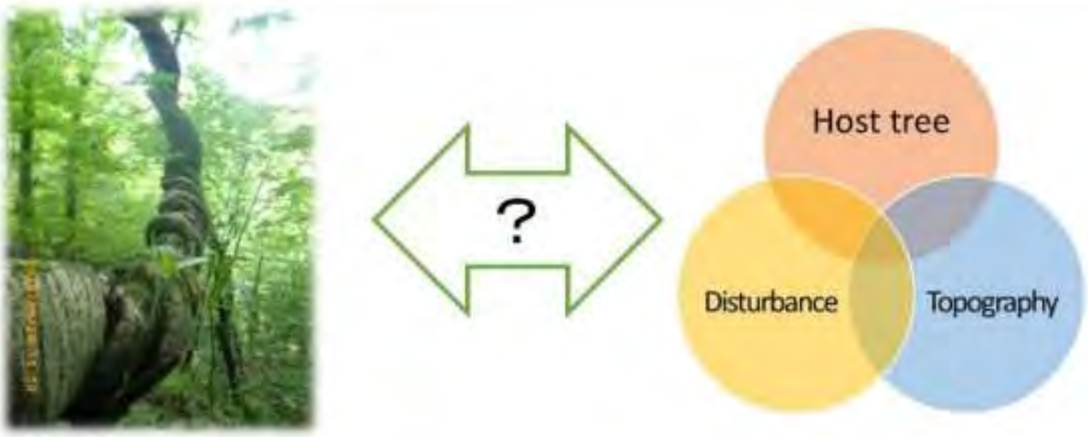
a. Tree architecture?
b. Small-scale disturbance?

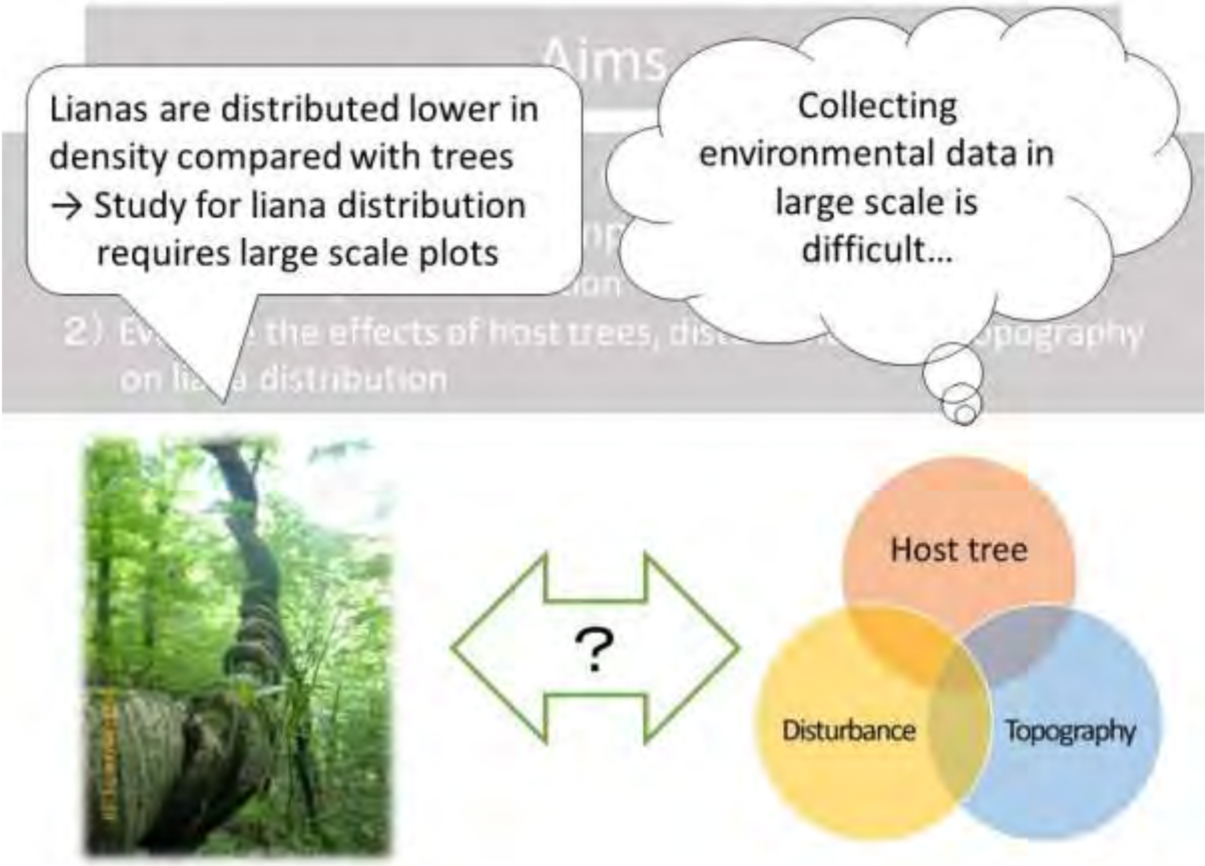


Aims

To clarify the factors which determine liana distribution in a cool temperate forest

1）Clarify liana spatial distribution
2）Evaluate the effects of host trees, disturbances and topography on liana distribution



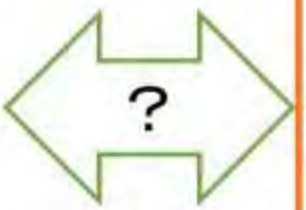


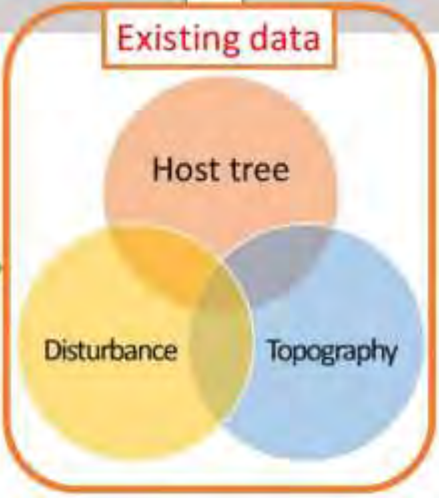
Aims

Lianas are distributed lower in density compared with trees
→ Study for liana distribution requires large scale plots

Collecting environmental data in large scale is difficult…

2) Ev… the effects of host trees, dis… topography on lia… distribution





Methods Existing data(1): Tree inventory

Tree inventory data in OFR 6-ha plot since 1987

Species name, DBH and location for trees (DBH > 5cm) are surveyed

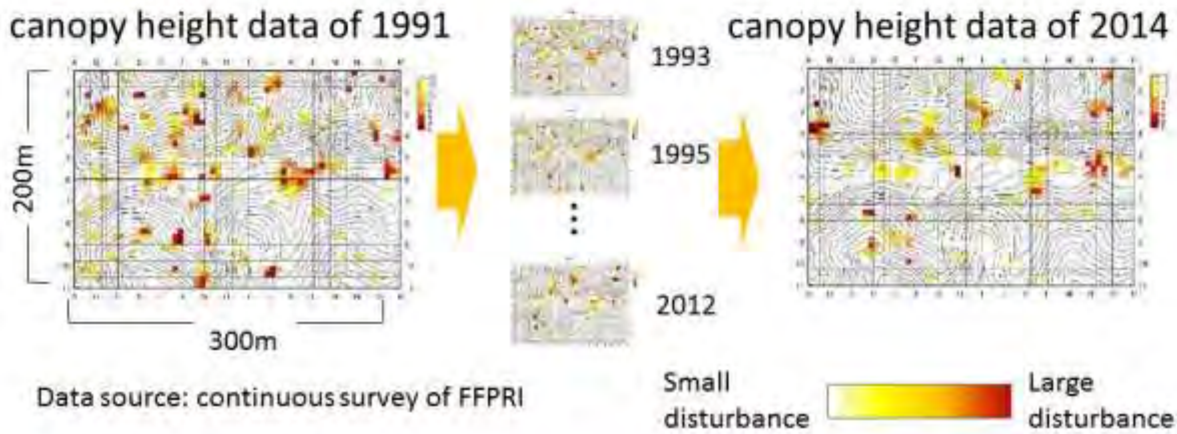
Additional tree inventory for trees (5 > DBH ≥ 1cm) were conducted in 2014 to 2015

Data for all trees (DBH ≥ 1cm) were completed

As for host tree data, tree inventory data (dbh > 1cm) were used

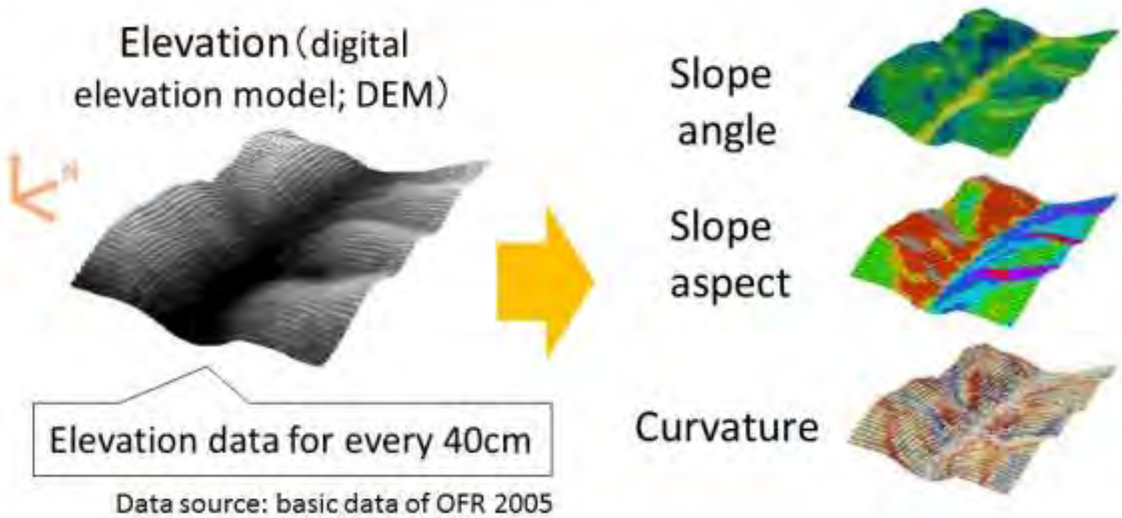
Methods Existing data(2): canopy gap

Canopy height data for every 5m × 5m grid since 1991



As for disturbance indicator,
minimum value of canopy height data was used

Methods Existing data(3): topography



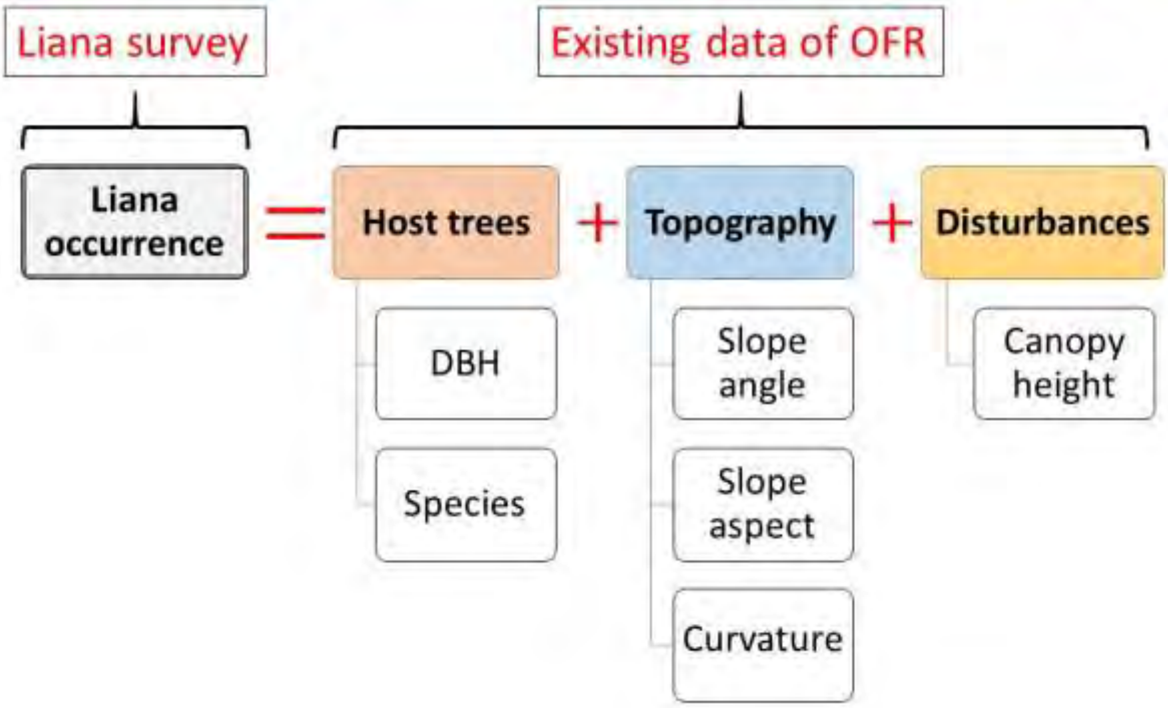
As for topographical indices,
Slope angle, slope aspect and curvature were used

Methods Liana survey

Because of plentiful existing data, only survey
I conducted was liana survey;

For all lianas on trees (dbh ≥1cm),
species name, DBH and host tree ID were recorded

Analysis(1) spatial distribution



Analysis(1) spatial distribution

For each species, occurrence probability (p_i) on i– th non-liana tree was analyzed assuming Bernoulli process:

$$Y_i \sim \text{Bernoulli}(p_i)$$

$$\text{logit}(p_i) = \beta_0 + \beta_1 z_{1i} + \beta_2 z_{2i} + \beta_3 z_{3i} + \beta_4 z_{4i} + \beta_5 z_{5i} + \gamma + \delta + \varepsilon \quad (1)$$

$$\text{where} \quad \beta_j = a_j * \text{DBH}_i + b_j \quad (2)$$

Liana dbh

Y_i : data (presence or absence)
β_j : parameters
δ : host tree species (random effect)
γ : spatial random effect (CAR)
ε : error

Analysis(1) spatial distribution

For each species, occurrence probability (p_i) on i– th non-liana tree was analyzed assuming Bernoulli process:

$$Y_i \sim \text{Bernoulli}(p_i)$$

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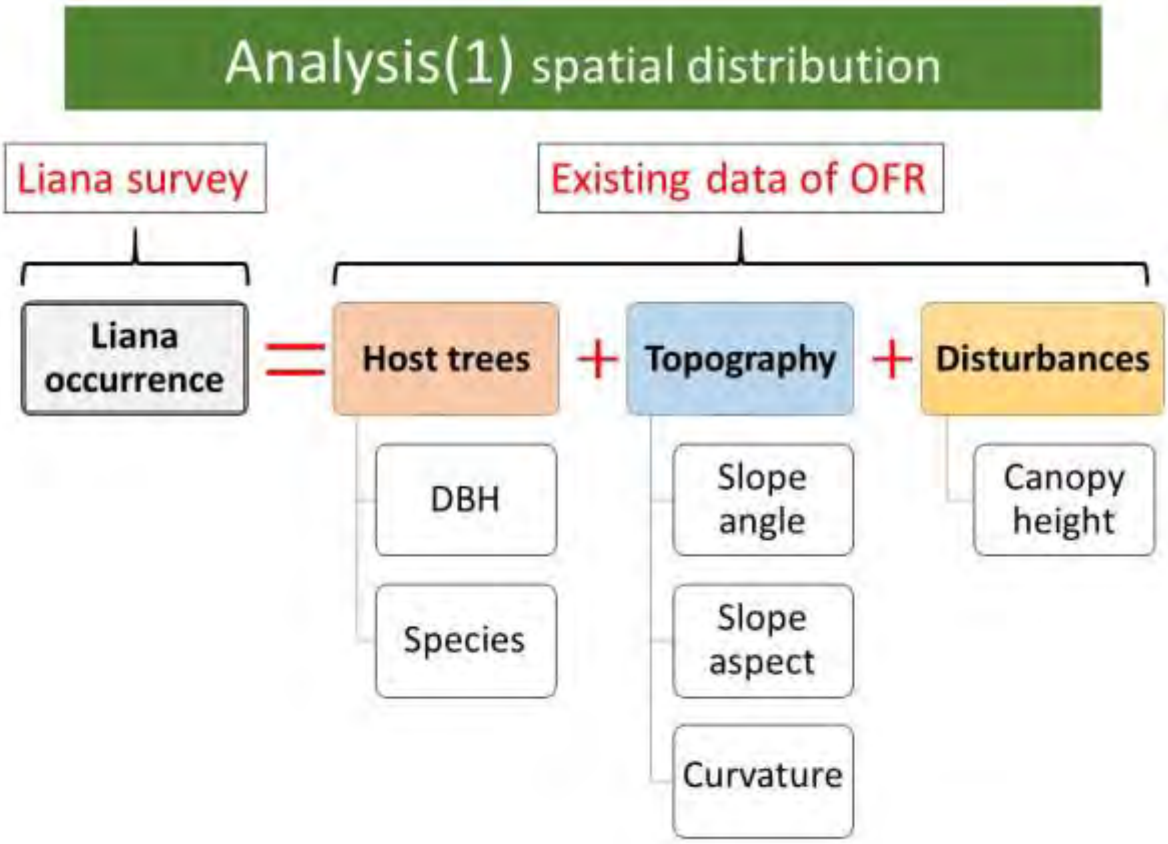
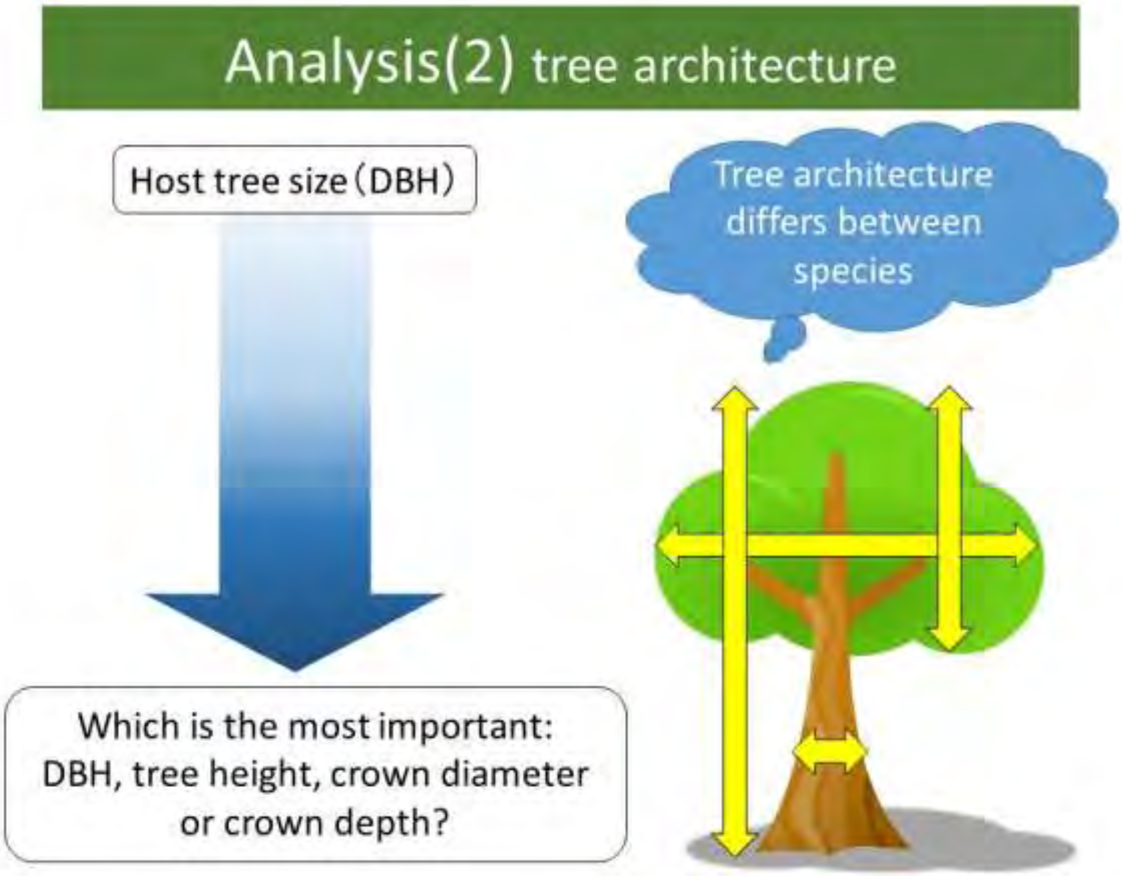
$$\text{where} \quad \beta_j = a_j * \text{DBH}_i + b_j \quad (2)$$

β changes with liana dbh

Y_i : data (presence or absence)
β_j : parameters
δ : host tree species (random effect)
γ : spatial random effect (CAR)
ε : error


Analysis(1) spatial distribution
Liana survey
Existing data of OFR
Liana occurrence
Host trees
Topography
Disturbances
DBH
Species
Slope angle
Slope aspect
Curvature
Canopy height


Analysis(2) tree architecture
Host tree size (DBH)
Tree architecture differs between species
Which is the most important: DBH, tree height, crown diameter or crown depth?

Analysis(2) tree architecture

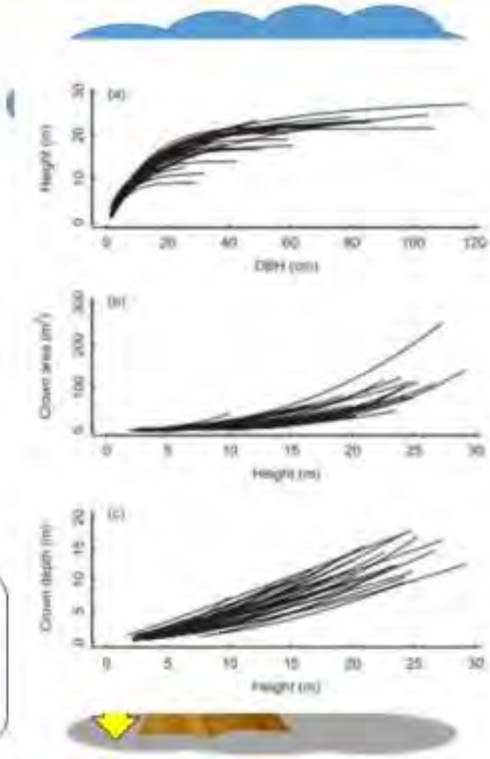
Host tree size（DBH）

Allometric equations for 30 species
Aiba and Nakashizuka (2009)
$y = f(x)$

Tree height, crown diameter and depth

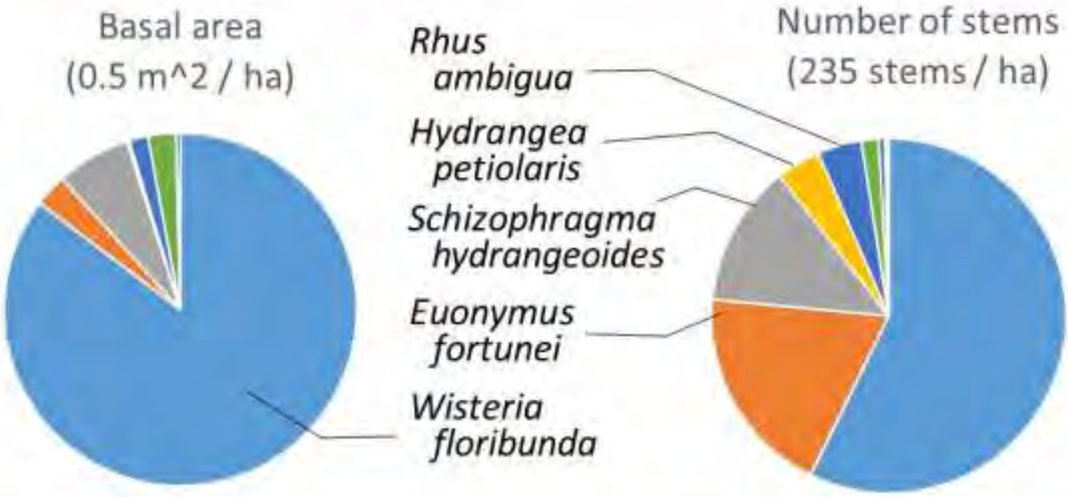
Hierarchical partitioning

Which is the most important:
DBH, tree height, crown diameter
or crown depth?



Results

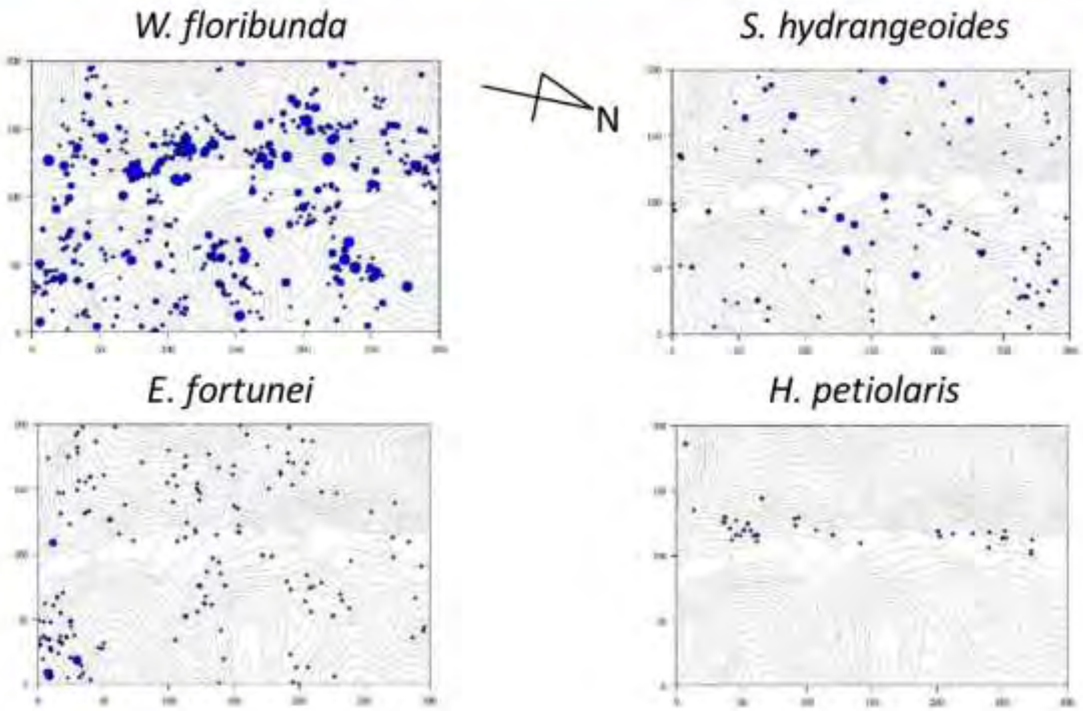
Results Species composition of lianas



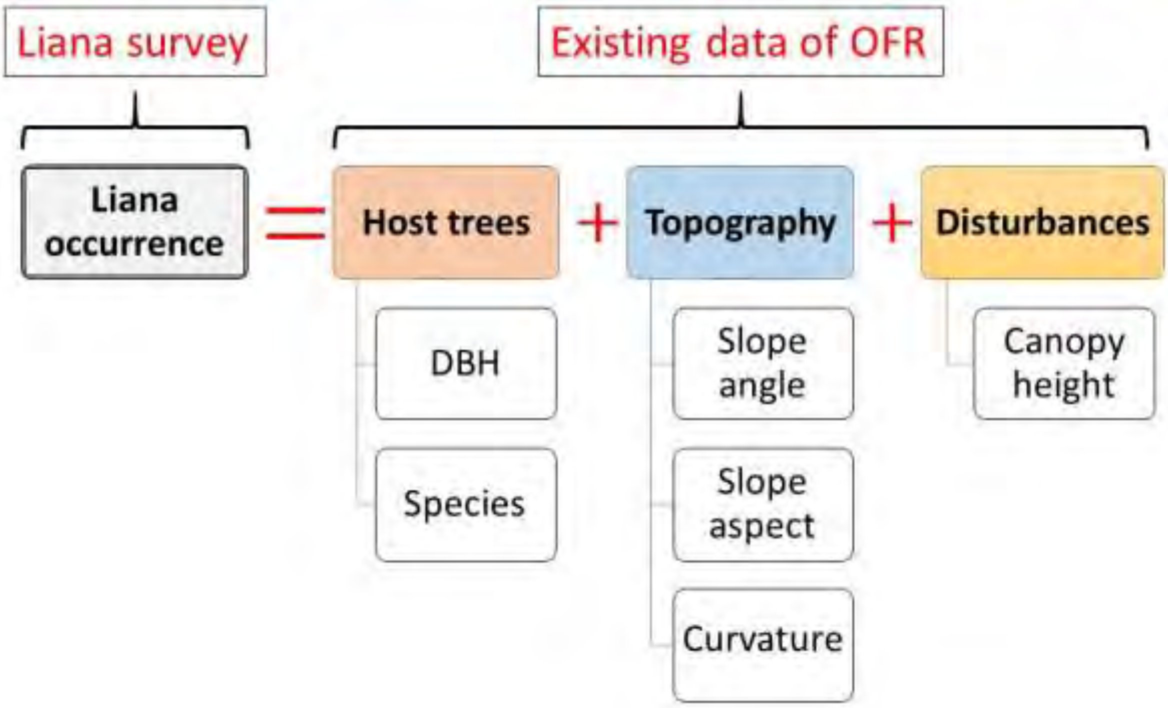
- In a 6-ha plot, 9 species, 1408 stems were recorded
- Abundant five species were analyzed

Results Species composition of lianas

Results distribution map of lianas in OFR



Analysis(1) spatial distribution



Results of analysis (1)

+ Positive effect on liana occurrence
· No significant effect
− Negative effect on liana occurrence

Liana dbh: Small (-1SD) Medium (mean) Large (+1SD)

Liana species	Host tree dbh	Topography: Slope angle	Topography: Slope aspect	Topography: Curvature	Disturbance
W. floribunda	− + +	· · ·	· · ·	+ · ·	· · ·
E. fortunei	+ + +	− − −	+ + +	· · ·	· · ·
S. hydrangeoides	+ + +	· − −	· · ·	+ + ·	· · ·
H. petiolaris	+ + +	− − ·	+ + +	· − ·	· · ·
R. ambigua	+ + +	− − ·	· · ·	· · ·	· · ·

Results of analysis (1)

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W. floribunda	− + +	· · ·	· · ·	+ · ·	· · ·
E. fortunei	+ + +	− − −	+ + +	· · ·	· · ·
S. hydrangeoides	+ + +	· − −	· · ·	+ + ·	· · ·
H. petiolaris	+ + +	− − ·	+ + +	· − ·	· · ·
R. ambigua	+ + +	− − ·	· · ·	· · ·	· · ·

Results of analysis (1)

1. Host tree dbh : Significantly positive to all species

Liana species	Host tree dbh	Topography			Disturbance
		Slope angle	Slope aspect	Curvature	
W. floribunda	− + +	• • •	• • •	+ • •	• • •
E. fortunei	+ + +	− − −	+ + +	• • •	• • •
S. hydrangeoides	+ + +	• − −	• • •	+ + •	• • •
H. petiolaris	+ + +	− − •	+ + +	• − •	• • •
R. ambigua	+ + +	− − •	• • •	• • •	• • •

Results of analysis (1)

1. Host tree dbh : Significantly positive to all species

2. Different effects depending on species

Liana species	Host tree dbh	Topography			Disturbance
		Slope angle	Slope aspect	Curvature	
W. floribunda	− + +	• • •	• • •	+ • •	• • •
E. fortunei	+ + +	− − −	+ + +	• • •	• • •
S. hydrangeoides	+ + +	• − −	• • •	+ + •	• • •
H. petiolaris	+ + +	− − •	+ + +	• − •	• • •
R. ambigua	+ + +	− − •	• • •	• • •	• • •

Results of analysis (1)

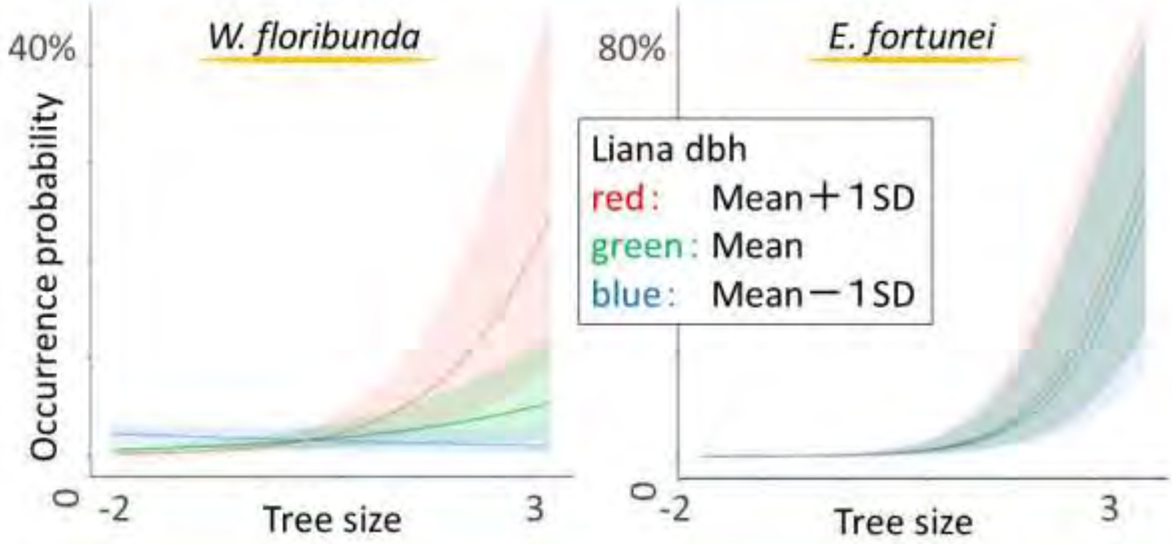
1. Host tree dbh : Significantly positive to all species

2. Different effects depending on species

3. No significant effect on all species

Liana species	Host tree dbh	Topography			Disturbance
		Slope angle	Slope aspect	Curvature	
W. floribunda	− + +	・・・	・・・	+ ・・	・・・
E. fortunei	+ + +	− − −	+ + +	・・・	・・・
S. hydrangeoides	+ + +	・− −	・・・	+ + ・	・・・
H. petiolaris	+ + +	− − ・	+ + +	・− ・	・・・
R. ambigua	+ + +	− − ・	・・・	・・・	・・・

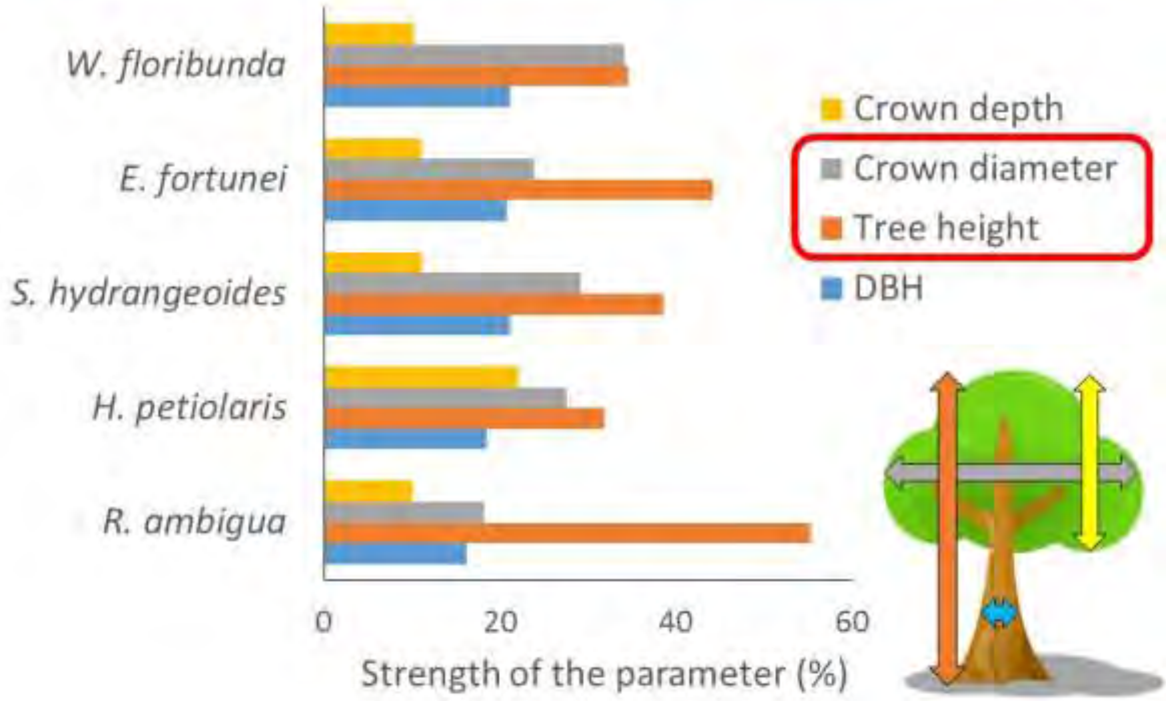
Results : Effect of tree size



Different effects depending on liana dbh

Positive effects regardless of liana dbh

Results (2) Effect of tree architecture



Discussion

Discussion Host tree size

- Host tree size had positive effect on all species
  → **Lianas are likely to occur on larger trees**

- For *W. floribunda*, the effect of host size changed depending on the size of itself
  → **Difference of climbing mechanism?**

Stem twiner;
uses stems to climb trees
(*W. floribunda*)

Root climber;
uses adhesive roots to climb trees
(e.g., *E. floribunda*)

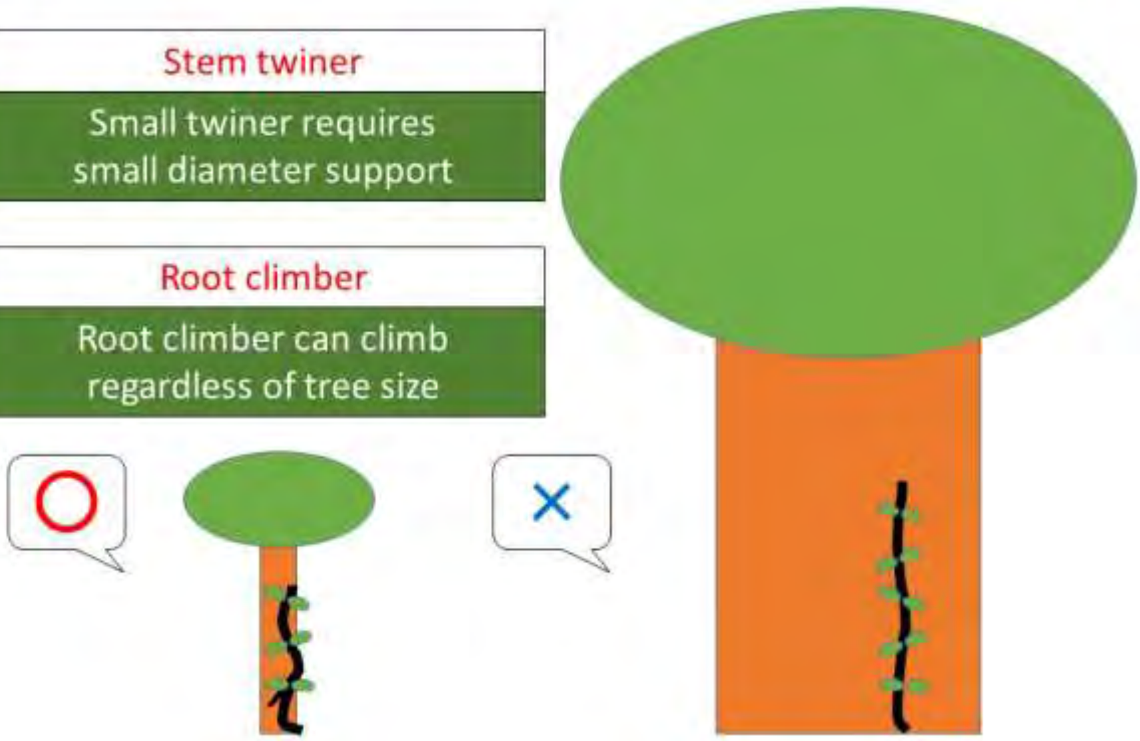
Discussion Host tree size

Stem twiner

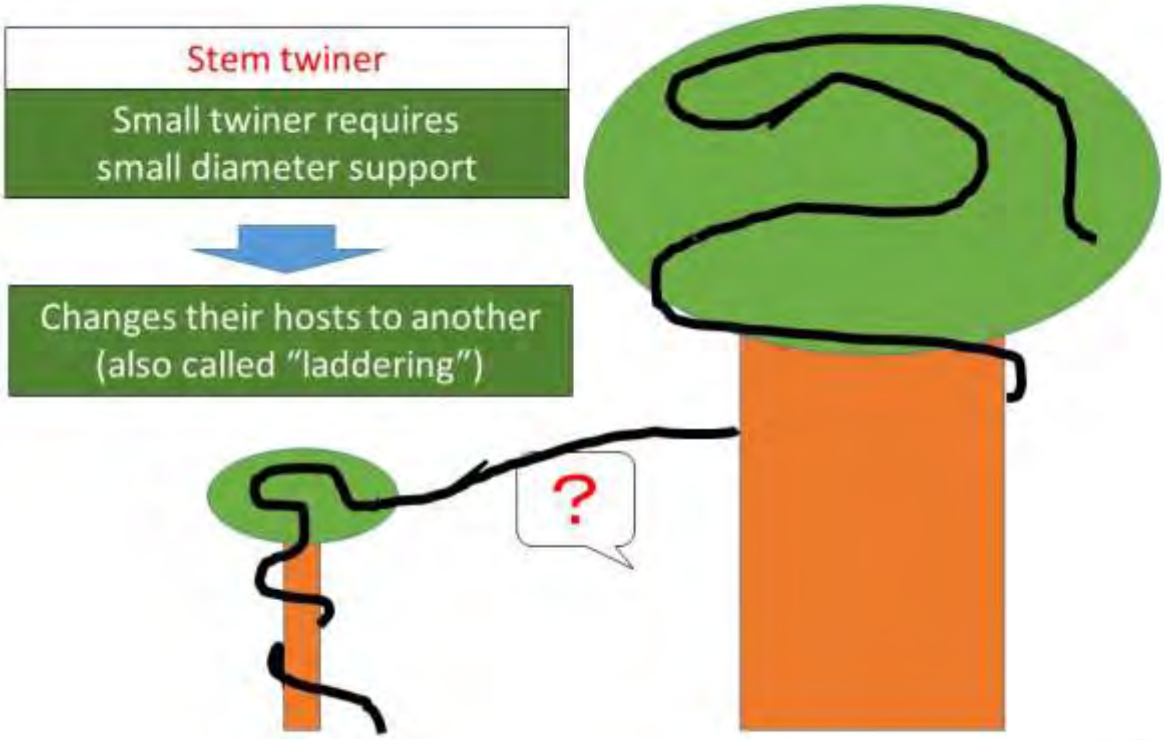
Small twiner requires small diameter support

Root climber

Root climber can climb regardless of tree size



Discussion Host tree preferences



Discussion Tree architecture preferences

- Importance of tree architecture on liana occurrence:

  Tree height > crown diameter >> DBH > crown depth

  W. floribunda (stem twiner): Tree height ≒ crown diameter

  others (root climbers): Tree height > crown diameter

→ **Related to climbing mechanism of lianas?**

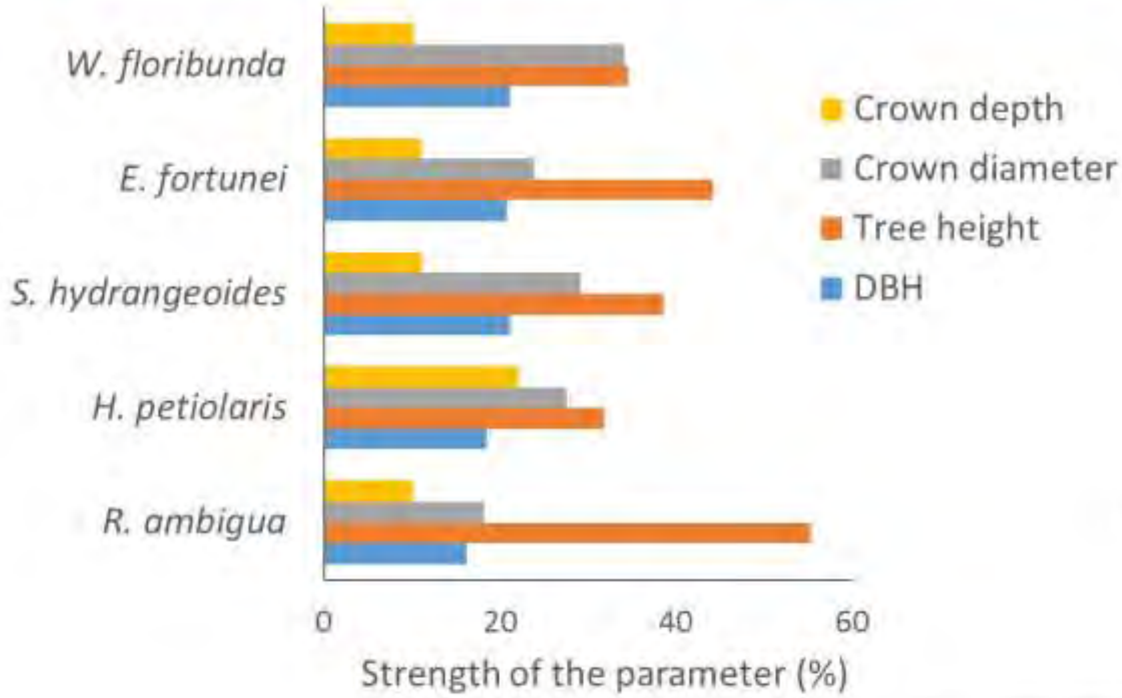
○ stem twiner like *W. floribunda* changes its host to another

→ Crown diameter is more important?

○ Root climbers cannot change their hosts

→ Tree height is more important?

Discussion Tree architecture preferences



Discussion: topography

- Slope angle had significantly negative effect on 4 species
  → Root climbers are weak to soil surface disturbance?
- Slope aspect and curvature are related to water conditions
  → Adaptive to different conditions? ・・・ niche differentiation

Liana species	Host tree dbh	Topography			Distur-bance
		Slope angle	Slope aspect	Curvature	
W. floribunda	− + +	・・・	・・・	+ ・・	・・・
E. fortunei	+ + +	− − −	+ + +	・・・	・・・
S. hydrangeoides	+ + +	・ − −	・・・	+ + ・	・・・
H. petiolaris	+ + +	− − ・	+ + +	・ − ・	・・・
R. ambigua	+ + +	− − ・	・・・	・・・	・・・

Discussion: disturbance

- Disturbance had no significant effect on all species
- Disturbance data is based on 25 years continuous survey
  → In 20-30 years scale, it is difficult to explain liana distribution by small scale disturbance

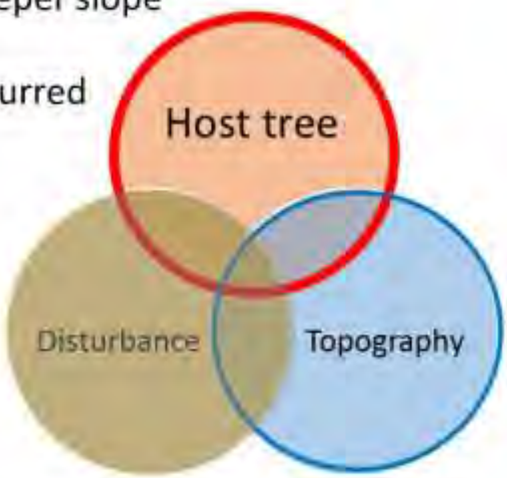
Liana species	Host tree dbh	Topography			Distur-bance
		Slope angle	Slope aspect	Curvature	
W. floribunda	− + +	· · ·	· · ·	+ · ·	· · ·
E. fortunei	+ + +	− − −	+ + +	· · ·	· · ·
S. hydrangeoides	+ + +	· − −	· · ·	+ + ·	· · ·
H. petiolaris	+ + +	− − ·	+ + +	· − ·	· · ·
R. ambigua	+ + +	− − ·	· · ·	· · ·	· · ·

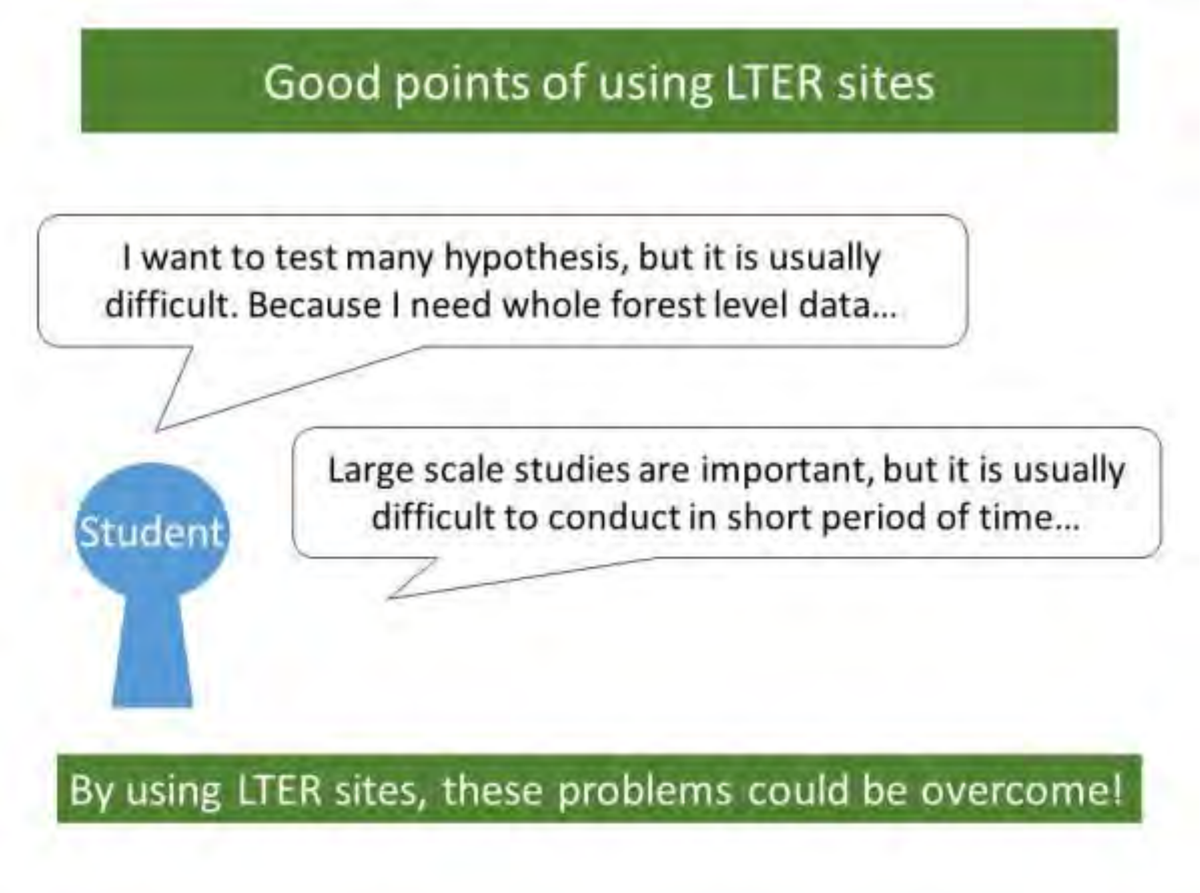
Summary

(1) Host tree preference were highly important to all liana species
Tree architecture could be related to climbing mechanism

(2) Topography showed species specific variation
Root climbers were sensitive to steeper slope

(3)Effect of small scale disturbance occurred in 25yr were not significant




Good points of using LTER sites
I want to test many hypothesis, but it is usually difficult. Because I need whole forest level data...
Student
Large scale studies are important, but it is usually difficult to conduct in short period of time...
By using LTER sites, these problems could be overcome!

3) Spatial structure and dynamics of northern Korean Pine - broadleaved forests

Dr. Anna Vozmishcheva

Researcher

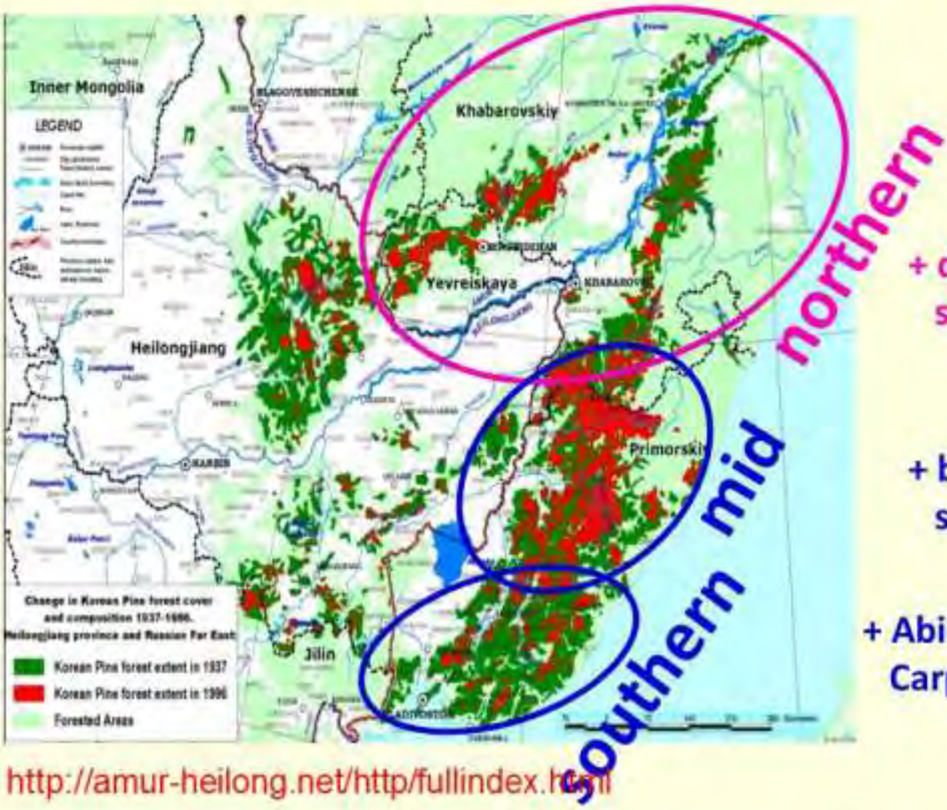
Botanical Garden-Institute, Far East Branch, Russian Academy of Sciences,
Institute of Biology and Soil Sciences, Far East Branch, Russian Academy of Sciences

SPATIAL STRUCTURE AND DYNAMICS OF NORTHERN KOREAN PINE – BROADLEAVED FORESTS

Vozmishcheva Anna, 2016

2

KOREAN PINE – BROADLEAVED FOREST RANGE



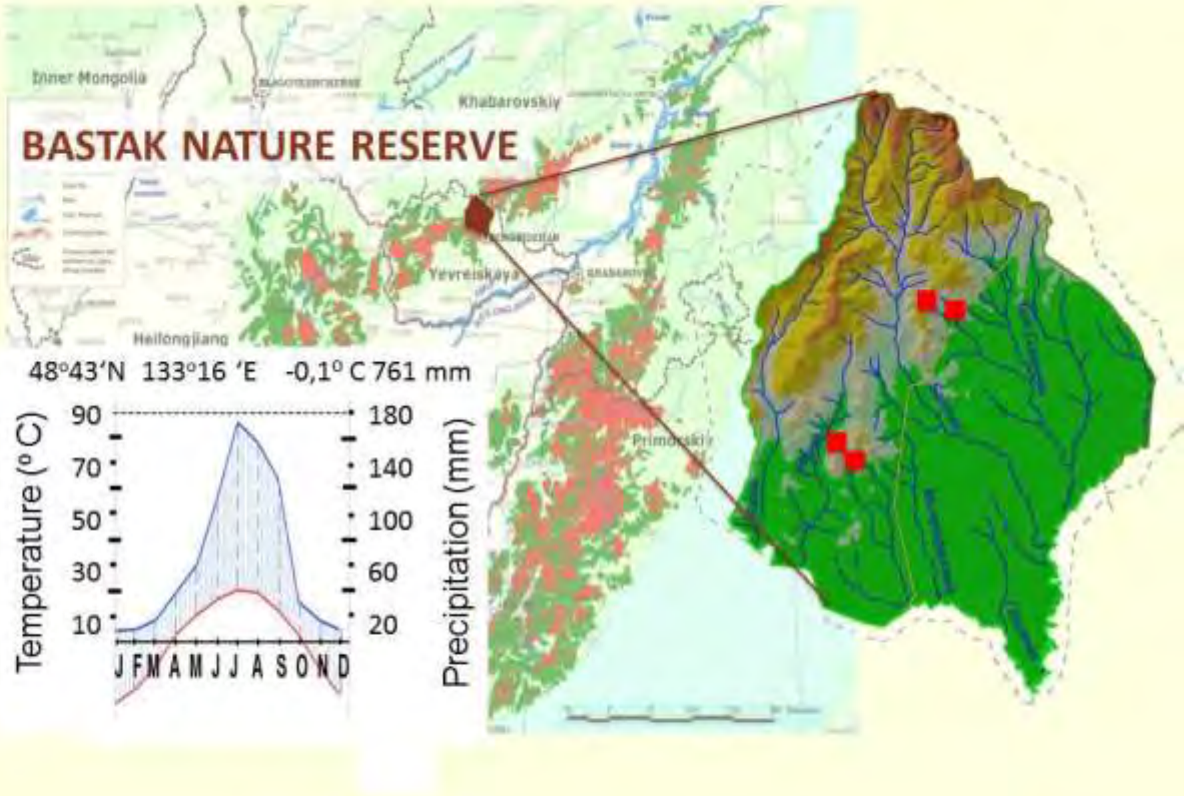
+ dark conifer species

+ broadleaved species

+ Abies holophylla Carpinus cordata

http://amur-heilong.net/http/fullindex.html

3 KOREAN PINE – BROADLEAVED FORESTS RANGE

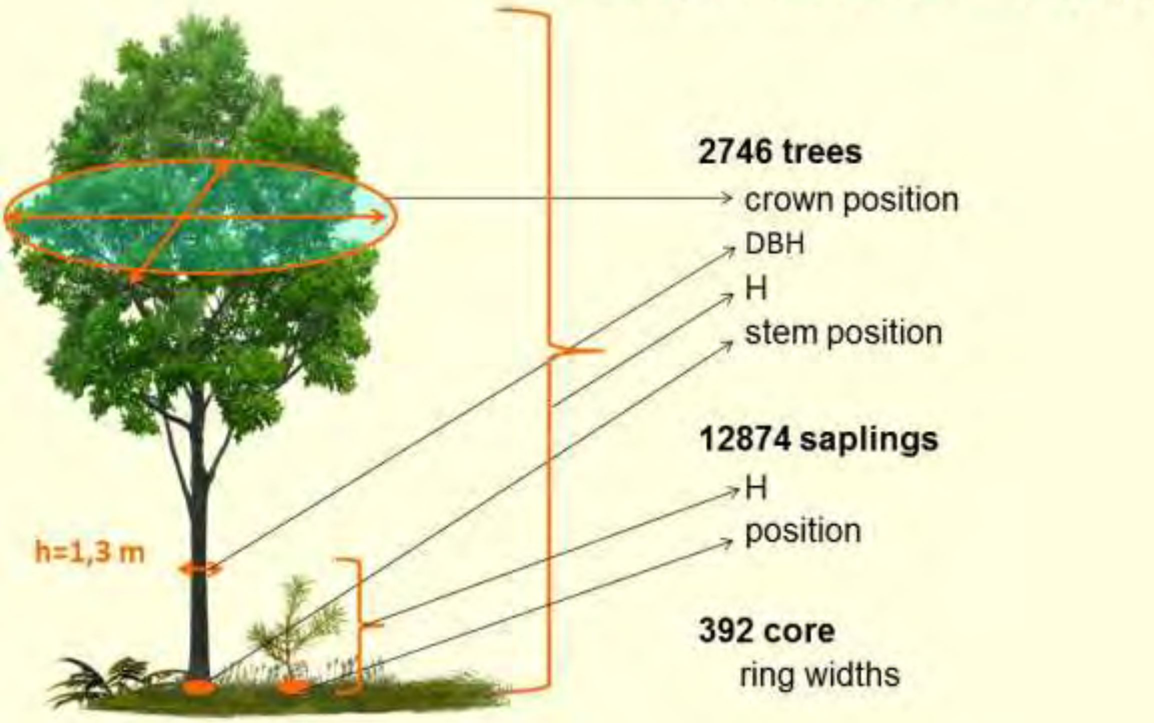


MATERIAL AND METHODS

4

Material:

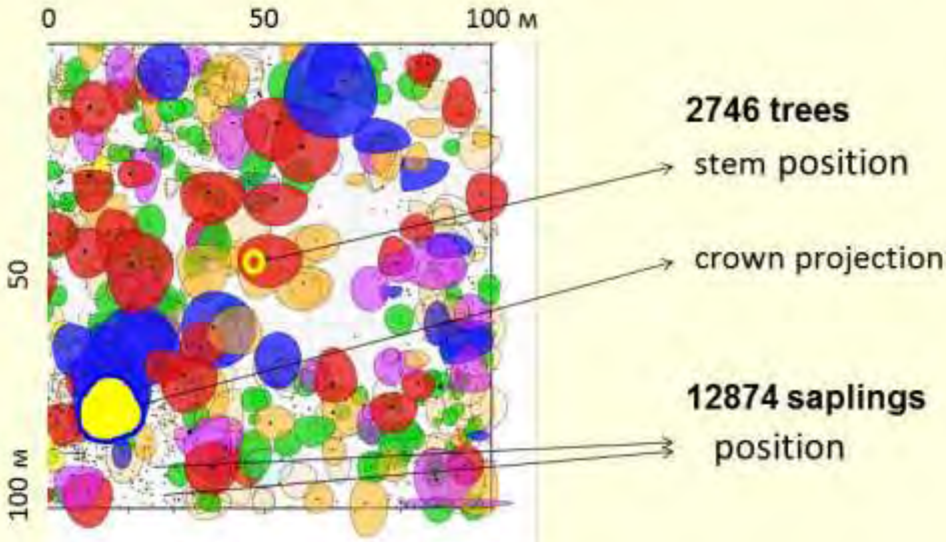
4 sample plots (S = 3 ha):



5

Methods:

Mapping sample plots

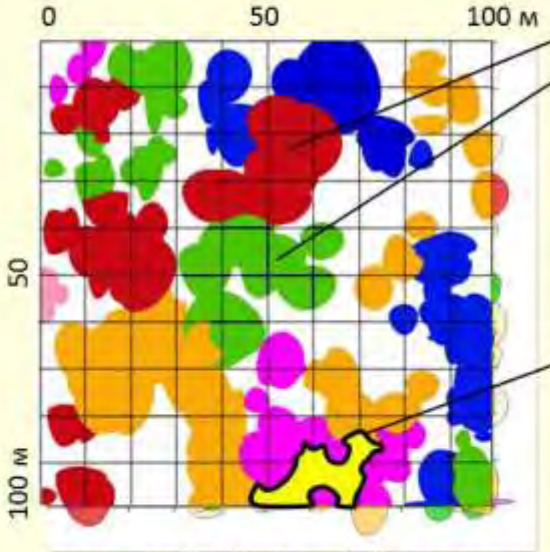


crowns projections modeling program (Drozdov et al. 2015)

6

Methods:

Definition of microstands and canopy gaps



crowns projections modeling program (Drozdov et al. 2015)

Microstand type

A microstand is a homogenous forest area that is usually smaller than an forest stand (Hyyonen et al. 2005).

Canopy gap

- S (area)
- H
- Distance from saplings to canopy border

7

Methods:

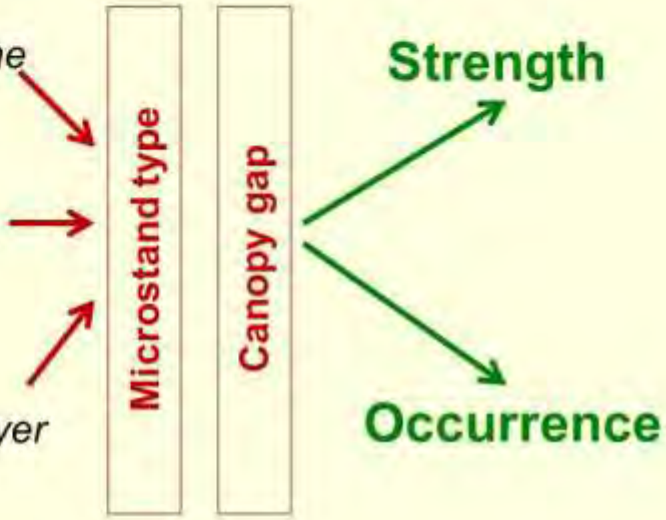
Vertical structure: determination of tree layer boundary with *K*-means (Steinhaus, 1956; Lloyd, 1957), Statistica

Saplings layer:

LOW (0,1 – 0,5 m)
development within the herb layer

MID (0,51 – 1,5 m)
development within the shrub layer

HIGH (1,51 – 6 m)
output from the shrub layer



8

Methods:

spatial structure: pair correlation function *g(r)*

null hypotheses:

- **complete spatial randomness** (univariate interactions)
- **bivariate random labeling** (bivariate interactions within the understory and saplings layers)
- **toroidal shift** (bivariate interactions within the overstory layer)
- **antecedent conditions** (the influence of higher height classes on lower height classes spatial structure)

• *Monte-Carlo approach for construction of 95% confidence limits of a given null model*

(Wiegand et al. 2004, 2007; Wiegand, Moloney, 2014), Programita

9

Methods:

Age structure and Disturbance history

boring →

↓

ring width measuring

→ **Age structure**

↓

Boundary line release criteria

↓

Canopy gap

↓

Release

(wood response)

major: > 25% for 5 years

moderate: < 25% for 5 years

RESULTS

10

FOREST ECOSYSTEMS

Ribesi maximowicziani-Pinetum koraiensis
(Krestov et al. 2006)

11

Composition (dominant tree species)

	percentage											
	SP №1			SP №2			SP №4			SP №5		
	I	II	sapl	I	II	sapl	I	II	sapl	I	II	sapl
Abies nephrolepis	17,8	49,3	9,1	46,9	26,5	24,6	21	26	49,4	18	43	45,2
Acer mono	11,8	15,5	5,4	4,9	7,3	9,4	-	-	0,6	-	1	2,3
Acer tegmentosum	-	5,5	12,4	-	4,1	12,2	0,3	2,5	10,2	-	0,2	7,4
Acer ukuruduense	-	13,4	7,3	-	14,6	3,8	-	3,4	22,5	-	2	19,1
Betula costata	11,8	1,4	2	22,2	14,9	0,1	3,5	0,6	0,4	2,5	0,4	0,4
Fraxinus mandshurica	15,8	5,5	51,9	4,9	7,6	19,2		0,1	0,3	10	1,4	4,8
Picea ajanensis	2	1	0,1	7,4	0,5	1	9,1	19	3,7	13	28	1,8
Pinus koraiensis	25,7	1,4	3,8	2,5	4,3	20,7	20	28	6,2	17	7,4	15,1
Tilia amurensis	13,2	3,1	0,6	7,4	2,4	1,7	5,6	6,5	5,1	15	10	1,7
Ulmus laciniata	1,3	0,7	4,5	-	0,5	4,6	0,1	-	-	-	0,2	-
Height, m	17~40	6,1~17	0,1~6	19,1~36	6,1~19	0,1~6	16,1~27	6,1~16	0,1~6	17~40	6,1~17	0,1~6

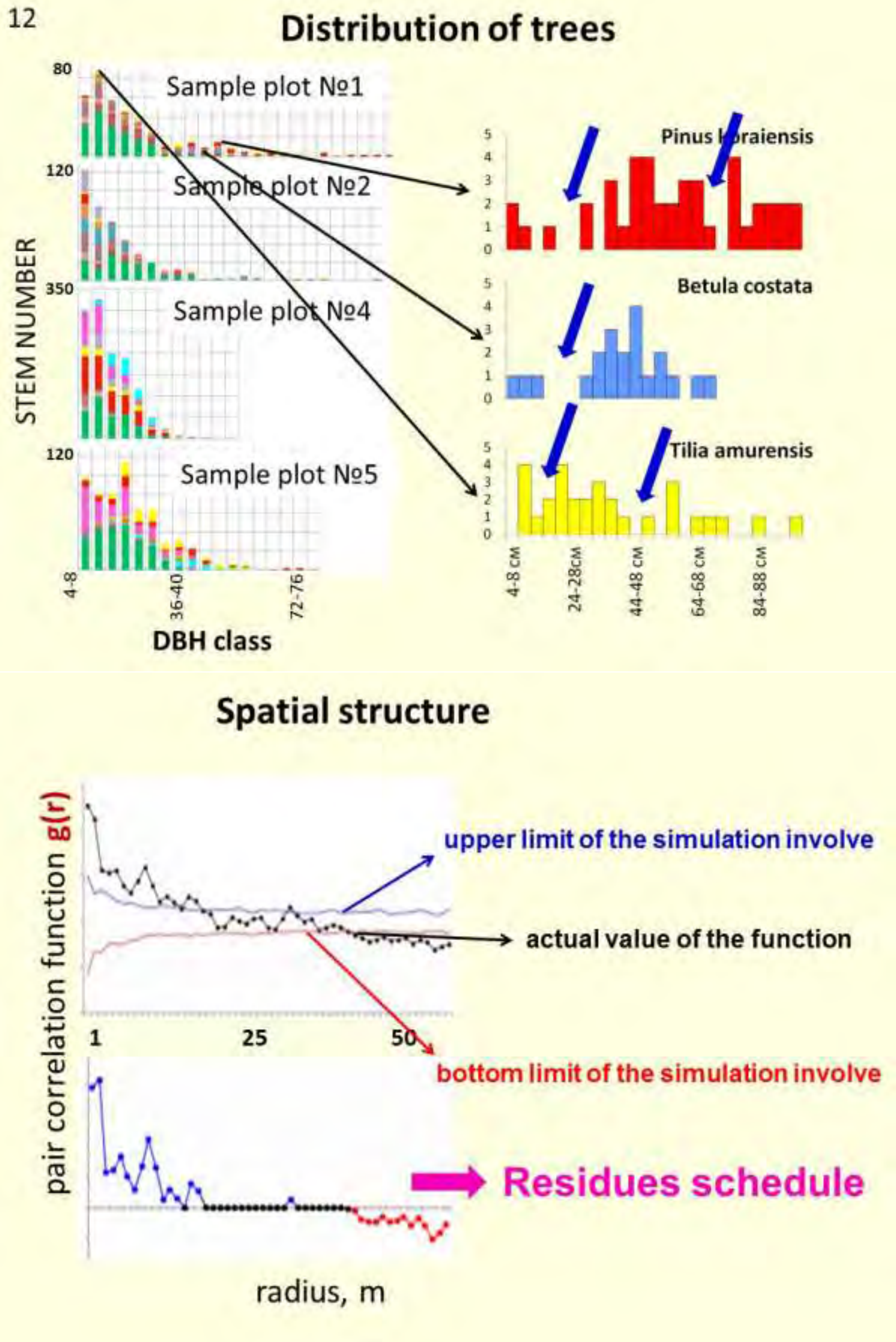
Sapl – saplings I – overstory II – understory SP – sample plot

11b

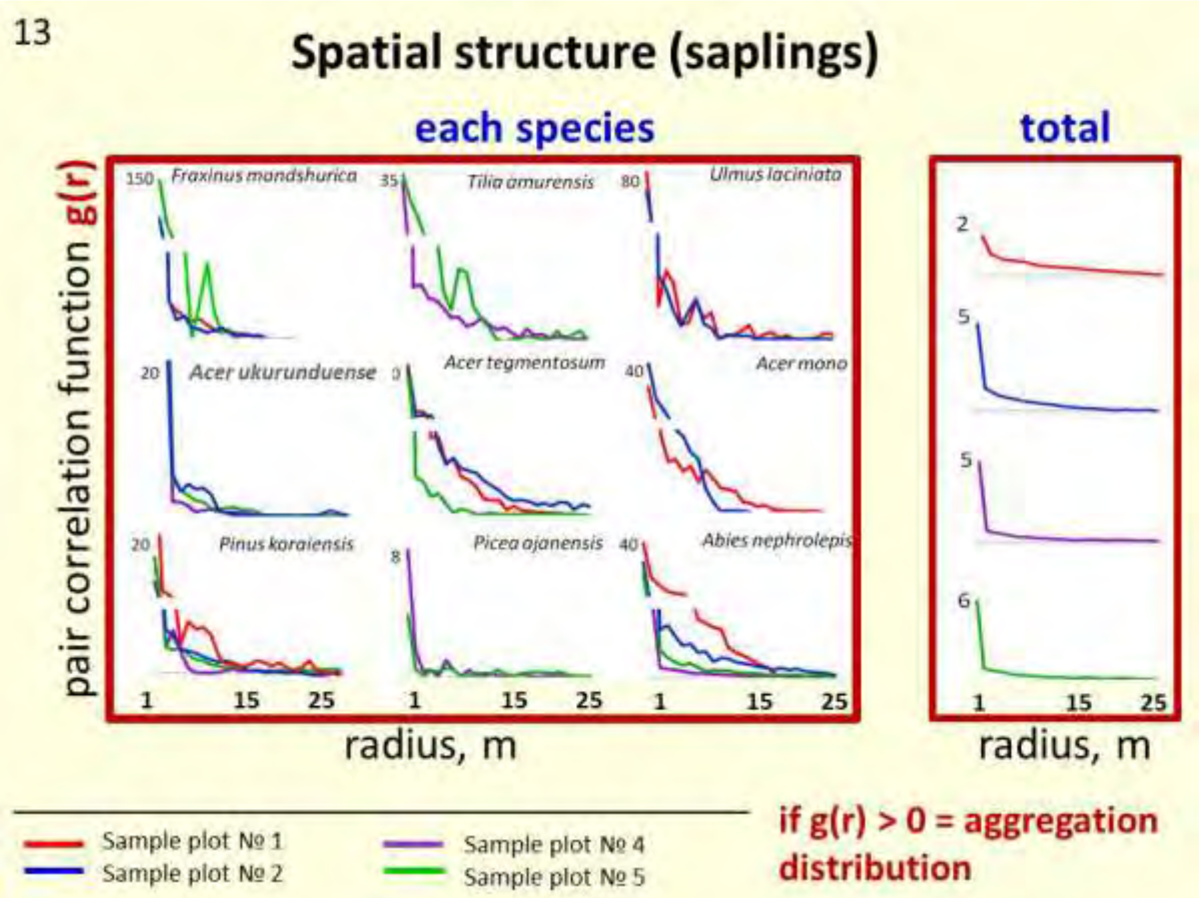
Microstand type characteristics

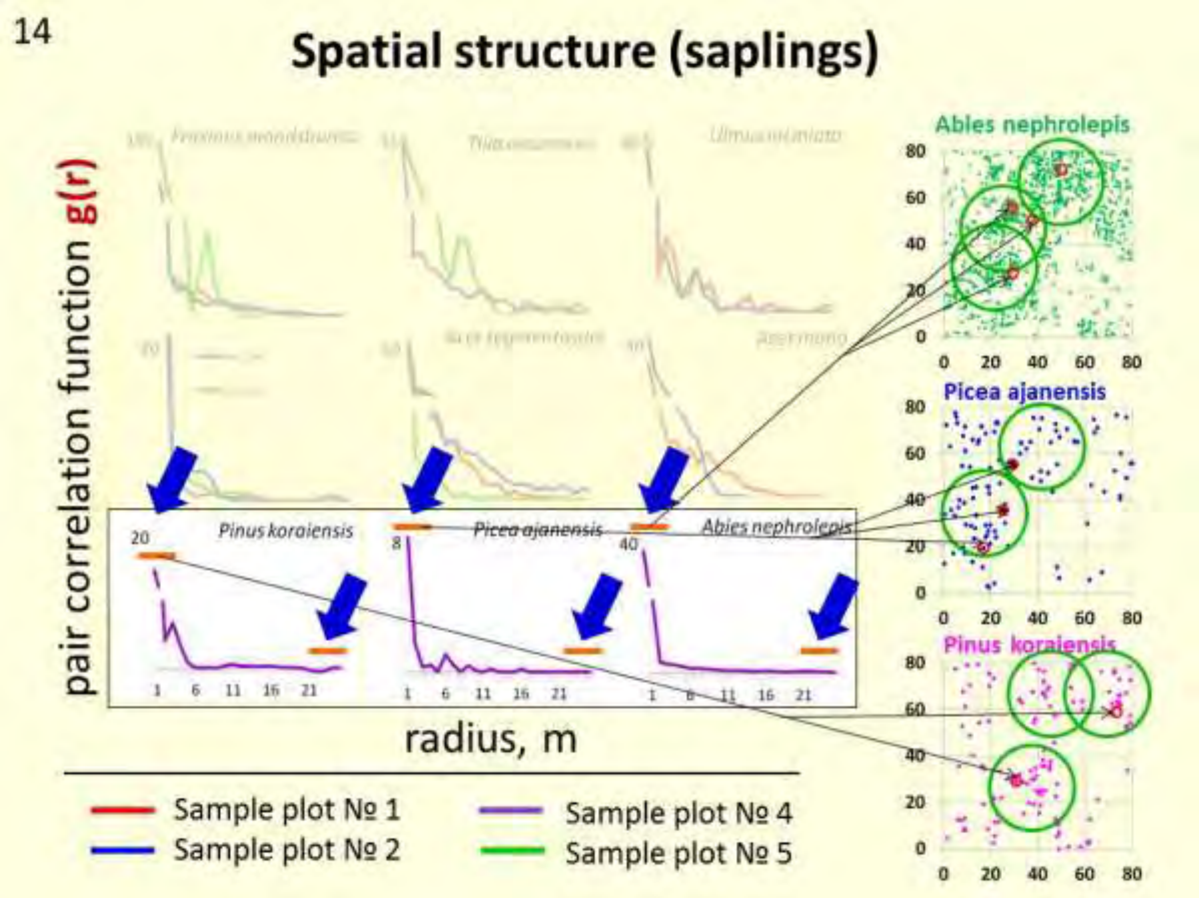
Microstand type	Overstory dominant	Understory dominant	Shrub layer dominant
Dark conifer	*Abies nephrolepis, Picea ajanensis*	*Abies nephrolepis, Picea ajanensis*	–
Broadlived - Pine	*Betula costata, B. lanata, Tilia amurensis, Pinus koraiensis*	*Abies nephrolepis, Acer mono, A. tegmentosum, Pinus koraiensis, Tilia amurensis*	*Actinidia kolomikta, Corylus mandshurica, Eleutherococcus senticocus, Sorbaria sorbifolia*
Pine	*Pinus koraiensis*	*Abies nephrolepis, Acer mono*	–
Ash-Pine	*Fraxinus* ***mandshurica****, Pinus koraiensis*	*Abies nephrolepis, Pinus koraiensis*	–
Broadlived-conifer	*Abies nephrolepis, Betula costata, Picea ajanensis*	*Abies nephrolepis, Acer mono, A. tegmentosum, Picea ajanensis*	*Acer ukurunduense, Actinidia kolomikta, Corylus mandshurica, Eleutherococcus senticocus, Euonymus pauciflora, Sorbaria sorbifolia*
Broadlived	*Betula costata, B. lanata, B. platyphylla, Tilia amurensis*	*Abies nephrolepis, Acer tegmentosum, Picea ajanensis, Pinus koraiensis*	*Actinidia kolomikta, Corylus mandshurica, Eleutherococcus senticocus Sorbaria sorbifolia*

12



Distribution of trees
Sample plot №1
Sample plot №2
Sample plot №4
Sample plot №5
STEM NUMBER
80
120
350
120
4-8
36-40
72-76
DBH class
Pinus koraiensis
Betula costata
Tilia amurensis
4-8 см
24-28см
44-48 см
64-68 см
84-88 см
Spatial structure
pair correlation function g(r)
upper limit of the simulation involve
actual value of the function
bottom limit of the simulation involve
1
25
50
Residues schedule
radius, m


13
Spatial structure (saplings)
each species
total
pair correlation function g(r)
Fraxinus mandshurica
Tilia amurensis
Ulmus laciniata
Acer ukurunduense
Acer tegmentosum
Acer mono
Pinus koraiensis
Picea ajanensis
Abies nephrolepis
1 15 25
radius, m
if g(r) > 0 = aggregation distribution
Sample plot № 1
Sample plot № 2
Sample plot № 4
Sample plot № 5

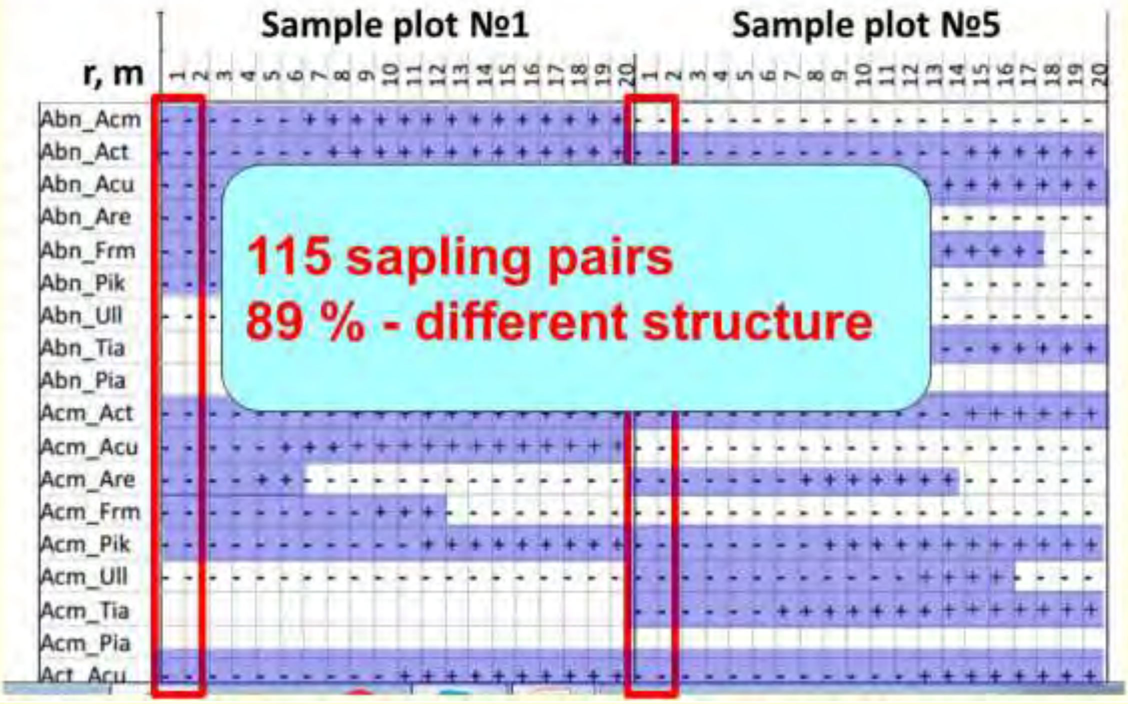

14
Spatial structure (saplings)
pair correlation function g(r)
Pinus koraiensis
Picea ajanensis
Abies nephrolepis
1 6 11 16 21
radius, m
Abies nephrolepis
Picea ajanensis
Pinus koraiensis
0 20 40 60 80
Sample plot № 1
Sample plot № 2
Sample plot № 4
Sample plot № 5

15

Spatial structure (saplings)

«+» – the same structure; «-» - the different structure

Used random labeling null hypothesis



15

Spatial structure (saplings)

«+» – the same structure; «-» - the different structure

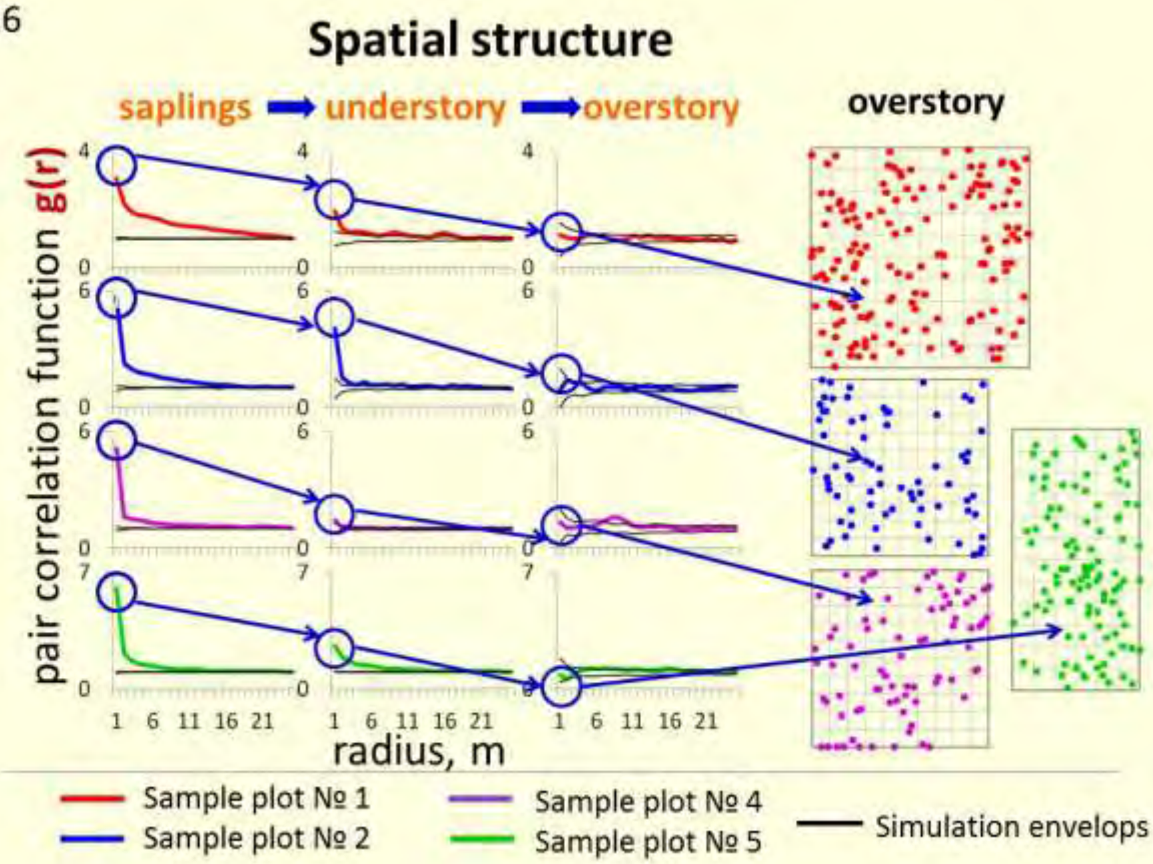
Used random labeling null hypothesis

Pinus koraiensis – Abies nephrolepis interacions

r, m	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
plot № 1	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-
plot № 2	-															-	-	-	-	-
plot № 4	-															+	+	+	-	-
plot № 5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

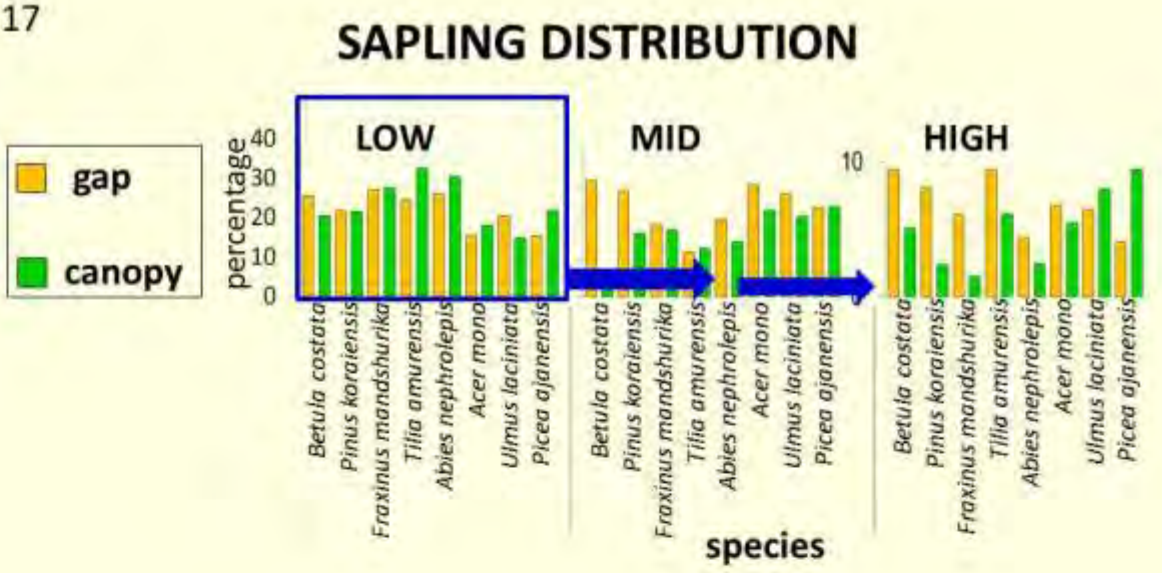
various relationships at different communities

16



Spatial structure
saplings
understory
overstory
overstory
pair correlation function g(r)
radius, m
1 6 11 16 21
Sample plot № 1
Sample plot № 2
Sample plot № 4
Sample plot № 5
Simulation envelops

17



SAPLING DISTRIBUTION
gap
canopy
percentage
LOW
MID
HIGH
Betula costata
Pinus koraiensis
Fraxinus mandshurika
Tilia amurensis
Abies nephrolepis
Acer mono
Ulmus laciniata
Picea ajanensis
species

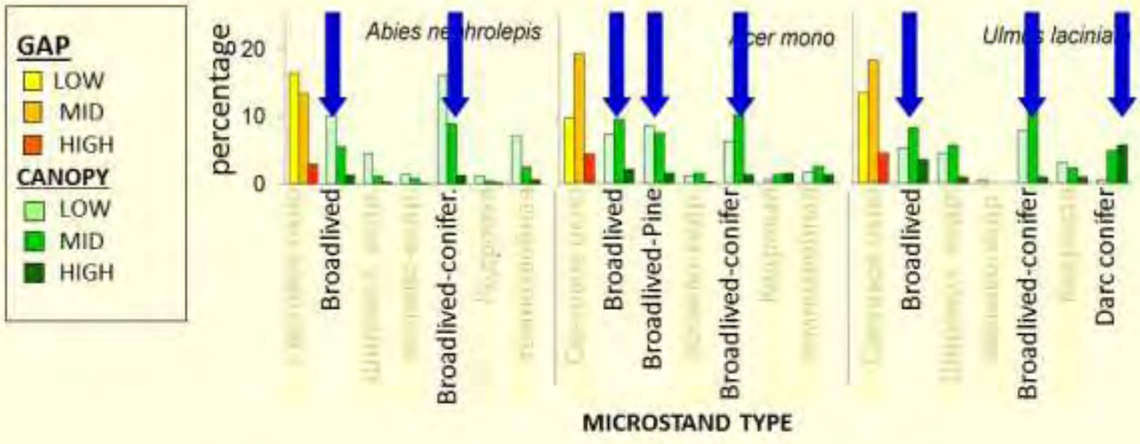
18

SAPLING DISTRIBUTION

	CANOPY GAP	CANOPY GAP / CANOPY	CANOPY
OVERSTORY	***Betula costata*** ***Pinus koraiensis*** ***Fraxinus mandshurica*** ***Tilia amurensis***		***Picea ajanensis***
UNDERSTORY	***Abies nephrolepis***	***Acer mono*** ***Ulmus laciniata***	

19

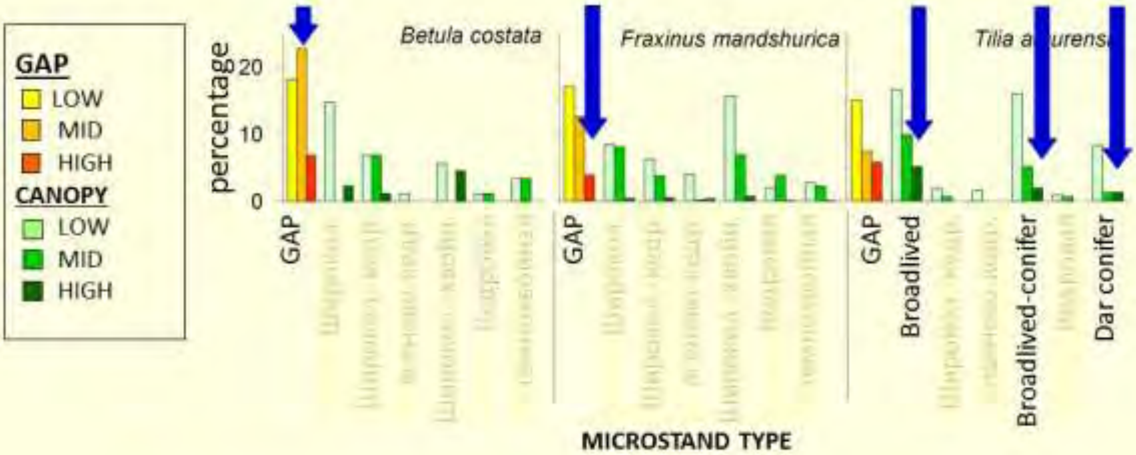
SAPLING DISTRIBUTION (with canopy respect)



	CANOPY GAP	CANOPY GAP / CANOPY	CANOPY
OVERSTORY	*Betula costata* *Pinus koraiensis* *Fraxinus mandshurica* *Tilia amurensis*		*Picea ajanensis*
UNDERSTORY	***Abies nephrolepis***	***Acer mono*** ***Ulmus laciniata***	

20

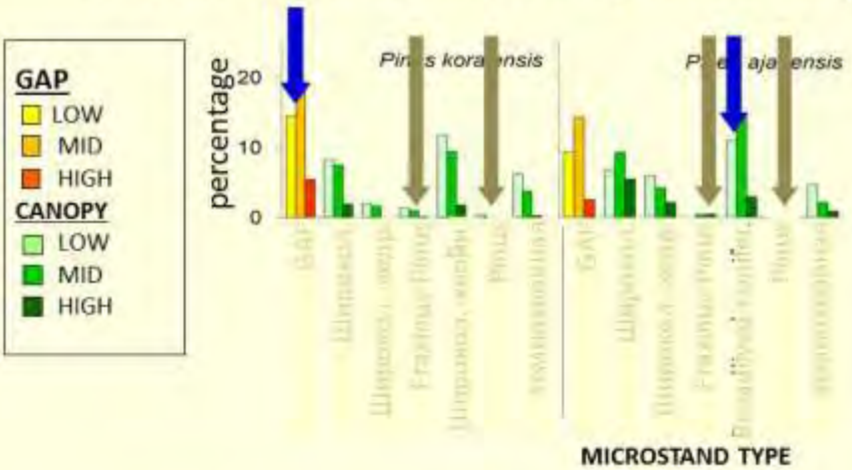
SAPLING DISTRIBUTION (with canopy respect)



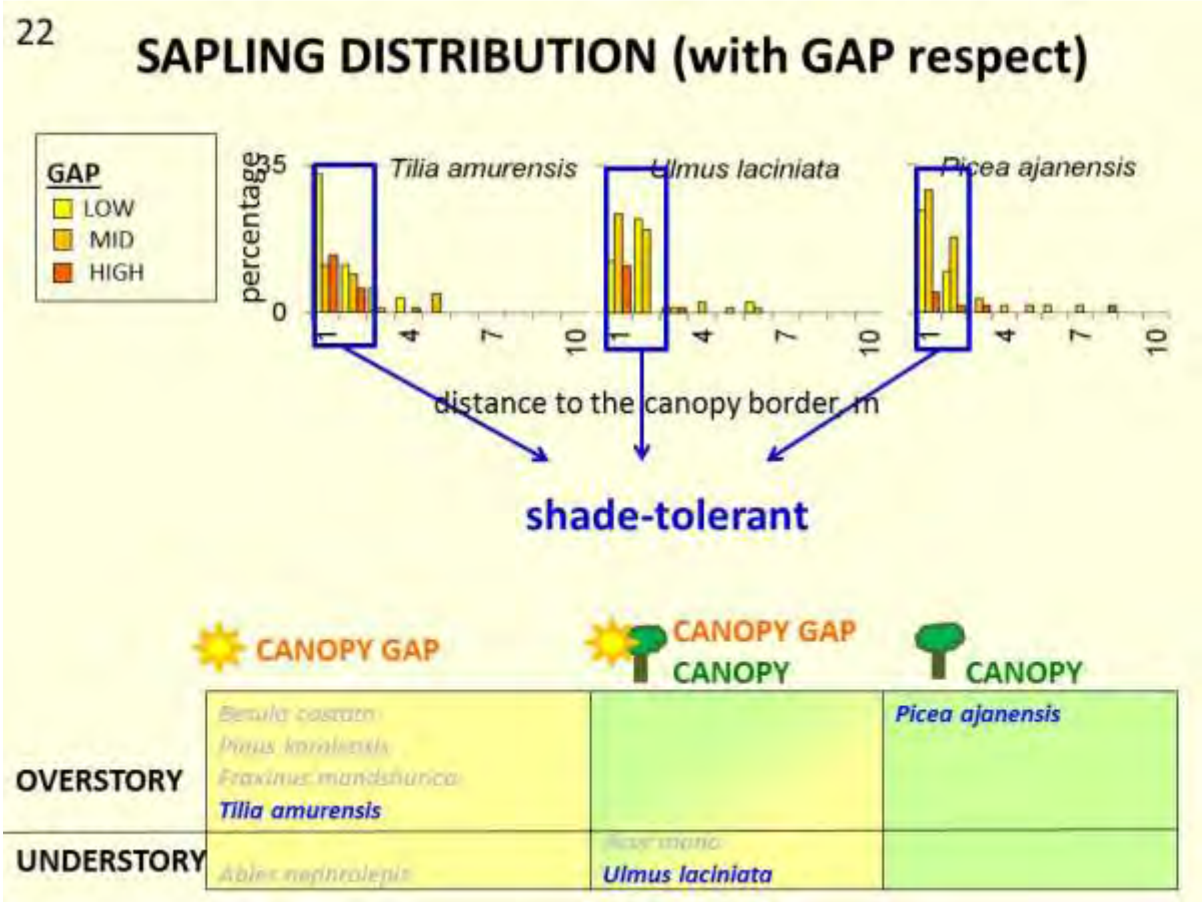
	CANOPY GAP	CANOPY GAP / CANOPY	CANOPY
OVERSTORY	***Betula costata*** *Pinus koraiensis* ***Fraxinus mandshurica*** ***Tilia amurensis***		*Picea ajanensis*
UNDERSTORY	*Abies nephrolepis*	*Acer mono* *Ulmus laciniata*	

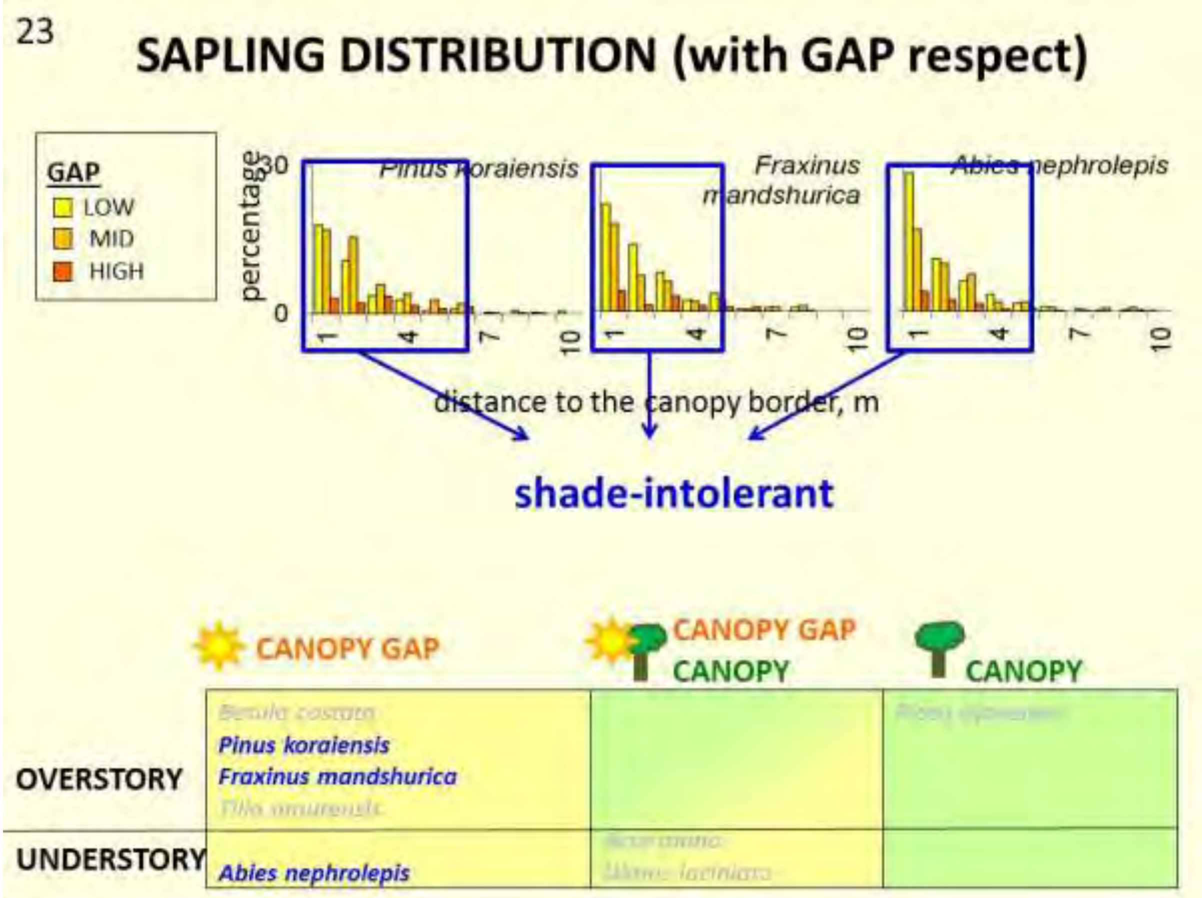
21

SAPLING DISTRIBUTION (with canopy respect)



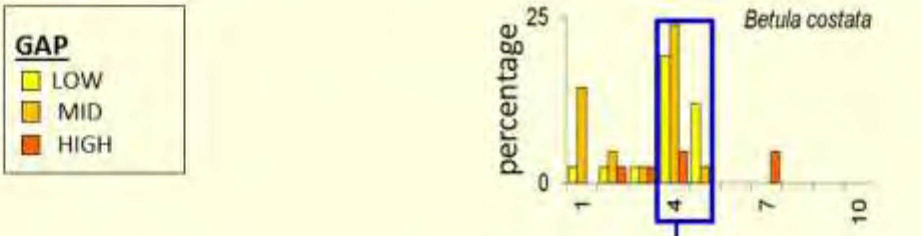
	CANOPY GAP	CANOPY GAP / CANOPY	CANOPY
OVERSTORY	*Betula costata* ***Pinus koraiensis*** *Fraxinus mandshurica* *Tilia amurensis*		***Picea ajanensis***
UNDERSTORY	*Abies nephrolepis*	*Acer mono* *Ulmus laciniata*	


22
SAPLING DISTRIBUTION (with GAP respect)
GAP
LOW
MID
HIGH
percentage
35
0
Tilia amurensis
Ulmus laciniata
Picea ajanensis
1
4
7
10
distance to the canopy border, m
shade-tolerant
CANOPY GAP
CANOPY GAP
CANOPY
CANOPY
OVERSTORY
UNDERSTORY
Betula costata
Pinus koraiensis
Fraxinus mandshurica
Tilia amurensis
Picea ajanensis
Abies nephrolepis
Acer mono
Ulmus laciniata


23
SAPLING DISTRIBUTION (with GAP respect)
GAP
LOW
MID
HIGH
percentage
30
0
Pinus koraiensis
Fraxinus mandshurica
Abies nephrolepis
1
4
7
10
distance to the canopy border, m
shade-intolerant
CANOPY GAP
CANOPY GAP
CANOPY
CANOPY
OVERSTORY
UNDERSTORY
Betula costata
Pinus koraiensis
Fraxinus mandshurica
Tilia amurensis
Picea ajanensis
Abies nephrolepis
Acer mono
Ulmus laciniata

24

SAPLING DISTRIBUTION (with GAP respect)



distance to the canopy border, m

shade-intolerant

(gap condition is optimal)

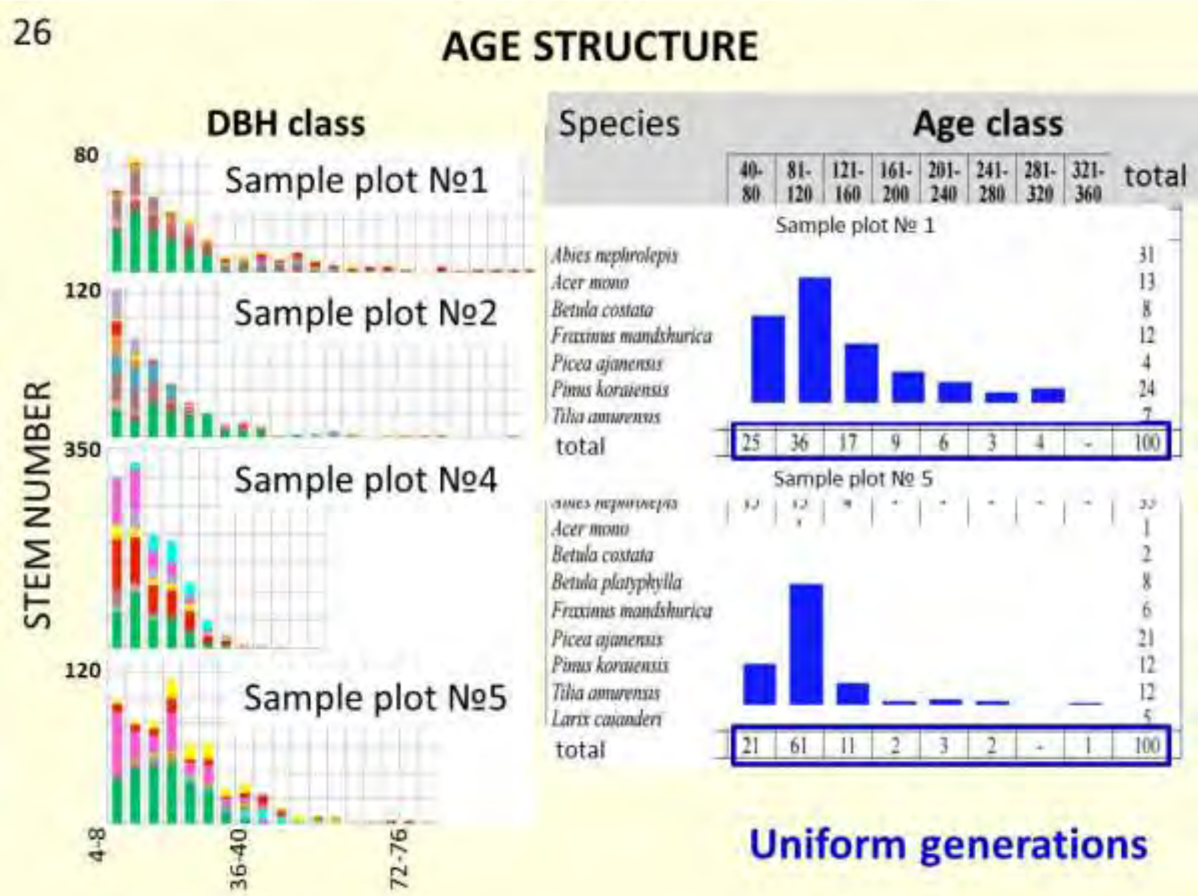
	CANOPY GAP	CANOPY GAP / CANOPY	CANOPY
OVERSTORY	*Betula costata* *Pinus koraiensis* *Fraxinus mandshurica* *Tilia amurensis*		*Picea ajanensis*
UNDERSTORY	*Abies nephrolepis*	*Acer mono* *Ulmus laciniata*	

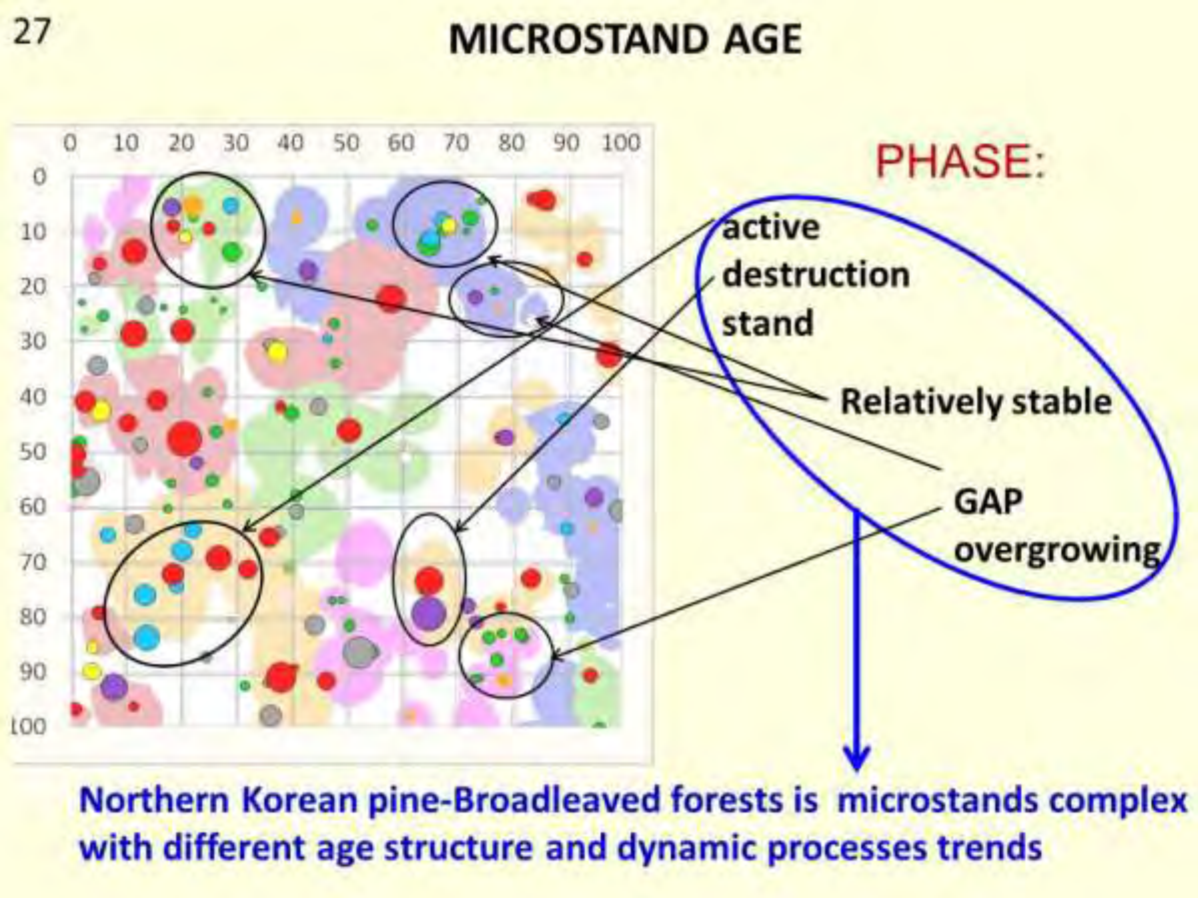
25

Отношение подроста к световым окнам

!!! Potential dominant species occupy different niches at early ontogenetic stages

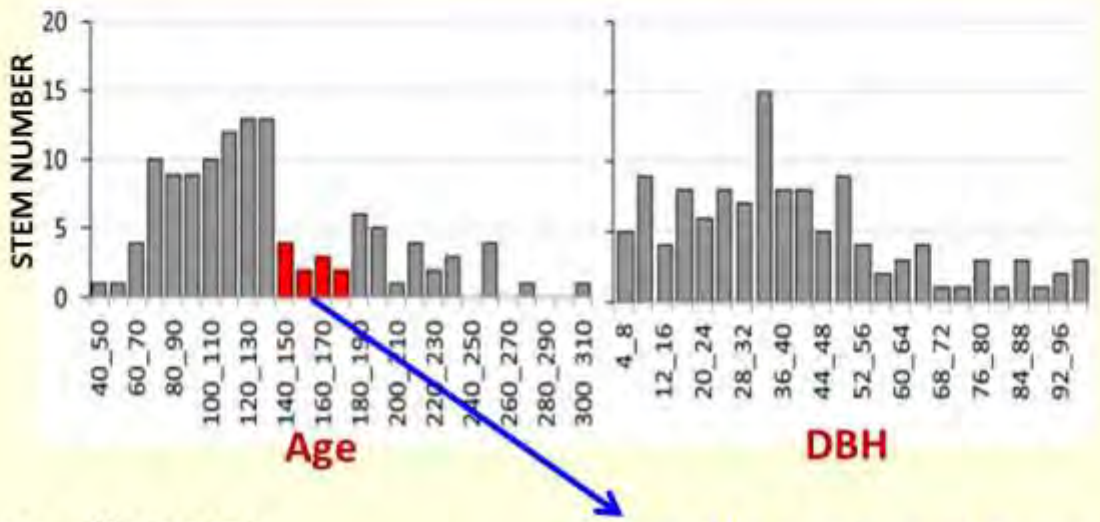
Условия в окнах - оптимальны


26
AGE STRUCTURE
DBH class
STEM NUMBER
80
Sample plot №1
120
Sample plot №2
350
Sample plot №4
120
Sample plot №5
4-8
36-40
72-76
Species
Age class
40-80
81-120
121-160
161-200
201-240
241-280
281-320
321-360
total
Sample plot № 1
Abies nephrolepis 31
Acer mono 13
Betula costata 8
Fraxinus mandshurica 12
Picea ajanensis 4
Pinus koraiensis 24
total 25 36 17 9 6 3 4 - 100
Sample plot № 5
Acer mono 1
Betula costata 2
Betula platyphylla 8
Fraxinus mandshurica 6
Picea ajanensis 21
Pinus koraiensis 12
Tilia amurensis 12
Larix cajanderi
total 21 61 11 2 3 2 - 1 100
Uniform generations


27
MICROSTAND AGE
0
10
20
30
40
50
60
70
80
90
100
PHASE:
active destruction stand
Relatively stable
GAP overgrowing
Northern Korean pine-Broadleaved forests is microstands complex with different age structure and dynamic processes trends

28

Pinus koraiensis distribution

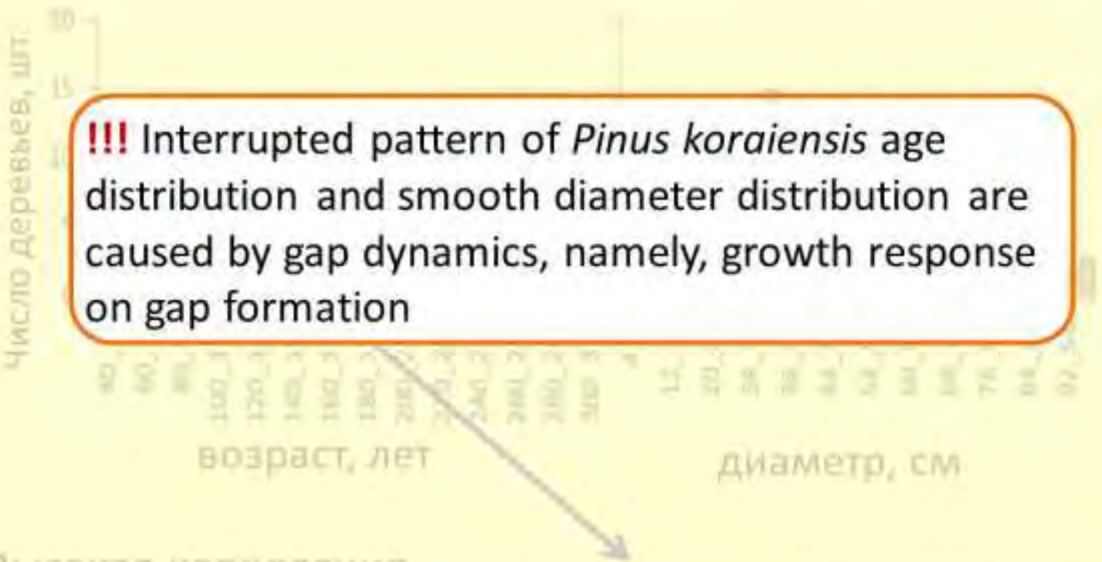


age - diameter correlation coefficient

r = 0,83; n = 120; P < 0,001

decline the number of trees growing into the canopy within 40 years

29 Распределение деревьев Pinus koraiensis по диаметру и возрасту



!!! Interrupted pattern of *Pinus koraiensis* age distribution and smooth diameter distribution are caused by gap dynamics, namely, growth response on gap formation

Высокая корреляция возраста и диаметра

r = 0,83; n = 120 деревьев; P < 0,001

Снижение числа деревьев, врастающих в полог в течении 40-ка лет

30

MAIN RELEASE CHARACTERISTICS

SPECIES	N	AGE MAX	percentage of trees with release (%)	Average No of release per tree	GC MAX, %
Abies nephrolepis	6523	210	89	1,7	809
Acer mono	2299	260	100	2,5	484
Betula costata	1562	260	94	3	278
Fraxinus mandshurica	2576	200	100	2,2	681
Picea ajanensis	2830	220	100	1,8	510
Pinus koraiensis	5986	310	95	2,7	1045
Tilia amurensis	3168	280	87	2,9	853

THE MOST TREES GREW UP AFTER GAP FORMATION

31

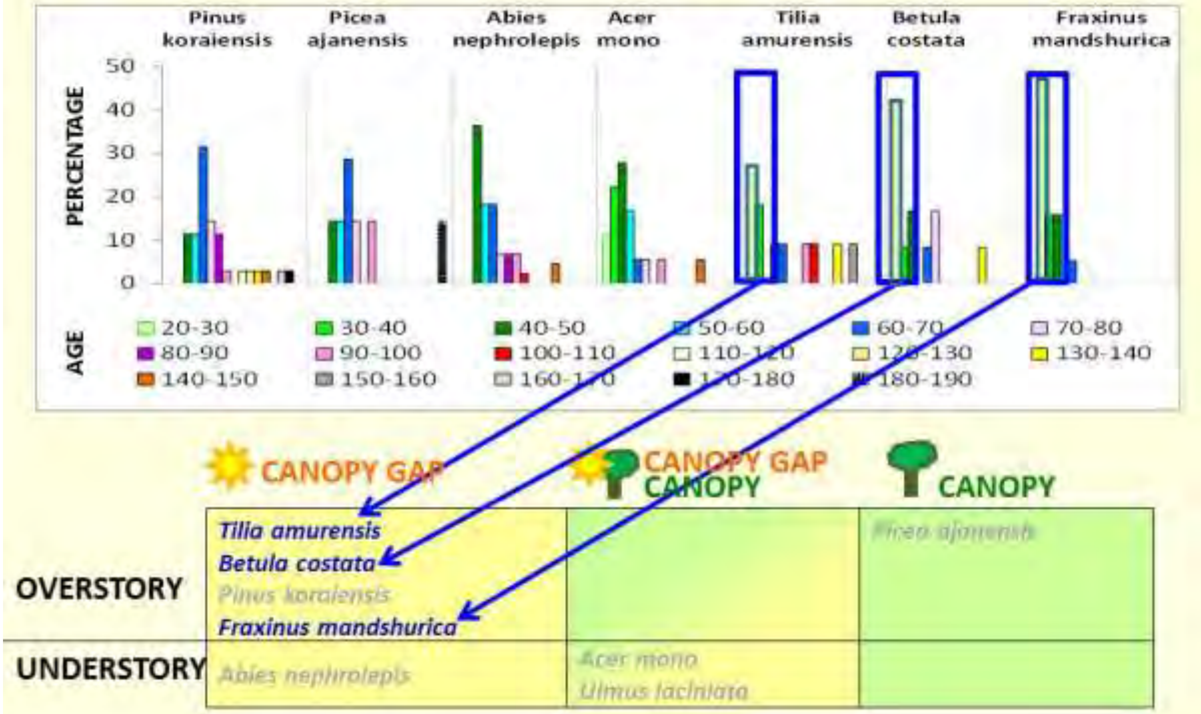
MAIN RELEASE CHARACTERISTICS

SPECIES	N	AGE MAX	percentage of trees with release (%)	Average No of release per tree	GC MAX, %
Abies nephrolepis	6523	210	89	1,7	809
Acer mono	2299	260	100	2,5	484
Betula costata	1562	260	94	3	278
Fraxinus mandshurica	2576	200	100	2,2	681
Picea ajanensis	2830	220	100	1,8	510
Pinus koraiensis	5986	310	95	2,7	1045
Tilia amurensis	3168	280	87	2,9	853

GROW UP AFTER MULTIPLE GAP FORMATION

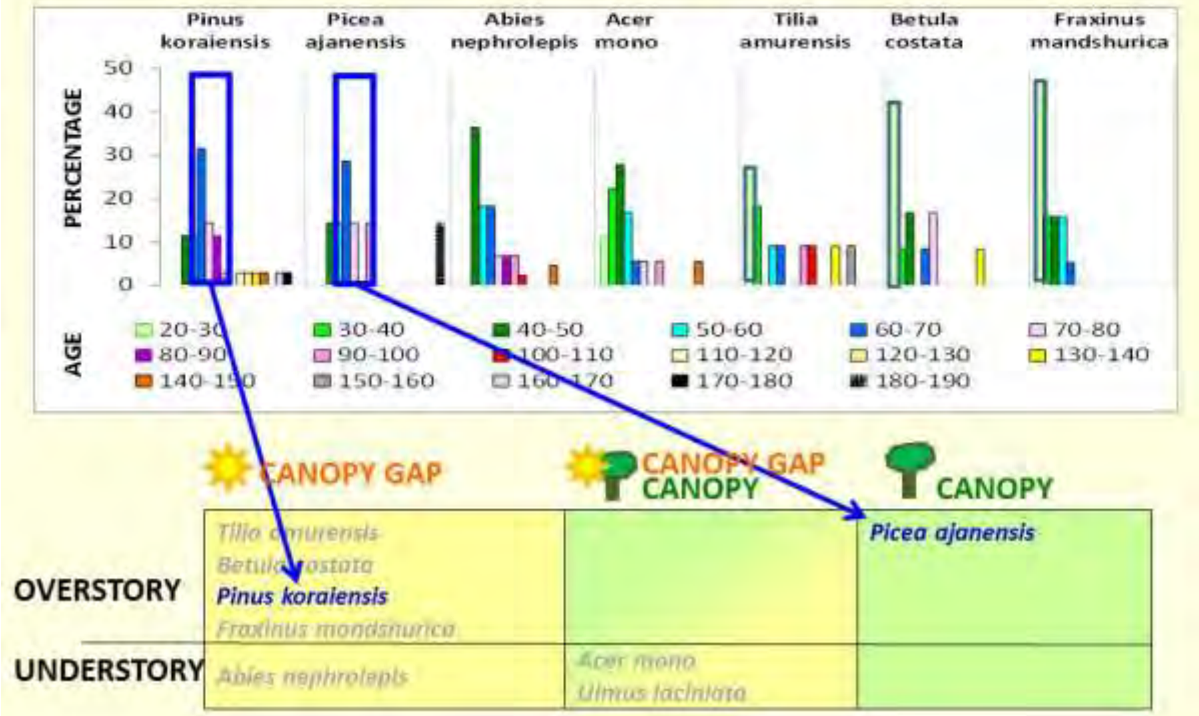
32

FIRST ONTOGENETIC RELEASE



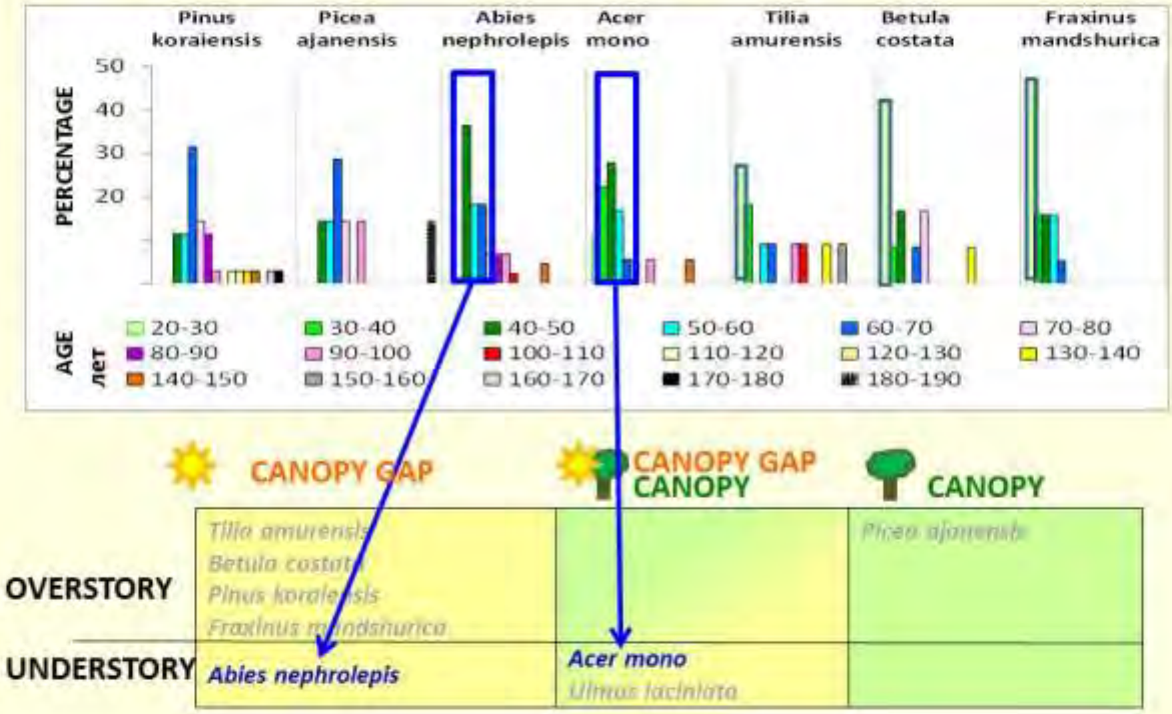
33

FIRST ONTOGENETIC RELEASE



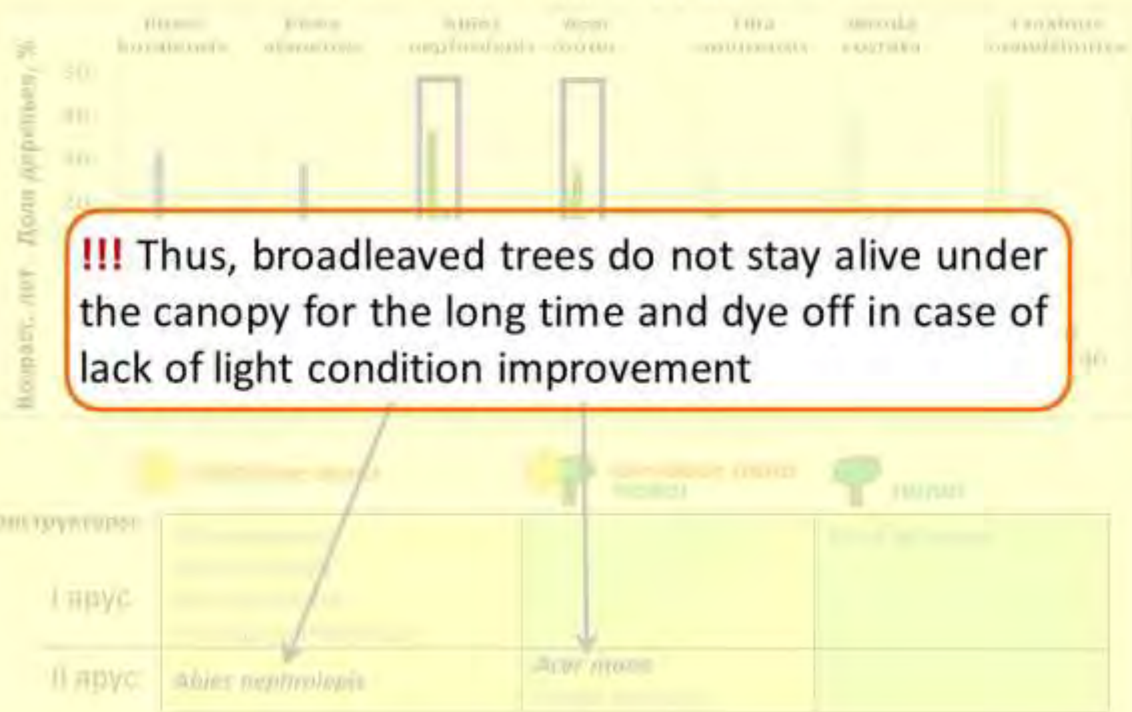
34

FIRST ONTOGENETIC RELEASE



35

Характеристика ускорений роста ключевых видов деревьев



!!! Thus, broadleaved trees do not stay alive under the canopy for the long time and dye off in case of lack of light condition improvement

36

MAIN RELEASE CHARACTERISTICS

SPECIES	N	AGE MAX	percentage of trees with release (%)	Average No of release per tree	GC MAX, %
Abies nephrolepis	6523	210	89	1,7	809
Acer mono	2299	260	100	2,5	484
Betula costata	1562	260	94	3	278
Fraxinus mandshurica	2576	200	100	2,2	681
Picea ajanensis	2830	220	100	1,8	510
Pinus koraiensis	5986	310	95	2,7	1045
Tilia amurensis	3168	280	87	2,9	853

MIN GC
+
NO NARROW TREE RINGS

Trees went in a more light of the canopy before the formation of GAP and release

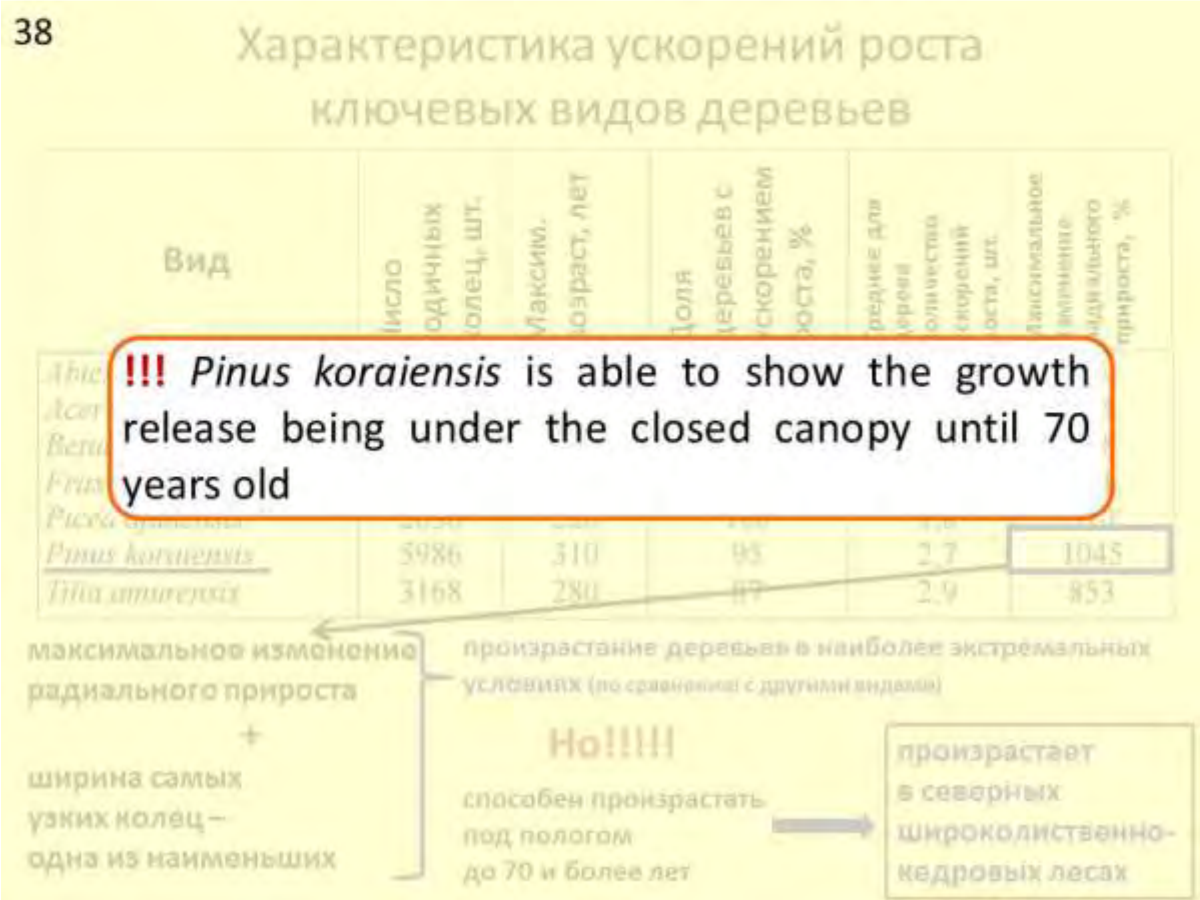
37

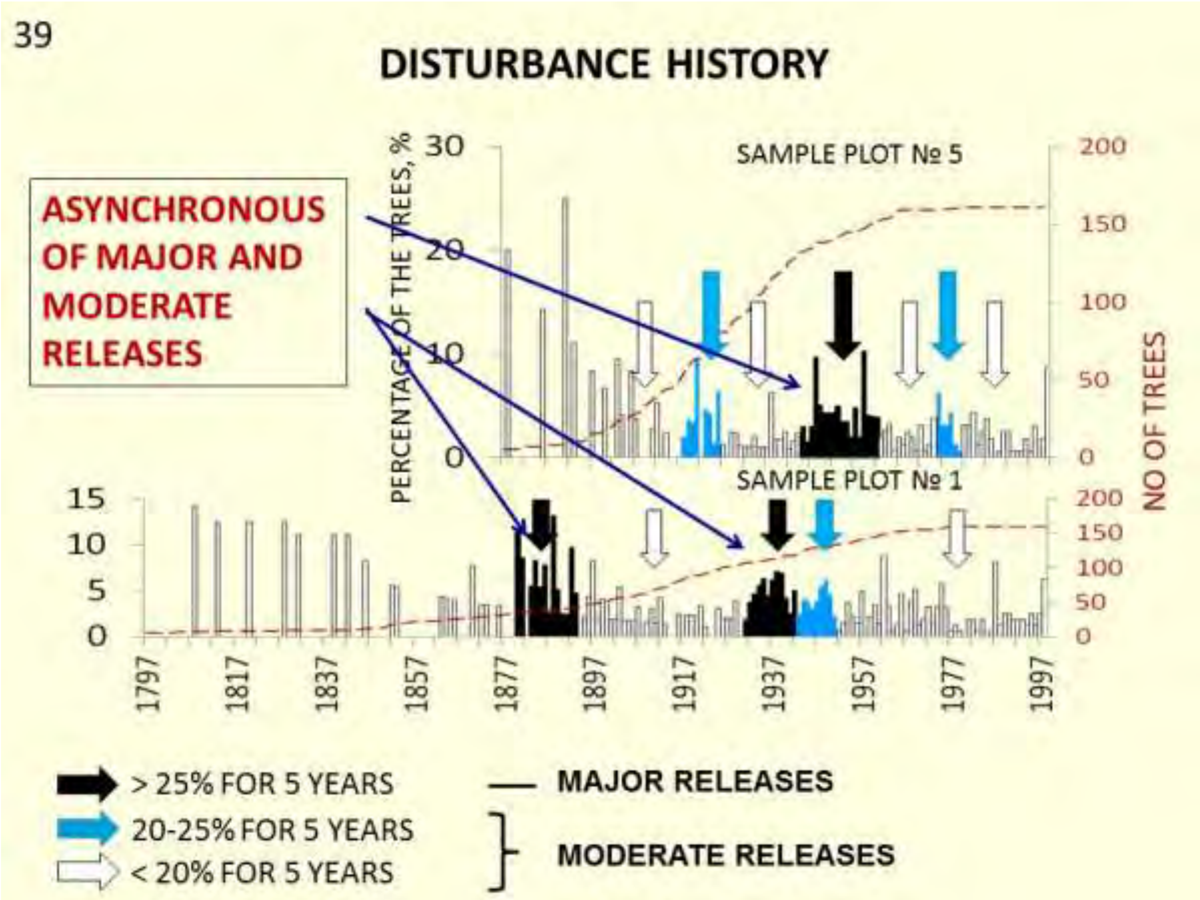
MAIN RELEASE CHARACTERISTICS

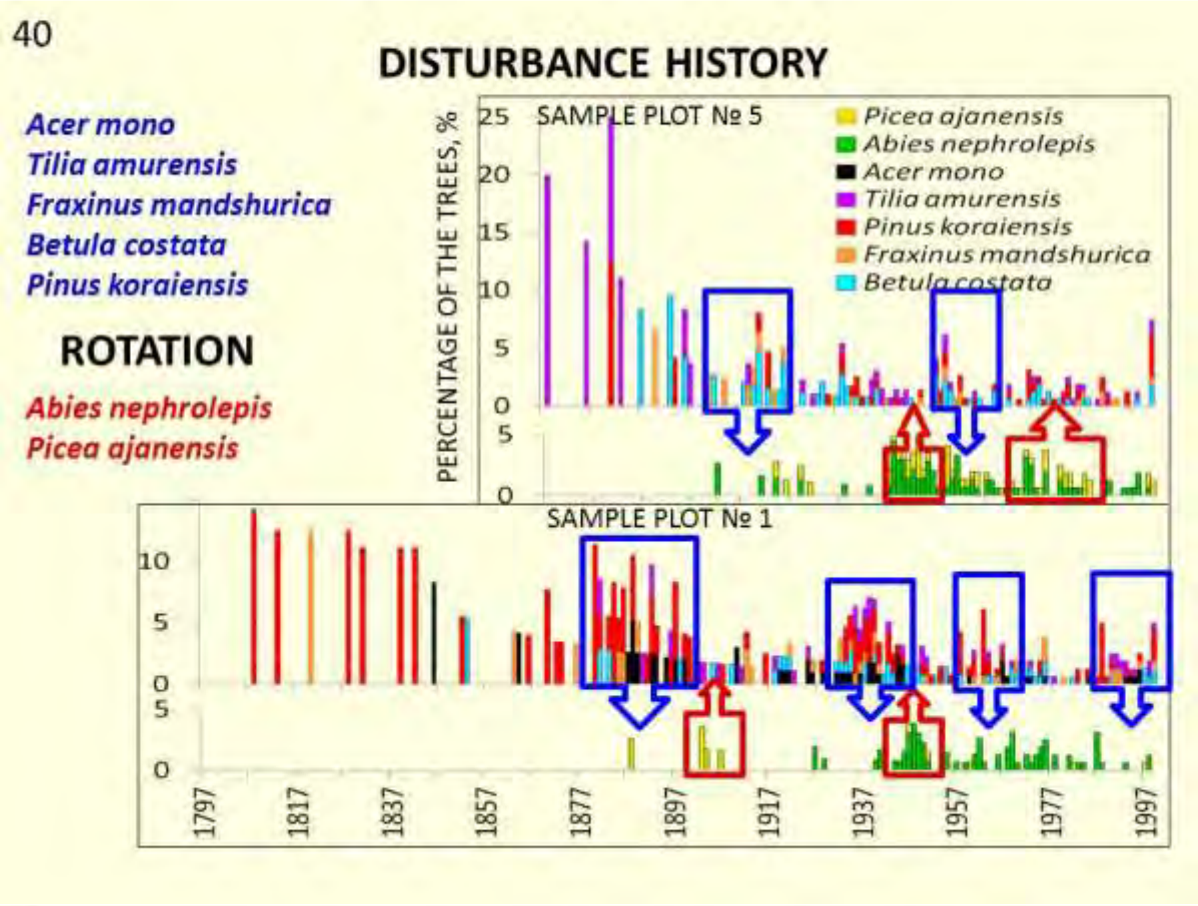
SPECIES	N	AGE MAX	percentage of trees with release (%)	Average No of release per tree	GC MAX, %
Abies nephrolepis	6523	210	89	1,7	809
Acer mono	2299	260	100	2,5	484
Betula costata	1562	260	94	3	278
Fraxinus mandshurica	2576	200	100	2,2	681
Picea ajanensis	2830	220	100	1,8	510
Pinus koraiensis	5986	310	95	2,7	1045
Tilia amurensis	3168	280	87	2,9	853

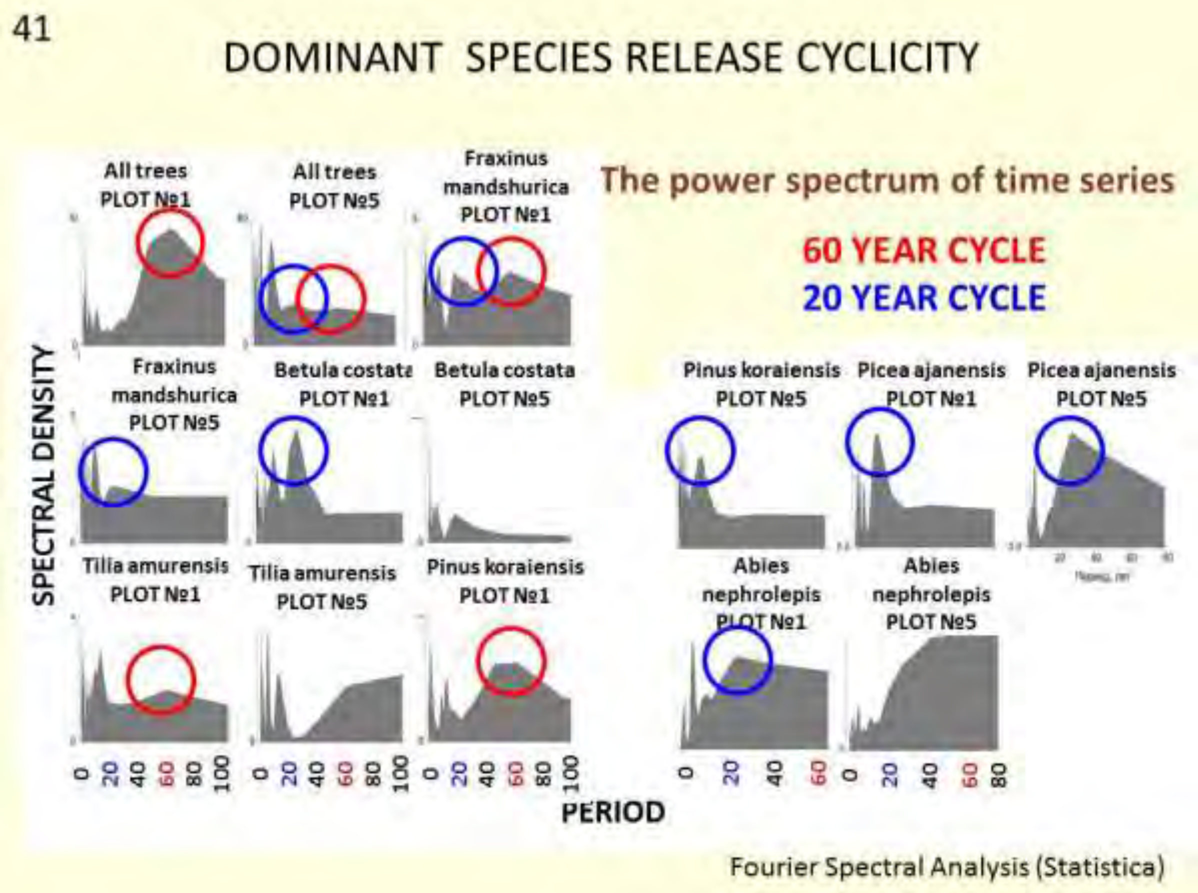
MAX GC

The highest sensitivity on GAP formation


38
Характеристика ускорений роста ключевых видов деревьев
Вид
Число годичных колец, шт.
Максим. возраст, лет
Доля деревьев с ускорением роста, %
Среднее для дерева количество ускорений роста, шт.
Максимальное изменение радиального прироста, %
Pinus koraiensis 5986 310 93 2.7 1045
Tilia amurensis 3168 280 87 2.9 853
!!! Pinus koraiensis is able to show the growth release being under the closed canopy until 70 years old
максимальное изменение радиального прироста
+
ширина самых узких колец – одна из наименьших
произрастание деревьев в наиболее экстремальных условиях (по сравнению с другими видами)
Но!!!!!
способен произрастать под пологом до 70 и более лет
произрастает в северных широколиственно-кедровых лесах


39
DISTURBANCE HISTORY
ASYNCHRONOUS OF MAJOR AND MODERATE RELEASES
SAMPLE PLOT № 5
SAMPLE PLOT № 1
PERCENTAGE OF THE TREES, %
NO OF TREES
30
20
10
0
15
10
5
0
200
150
100
50
0
1797
1817
1837
1857
1877
1897
1917
1937
1957
1977
1997
> 25% FOR 5 YEARS
20-25% FOR 5 YEARS
< 20% FOR 5 YEARS
MAJOR RELEASES
MODERATE RELEASES


40
DISTURBANCE HISTORY
Acer mono
Tilia amurensis
Fraxinus mandshurica
Betula costata
Pinus koraiensis
ROTATION
Abies nephrolepis
Picea ajanensis
PERCENTAGE OF THE TREES, %
SAMPLE PLOT № 5
Picea ajanensis
Abies nephrolepis
Acer mono
Tilia amurensis
Pinus koraiensis
Fraxinus mandshurica
Betula costata
SAMPLE PLOT № 1
1797
1817
1837
1857
1877
1897
1917
1937
1957
1977
1997


41
DOMINANT SPECIES RELEASE CYCLICITY
The power spectrum of time series
60 YEAR CYCLE
20 YEAR CYCLE
SPECTRAL DENSITY
All trees PLOT №1
All trees PLOT №5
Fraxinus mandshurica PLOT №1
Fraxinus mandshurica PLOT №5
Betula costata PLOT №1
Betula costata PLOT №5
Tilia amurensis PLOT №1
Tilia amurensis PLOT №5
Pinus koraiensis PLOT №1
Pinus koraiensis PLOT №5
Picea ajanensis PLOT №1
Picea ajanensis PLOT №5
Abies nephrolepis PLOT №1
Abies nephrolepis PLOT №5
PERIOD
Fourier Spectral Analysis (Statistica)

4) Climate, wildfire and forest management issues in Mongolia

Dr. Byambasuren Oyunsanaa

Professor, National University of Mongolia

International Workshop on Lessons Learnt and Challenges from Forest Long-term Ecological Research (LTER) in the Northeast Asian Region
Harbin, China, 20-24 September 2016

Climate, wildfire and forest management issues in Mongolia (Need for Forest Long-term Ecological Research)

OYUNSANAA BYAMBASUREN
Fire Management Resource Center – Central Asia Region (FMRC - CAR)
Ulaanbaatar, Mongolia

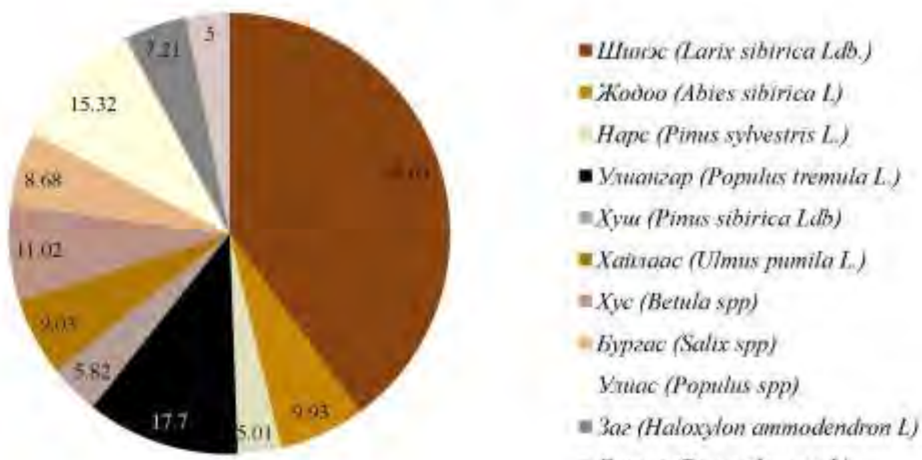
Outline

- Information about Mongolian forest ecosystems
- Forest and steppe fire and fire management
- Forestry Programme at the National University of Mongolia
- Forest Research and Training Center (University Forest) and its activities

Mongolian forest

In 2010, the total forest land area of the country was estimated 12,9 million ha of closed forest which covers 8,3% of total land area of the Mongolia.

Dominant forest tree species of Mongolia



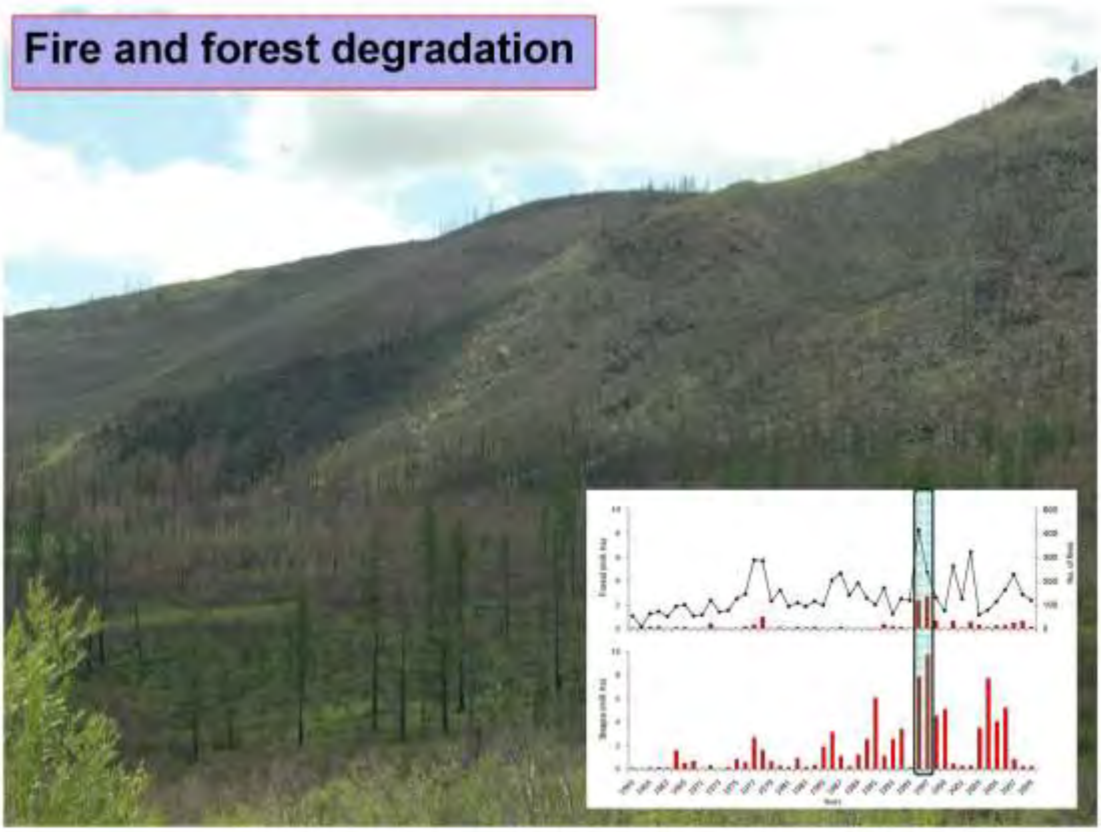
Key drivers of deforestation and forest degradation

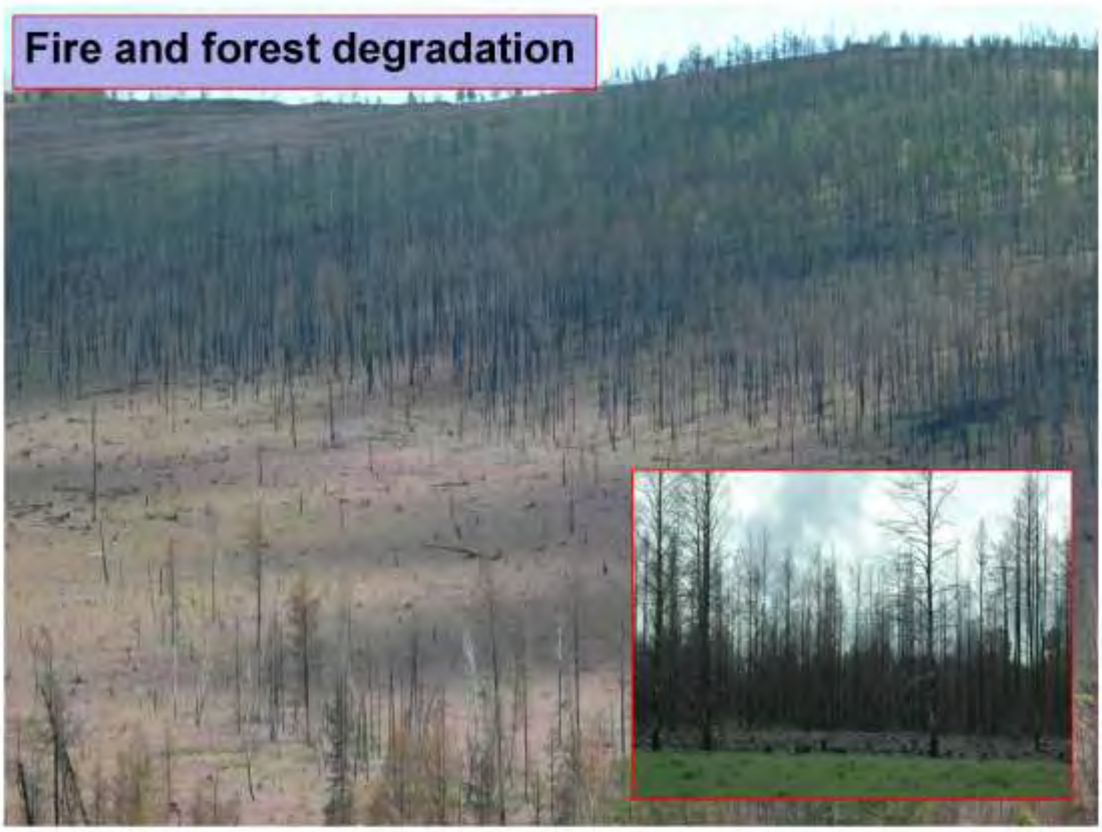
	Driver	Direct causes	Indirect causes
1	Forest fires	80-95%, caused by humans	Perverse incentives in regula tions
2	Illegal logging	Commercialized illegal logging; s mall-scale logging; fuel wood coll ection (cooking and heating)	Weak law enforcement; incre asing demand for timber; pov erty; lack of alternative fuel s ources
3	Insect invasion	Moths and beetles	Lack of research
4	Forest disease		Lack of research
5	Grazing forest areas	Livestock damage on forest rege neration/regrowth	Increased number of livestoc k; lack of regulation
6	Mining industry	Clearing mining sites and chemic al contamination	Mining license overlap with f orested areas

Fire situations:

- **Socio-economic changes**
- **Environment, human and economic security issues**




Fire and forest degradation

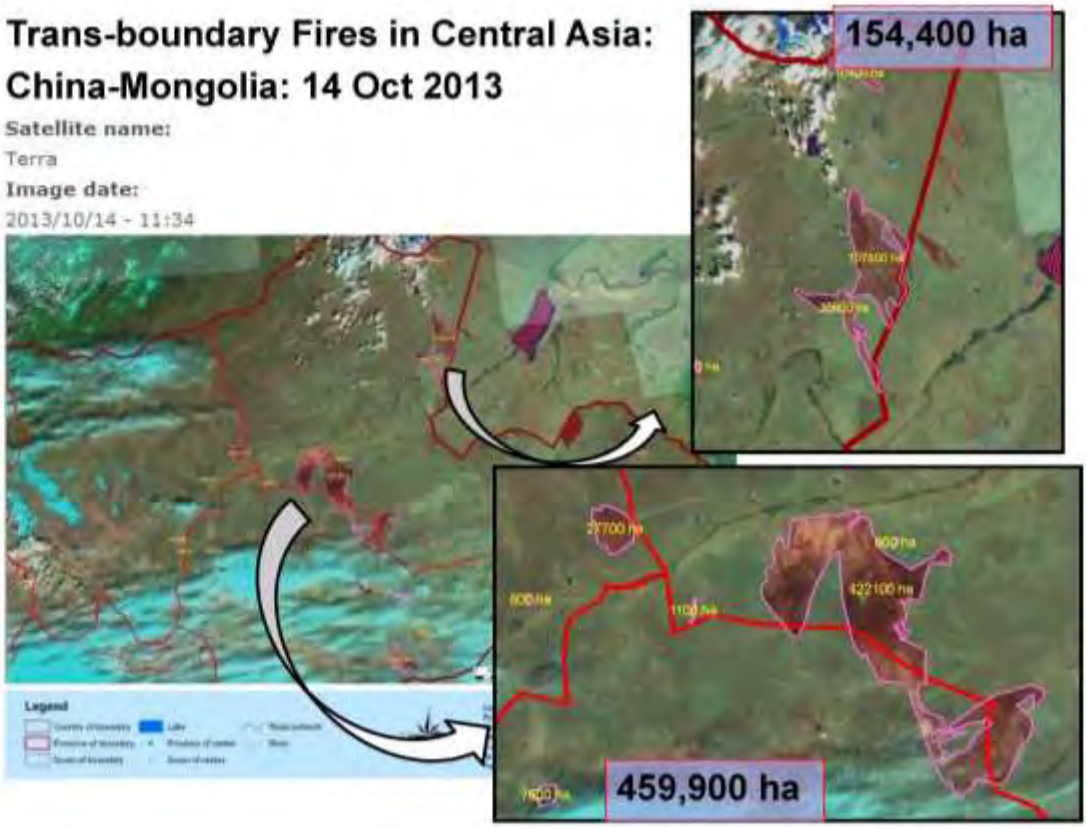

Fire and forest degradation

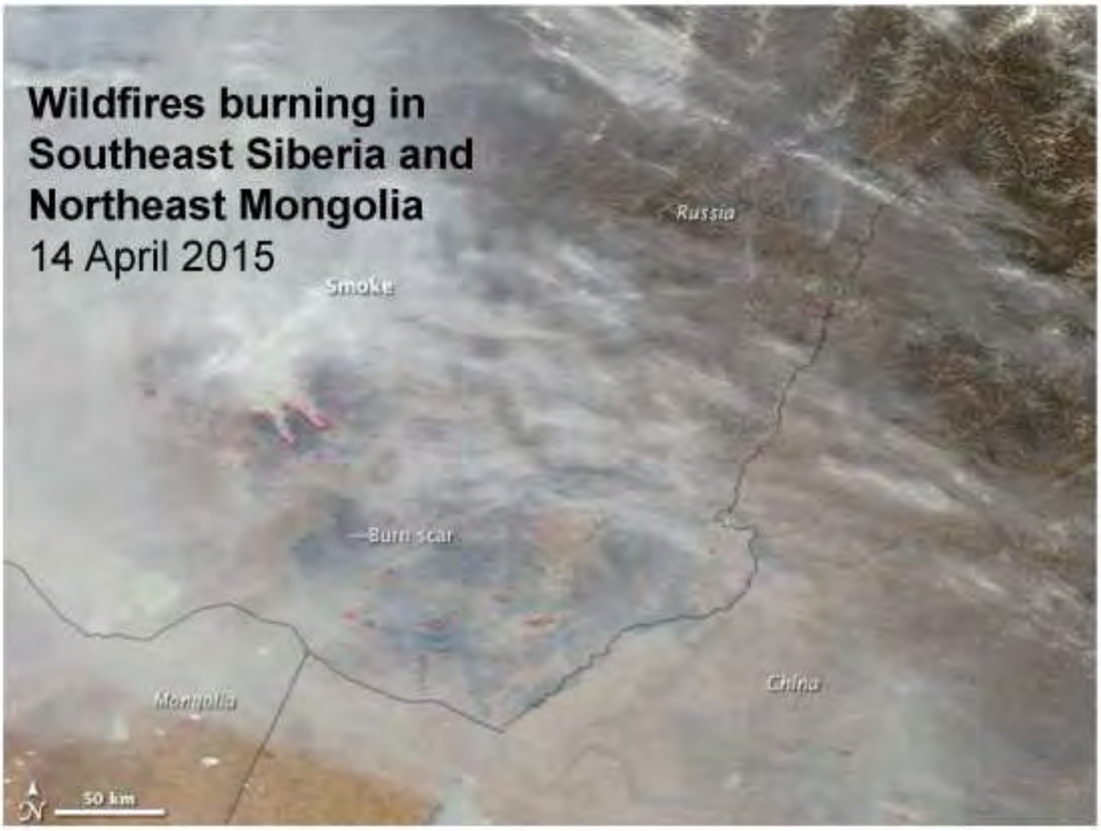

Fire and “steppezation” in Mongolia


Fire and “steppezation” in Kazakhstan

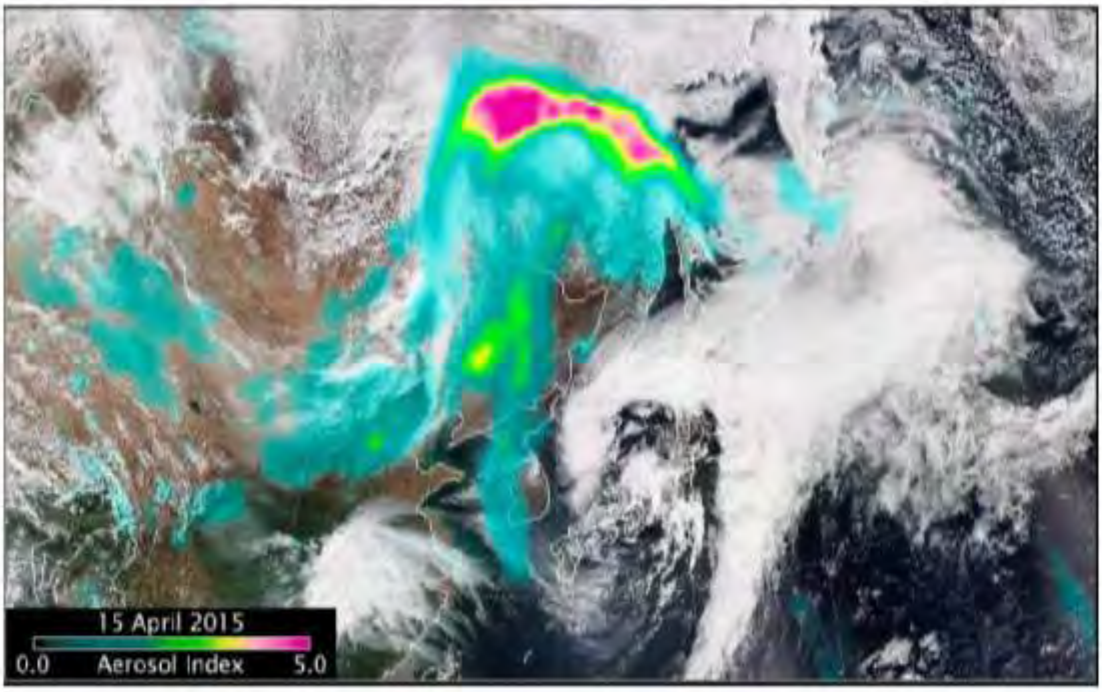

Fire and wildlife

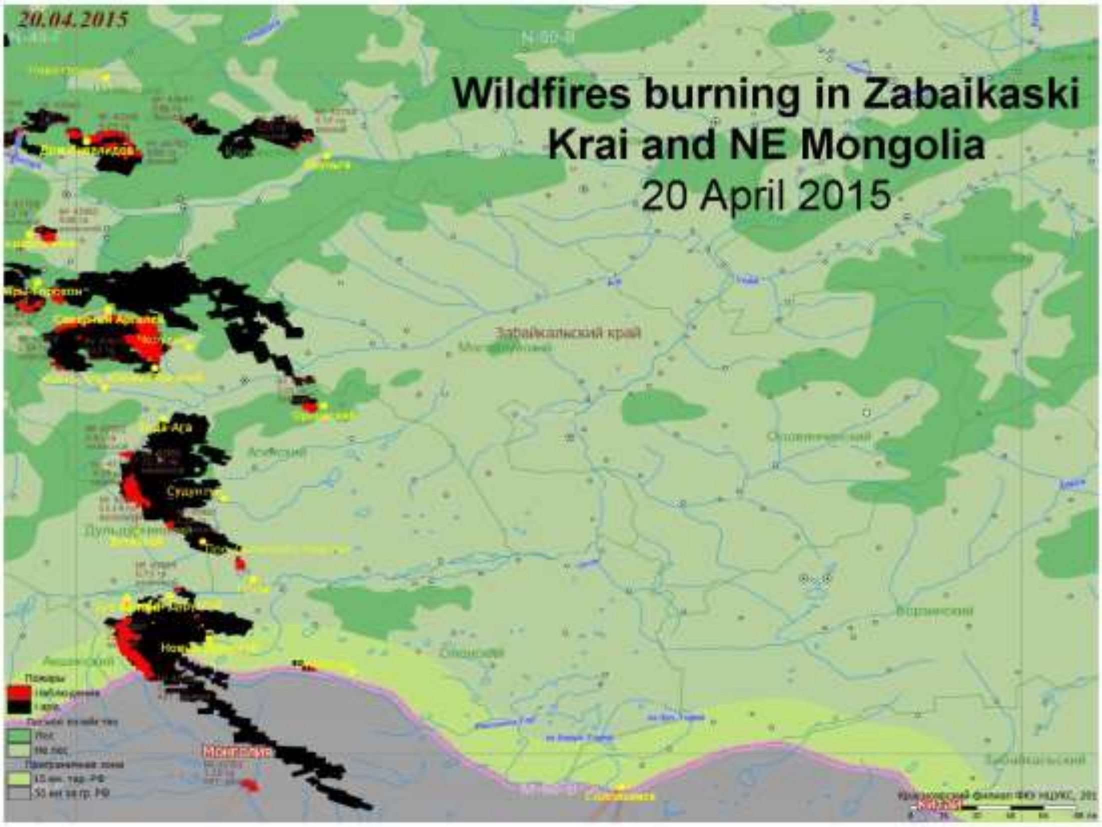

Fire and rural livelihood
Over 2000 livestock burned. Khentii province,
05 May 2013

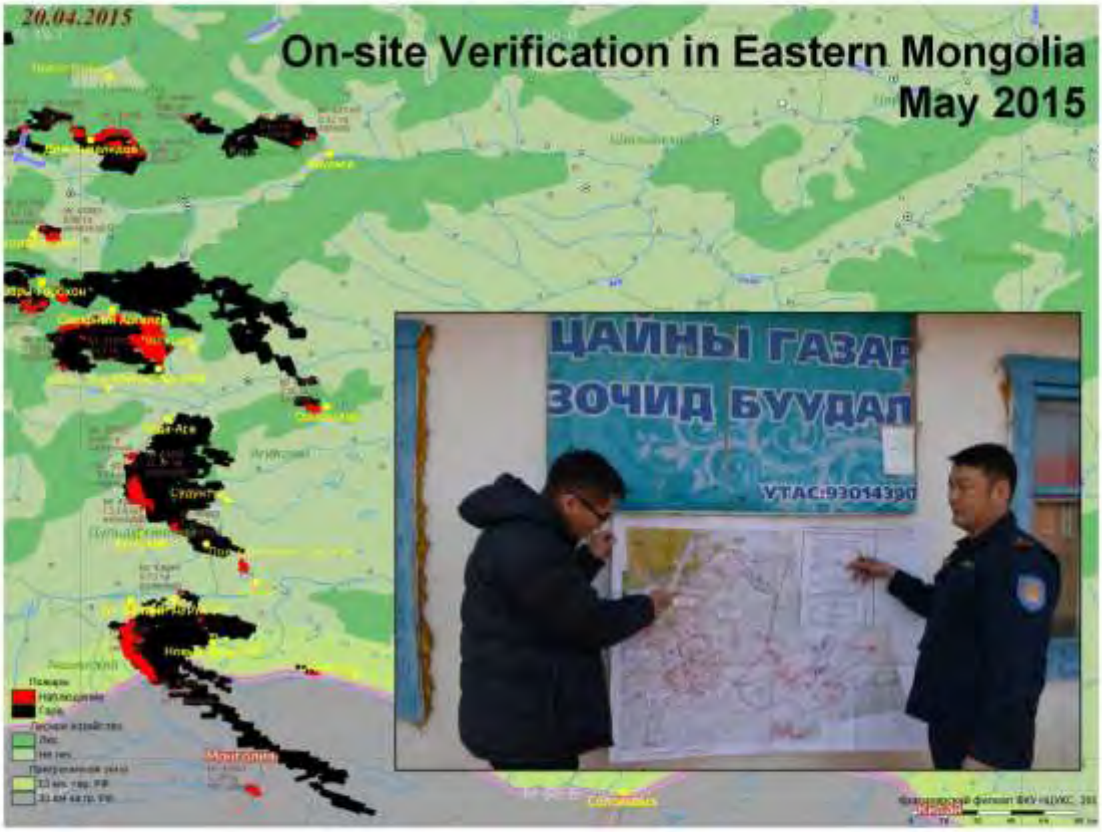

Trans-boundary Fires in Central Asia:
China-Mongolia: 14 Oct 2013
Satellite name:
Terra
Image date:
2013/10/14 - 11:34
154,400 ha
459,900 ha
Legend


Wildfires burning in
Southeast Siberia and
Northeast Mongolia
14 April 2015
Russia
Smoke
Burn scar
Mongolia
China
50 km

Smoke Export to the Pacific and North America April 2015






20.04.2015
On-site Verification in Eastern Mongolia
May 2015
ЦАЙНЫ ГАЗАР
ЗОЧИД БУУДАЛ


On-site Verification in Eastern Mongolia
May 2015

National Inter-Agency Round Table
May 2015

Conference and Consultation Facilitated by GIZ and GFMC in 2008

On behalf of
Federal Ministry
for Economic Cooperation
and Development


New fire fighting tools


Introduction: The use of Prescribed Fire


Introduction: The use of Prescribed Fire

International Conference on Cross-boundary Fire Management (Irkutsk, Russia, 16-18 June 2010)

Emphasis:

Enhancing efficiency and effectiveness of regional cooperation in fire management

International Transboundary Cooperation

- Establishment international agreements on cross-boundary cooperation on forest and steppe fires (Russia, Mongolia-Russia agreement: 10-14 June 2014)

Joint Mongolian-Russian Fire Exercise 2014

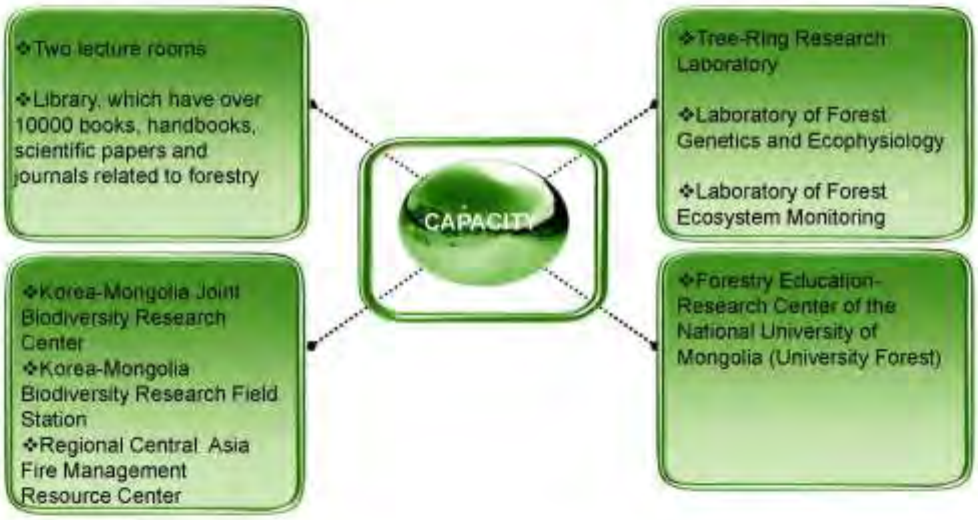
Participation and support of the International Wildfire Preparedness Mechanism (IWPM)

http://www.fire.uni-freiburg.de/iwpm/index.htm

- OSCE under the Chairmanship of Switzerland (2014):
    - Supported the Establishment of the Regional Central Asia Fire Management Resource Center, 2015 (RCAFMRC)
    - Partnership of Mongolian authorities, OSCE, Switzerland and GFMC

20-25 September 2015: The first OSCE-supported Central Asia Fire Management Training Course – introduction of the EuroFire Standards and Training Materials in Mongolian and Russian

PROGRAMME IN FORESTRY



JOINT INTERNATIONAL PROJECTS

YEARS	PROJECT TITLE	RESEARCH FUND	PI'S
2012~	Seabuckthorn (*Hippophae rhamnoides* L.), plantation and de velopment of medicinal and cosmetic products	Dongguk University, ROK	Prof. N. Bat khuu
2013-2016	"Strengthening Research Capacity for Sustainable Forest Ma nagement in Mongolia-StreFoMon"	Finnish Forest Resea rch Institute (Metla)	Prof. N. Baa tarbileg
2011-2014	"CNH: Pluvial, Drougth, Energetics and the Mongol Empire"	National Science Fou ndation, US	Prof. N. Baatarbileg
2014-2015	Multipurpose National Forest Inventory – quality control team	GIZ, Germany	Prof. N. Baatarbileg
2013~	Building Research And Teaching Capacity To Aid Climate Ch ange And Natural Resource Management At The National Un iversity Of Mongolia	National Science Foundation, US	Prof. N. Baatarbileg
2013~	Biodiversity Research Program and Establishment of Joint Lo ng Term Ecological Research Station in Mongolia	National Institute of Bi ological Resources, R OK	Prof. N. Batkhuu
2008-2017	Korea-Mongolia Joint "Green Belt" Plantation project		Prof. N. Batkhuu
2013-2016	"Studies on the collection of Wild plant seeds and Seed Vault in Northeast Asia" and "Establishment of East Asia Biodiversi ty Conservation Network"	Korea National Arbor etum, ROK	Prof. N. Bat khuu
2013-2016	Evaluation of Camelina (*Camelina sativa* L.)'s productivity an d adaptation test pilot project in Mongolia	Ministry of Agriculture , Food and Rural Affai rs, ROK	Prof. N. Bat khuu

Vision of the University Forest

- Since 2005, Dept. of Forestry got permission to use 2000 ha of forest area with 60 years of contract.
- It is located 80 km north of Ulaanbaatar
- We are started to establish Long-Term Forest Ecological Research Sites
- Planting different species of tree and woody plants and bushes for the reforestation and restoration of degraded forest land

Tree Ring Laboratory

Tree ring laboratory at National University of Mongolia was established in 1996 and lead by Prof. Baatarbileg Nachin. Since then this laboratory implemented and completed many research studies in related to dendrochronological science. Following projects have been implemented by this laboratory:
This laboratory fully equipped by dendrochronological tools and equipment that required by worldwide standards of dendrochronological lab. Outcomes and results of implemented projects have already published in international science peer reviewed journals

Implemented projects	Duration, by yea rs	Funded by	Funding amount
Mongolian American Tree Ring Project	1996-2006	National Science Foundation of USA	500 000,00USD
Air pollution effect on forest (by dendr ochemical methods)	2004-2005	Asian Research Center, National Uni versity of Mongolia	5 000 000,00 MNT
Dendro-dating of temples and monaster ies	2005-2006	National Science Foundation, Acade my of Sciences Mongolia	15 000 000,00 MNT
Dendrodating of Morin huur (horse hea ded feddle)		Asian Research Center, National Uni versity of Mongolia	5 000 000,00 MNT
Reconstruction of insect outbreak frequ ency of Bogdkhan Mountain, using den drochronological method	2007-2008	American Center for Mongolian Studi es, Ulaanbaatar	4 000 000,00 MNT
Climate, Fire and Forest History of Mon golia	2009-2013	National Science Foundation of USA	150 000,00 USD
Pluvial, droughts and Mongol Empire	2012-2014	National Science Foundation of USA	200 000,00 USD
Building Research And Teaching Capac ity To Aid Climate Change And Natural Resource Management At The National University Of Mongolia	2013-2016	National Science Foundation of USA	165 393,00 USD

Forest Ecosystem Monitoring Laboratory

This laboratory has officially established in 2014. But related projects are already started even before.

Implemented projects	Duration, by years	Funded by	Funding amount,
Multipurpose National Forest Invento ry – quality control team	2014-2015	GIZ and Ministry of Environment and Green Development of Mongolia	250 000,00 EU
Capacity Building of Higher educatio n	2014	Asian Development bank	38 000,00 CAD
Consulting on introducing containeriz ed seedlings in tree nursery	2013-2014	Ministry of Environment and Green Development of Mongolia and Institute of Forest Research And Development	20 000 000,00MNT
Introducing mycorrhizal inoculation in seedling nursery	2014-2015	Ministry of Environment and Green Development of Mongolia and Institute of Forest Research And Development	20 000 000,00MNT
Strengthening research capacity of S ustainable forest management of Mo ngolia	2011-2013	Ministry of Foreign Affairs of Finland and Ministry of Green Development of Mongolia Cooperation with NUM and Natural Resources Institute of Finland (LUK E)	500 000,00

Project title: "Forest carbon monitoring research"
Implementing Organization(s): National University of Mongolia and Hokkaido University, Japan

LONG-TERM FOREST CARBON MONITORING

Hokkaido University, Japan and National University of Mongolia

LI-7500 – Air carbon diodide (10 times/second)

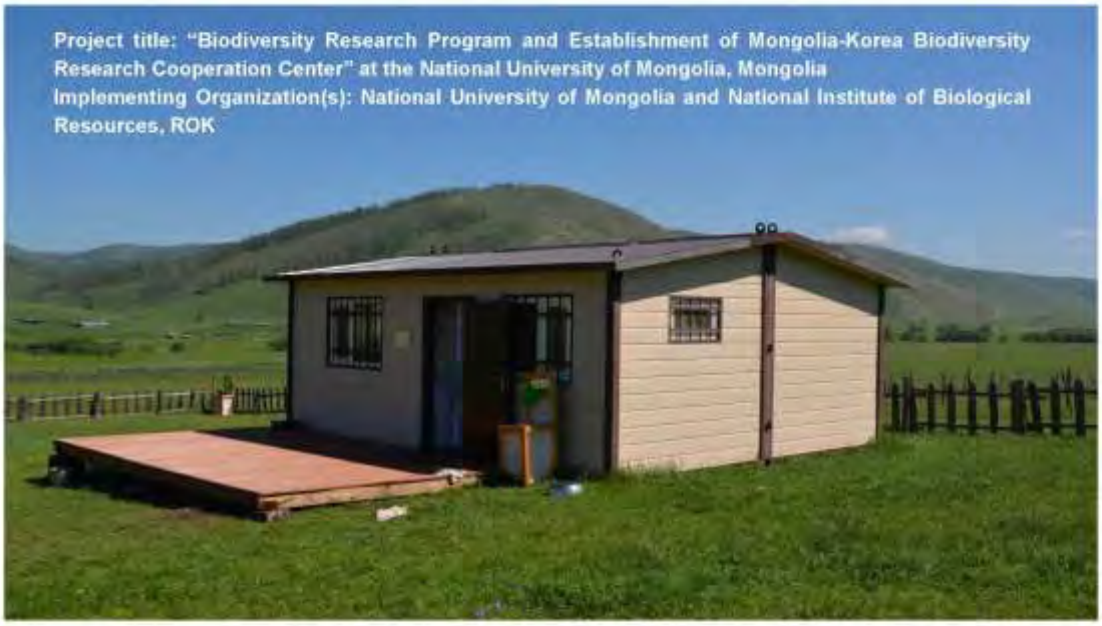
Vaisala Temperature and RH sensor: 10 m depth and every 0.5 m depth measuring soil T and RH

Vaisala Weather Transmitter - 2 ба 26 метрын өндөрт температур, хур тунадас, чийглэл, агаарын даралт зэрэг цаг салхины хурд, үүрын үзүүлэлтүүд хэмжинэ.

Sonic Ranging Sensor – Depth of snow cover

Laboratory of Forest Genetics and Ecophysiology

Officially established January, 2015 with support of:
A. Ministry of Education, Science and Culture: 46,940,000.00 MNT
B. Initiator's collected support: 80,551,967.00 MNT
C. National University of Mongolia: 6,980,000.00 MNT
Total fund for establishment of the Laboratory: 134,471,967.00 MNT



"Biodiversity Research Program and Establishment of Mongolia-Korea Biodiversity Research Cooperation Center" at the National University of Mongolia"

Total budget: 102,694,422.00 MNT

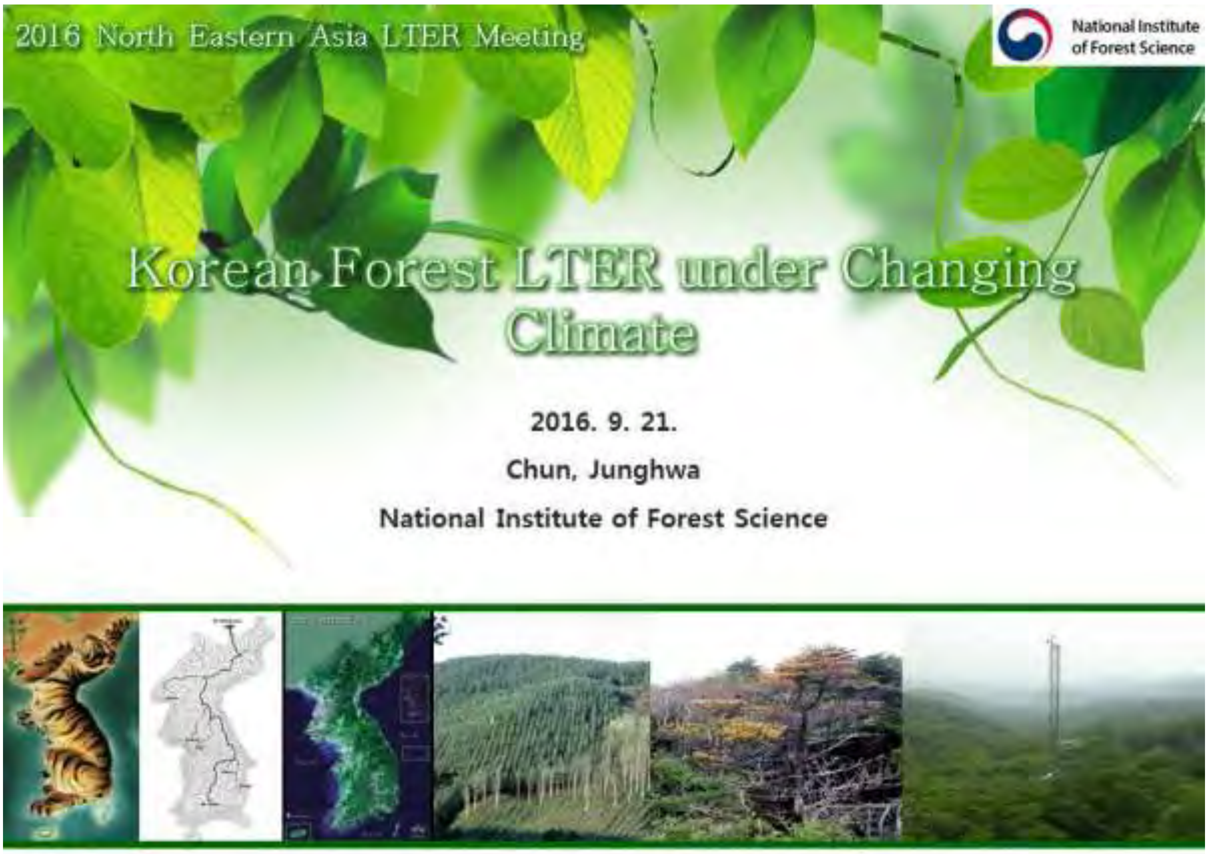
Seabuckthorn (*Hippophae rhamnoides* L.), plantation and development of medicinal and cosmetic products
Dongguk University, ROK and National University of Mongolia

Total budget: 88,228,349.00 MNT

5) Korean forest long-term ecological research under changing climate

Dr. Jung Hwa Chun

Researcher, Forest Ecology Division, Forest Conservation Department,
National Institute of Forest Science


2016 North Eastern Asia LTER Meeting
National Institute of Forest Science
Korean Forest LTER under Changing Climate
2016. 9. 21.
Chun, Junghwa
National Institute of Forest Science


Contents
I. Background
II. Long Term Ecosystem Monitoring
III. Recent Approaches
IV. Summary

National Institute of Forest Science

I. Background

NIFoS

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Environment of Korea Peninsula

Geography

- Latitude : 33°06' ~ 43°00', Longitude : 124°11' ~ 131°53'
- Average Elevation : 420 m
- Land area : 221,000 km² (South Korea : 99,660 km², 45%)
- Forest area : 70% of total land area (South Korea : 65%)

Climate

- Annual mean Temperature (four different seasons)
  South : 12-14°C, Central : 10-12°C, North : 5-10°C

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Korea – a Country of Mountains & Forests

Greening Korea

- Korea, a mountainous country with 64% of its land in forests, has a long history of its people living in close relationship with forests.
- Throughout the long history of Korea, the wise management of forests and water resources has been high on national agenda.
- During the first half of 20th century, severe deforestation had occurred across the Korea, due to widespread illegal cuttings and overcutting practices.
- Since the early 1970s, rehabilitation activities of forest lands have been strongly propelled in order to green the country again.

www.forest.go.kr

5

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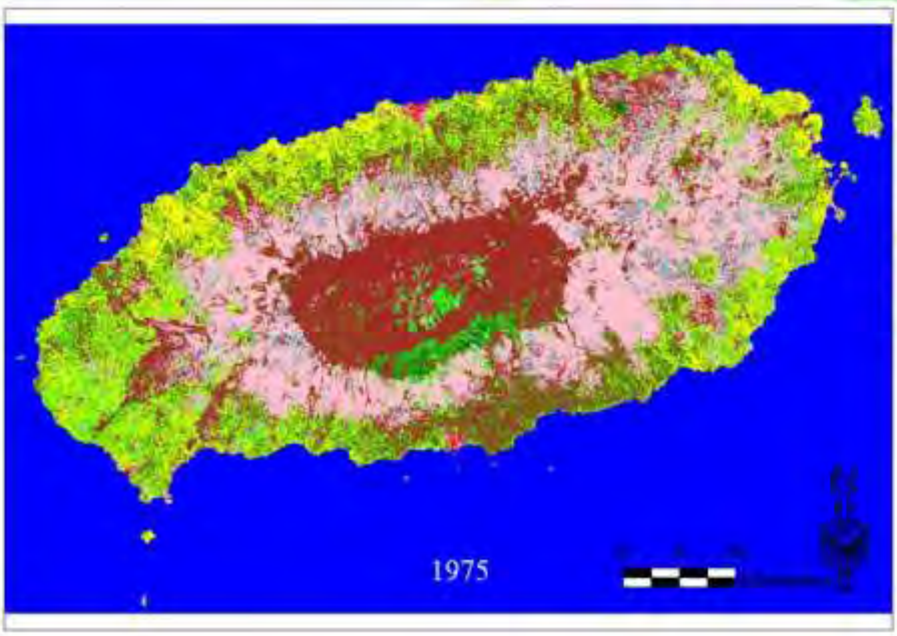
Fast rate of land cover change



Legend
- Water body
- Deciduous forest
- Evergreen conifer forest
- Evergreen broadleaved for
- Grassland or sparse forest
- Cultivated land
- Barren land
- Urban area

Chun, 2006

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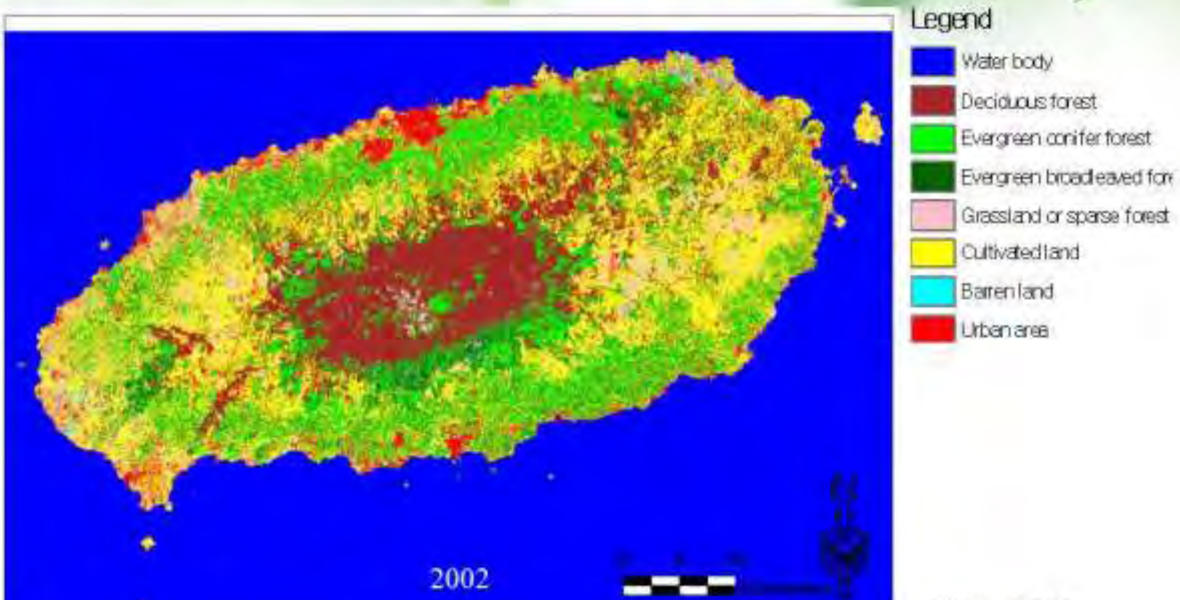
Fast rate of land cover change

National Institute of Forest Science



Chun, 2006

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Increase in CO_2 concentration

National Institute of Forest Science

- Daily average concentration of CO_2 in the atmosphere surpassed 400ppm for the first time at the Mauna Loa Observatory in Hawaii.
- 3~6℃ increase in mean annual temperature is expected by 2100 according to IPCC RCP 8.5 climate change scenarios.
- Ice core samples collected in Antarctica are not only used to support theories of climate change but also disprove it.

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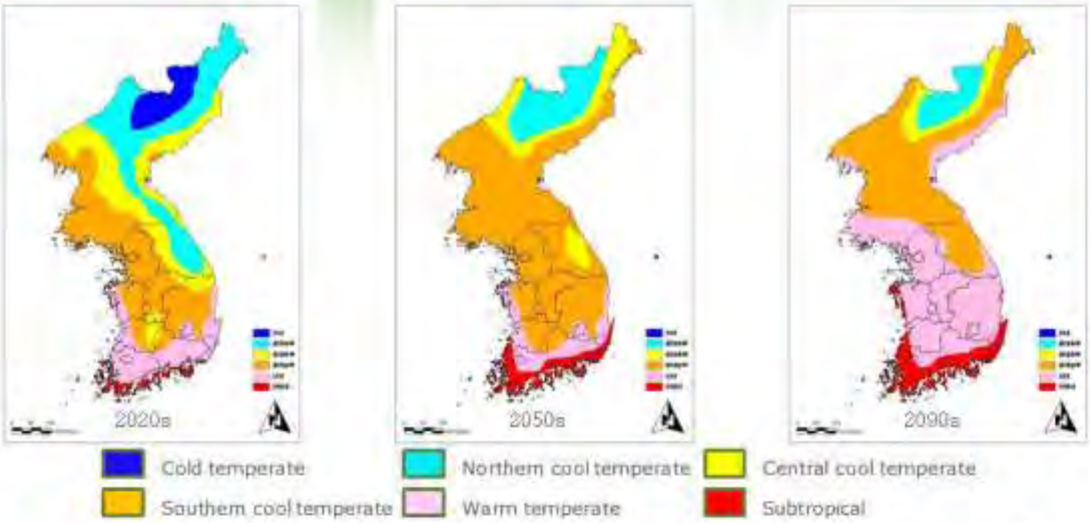
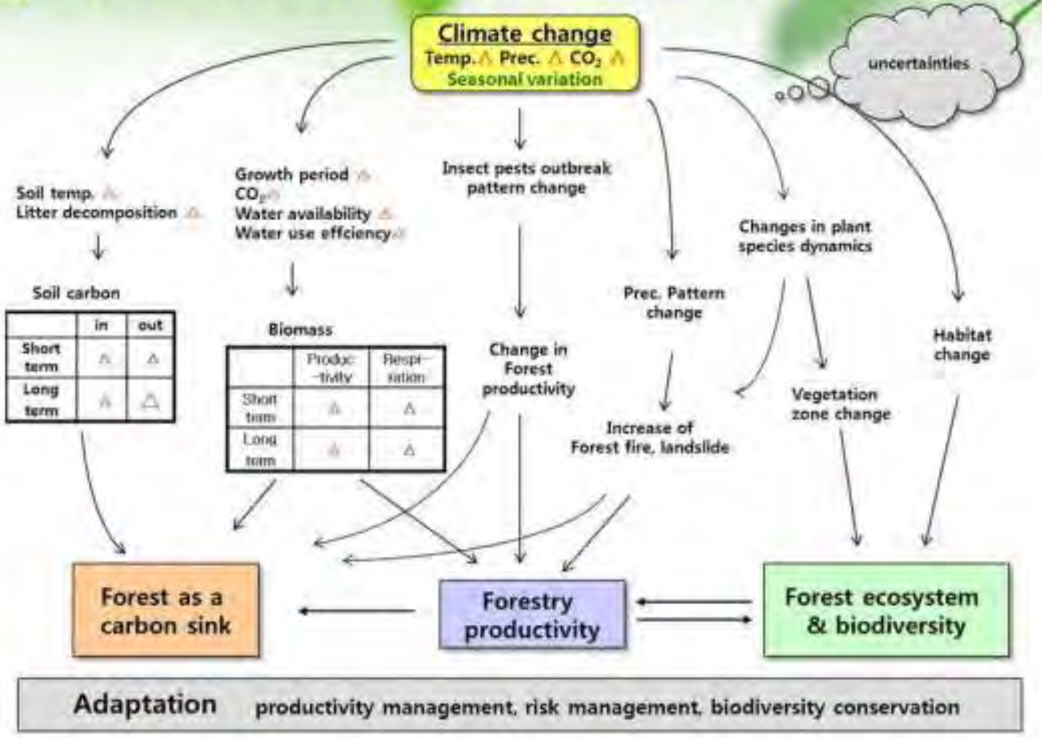
Shifts of Vegetation Zones



- Korea has experienced 1.5℃ increase of mean air temperature during the last 100 years
- 3~6℃ increase is expected by IPCC RCP 8.5 climate change scenarios.

Expected Effects of Climate Change



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Public Opinion on Climate Change

: Gallup Poll(2007~8)

Country	Awareness	Caused by human activity	Perceived as threat
Japan	99	91	80
Finland	98	53	39
Australia	97	46	75
United Kingdom	97	48	69
United States	97	49	63
Norway	97	47	43
Germany	96	59	60
Netherlands	96	44	57
Sweden	96	64	56
Luxembourg	95	60	75
Canada	95	61	74
Austria	95	51	54
Iceland	95	38	33
Ireland	94	66	60
South Korea	93	92	80
Hungary	93	65	75
France	93	53	75
Hong Kong	93	78	54
Taiwan	91	70	70
Lithuania	91	50	47

Country	Awareness	Caused by human activity	Perceived as threat
South Korea	93	92	80
Japan	99	91	80
Costa Rica	75	87	72
Greece	87	84	82
Argentina	75	81	71
Ecuador	70	81	69
Tajikistan	43	81	19
Brazil	79	80	76
Portugal	90	79	85
Paraguay	58	79	54
Hong Kong	93	78	54
Chile	73	78	69
Colombia	68	77	65
...dad and Tobago	72	76	71
Uruguay	73	75	58
El Salvador	55	75	51
Panama	65	73	51
Bolivia	55	73	51
Peru	62	72	58
Guatemala	57	72	51

Where is Al Gore on the right table?

Are Japanese and Korean people simple and innocent?

Climate change skeptics believe that science put the blame on humanity without enough scientific proof to back it up.

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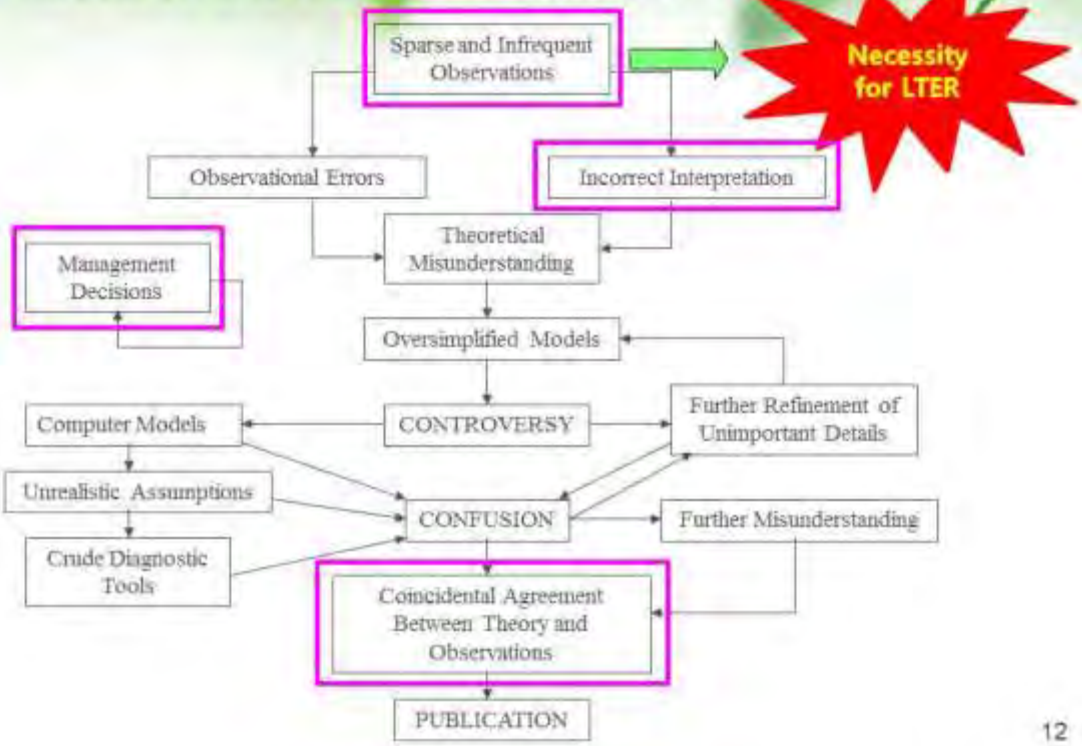
Cynic's View of the Interface Between Ecological Research and Management (Hobbs, 1998)



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II. Long-Term Ecosystem Monitoring
;Is Korean Forest Ecosystem Really Being Affected by Climate Change?

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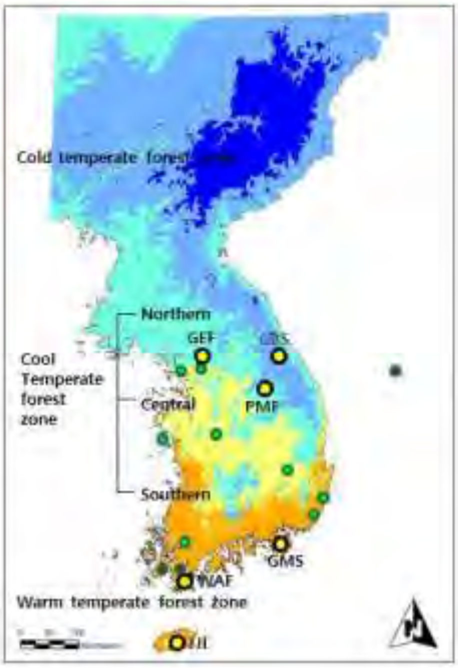
KFRI LTER sites



1. Mt. Gyebangsan Forest (GBS) 1995 ~
   - Deciduous broad-leaved and conifer
2. Gwangnung Exp. Forest (GEF) 1996 ~
   - Super site; multidisciplinary researches
   - Deciduous broad-leaved
3. Mt. Geumsan Forest (GMS) 2002 ~
   - Deciduous & evergreen conifer
4. Jeju-do island (JJI) 2004 ~
   - from warm temperate to cold
   - Deciduous & evergreen broad-leaved, conifer
5. Pyongchang Model Forest (PMF) 2014 ~
   - Deciduous broad-leaved and conifer
6. Wando Arboretum Forest (WAF) 2014 ~
   - Deciduous & evergreen broad-leaved

- Forests around major cities
- Islands and warm temperate natural forests

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Major LTER sites

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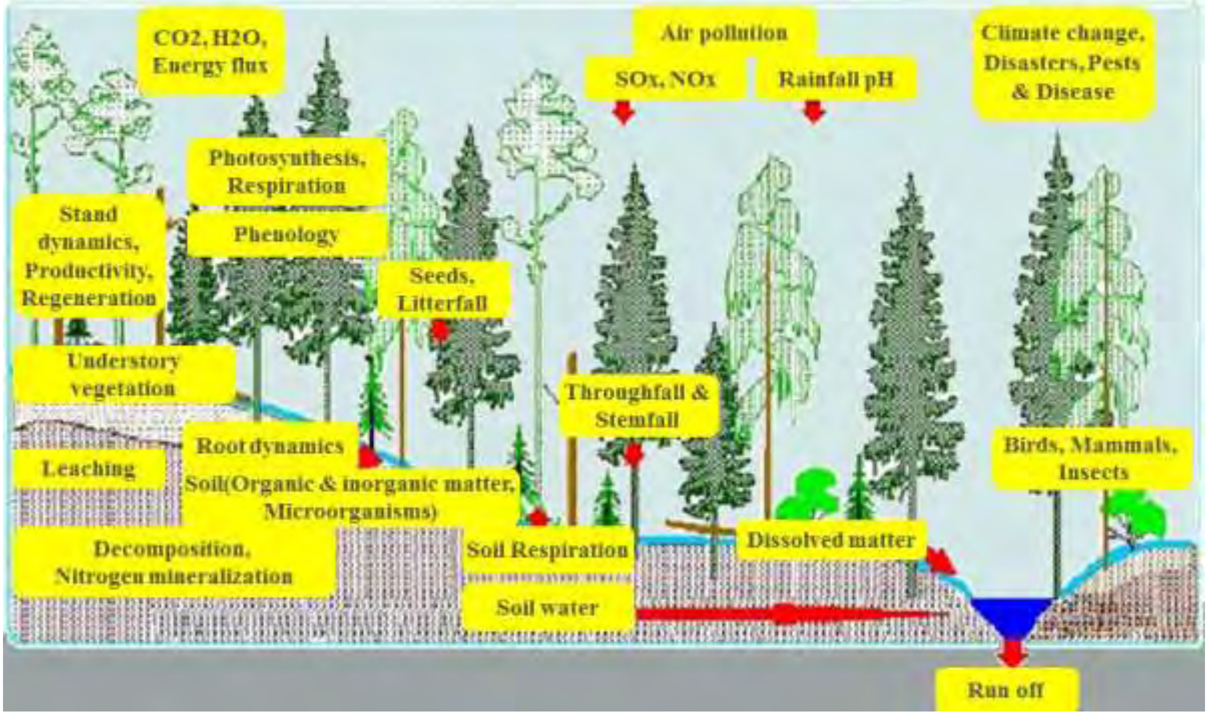
Complexity of Forest Ecosystem



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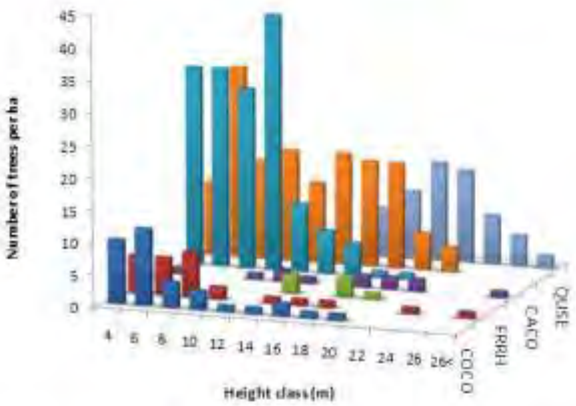
Stand Structure (GEF)



Stemmap and Coarse woody debris map

Tree Species Composition(GEF)

Dominant species : *Quercus serrata* (51%), *Carpinus laxiflora* (23%)

Others: *C. cordata*, *Cornus* spp., *Acer* spp., *Celtis jessoensis*, *Pinus* spp., *Prunus* spp., *Fraxinus rhynchophylla*, *Sorbus alnifolia etc.*

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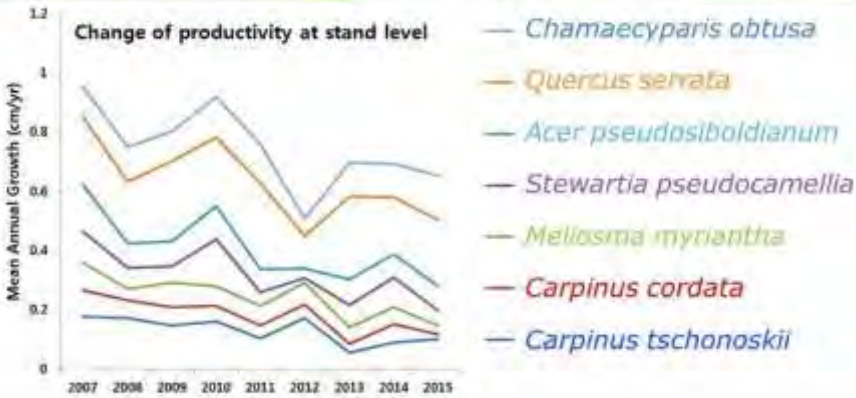
Stand Structure (GMS)



	Annual mean temperature	Annual precipitation	Mean temperature of growing season	Mean temperature of Spring season	GDD	Precipitation of growing season	Precipitation of Spring season
Carpinus tschonoskii	-.047	-.284	-.672	-.381	-.631	-.278	.300
Carpinus cordata	-.144	-.484	-.516	-.701	-.543	-.419	.633
Meliosma myriantha	-.567	-.269	-.568	-.715	-.636	-.153	.887
Stewartia pseudocamellia	.225	-.309	-.020	.172	.053	-.211	.066
Acer pseudosiboldianum	-.172	-.199	-.541	-.325	-.517	.024	.275
Quercus serrata	-.083	-.163	.022	-.159	.021	.072	-.155
Chamaecyparis obtusa	.485	-.007	.262	.370	.364	.102	-.518

- Statistical relationships between tree growth and weather conditions.

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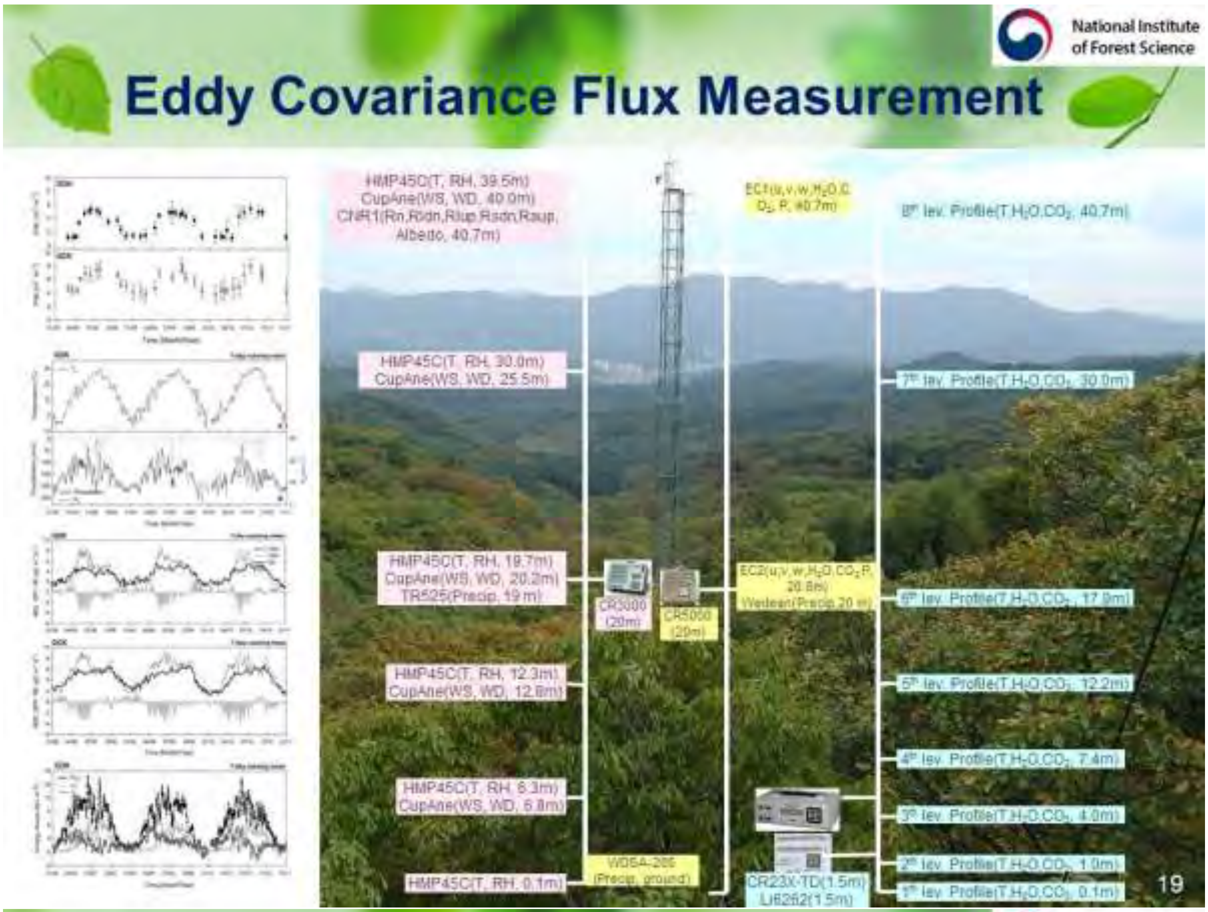
National Institute of Forest Science
Eddy Covariance Flux Measurement
HMP45C(T, RH, 39.5m)
CupAne(WS, WD, 40.0m)
CNR1(Rn,Rldn,Rlup,Rsdn,Rsup, Albedo, 40.7m)
8th lev. Profile(T,H2O,CO2, 40.7m)
HMP45C(T, RH, 30.0m)
CupAne(WS, WD, 25.5m)
7th lev. Profile(T,H2O,CO2, 30.0m)
HMP45C(T, RH, 19.7m)
CupAne(WS, WD, 20.2m)
TR525(Precip, 19 m)
CR3000 (20m)
CR5000 (20m)
6th lev. Profile(T,H2O,CO2, 17.9m)
HMP45C(T, RH, 12.3m)
CupAne(WS, WD, 12.8m)
5th lev. Profile(T,H2O,CO2, 12.2m)
4th lev. Profile(T,H2O,CO2, 7.4m)
HMP45C(T, RH, 6.3m)
CupAne(WS, WD, 6.8m)
3rd lev. Profile(T,H2O,CO2, 4.0m)
2nd lev. Profile(T,H2O,CO2, 1.0m)
HMP45C(T, RH, 0.1m)
WDSA-200 (Precip, ground)
CR23X-TD(1.5m)
Li6262(1.5m)
1st lev. Profile(T,H2O,CO2, 0.1m)
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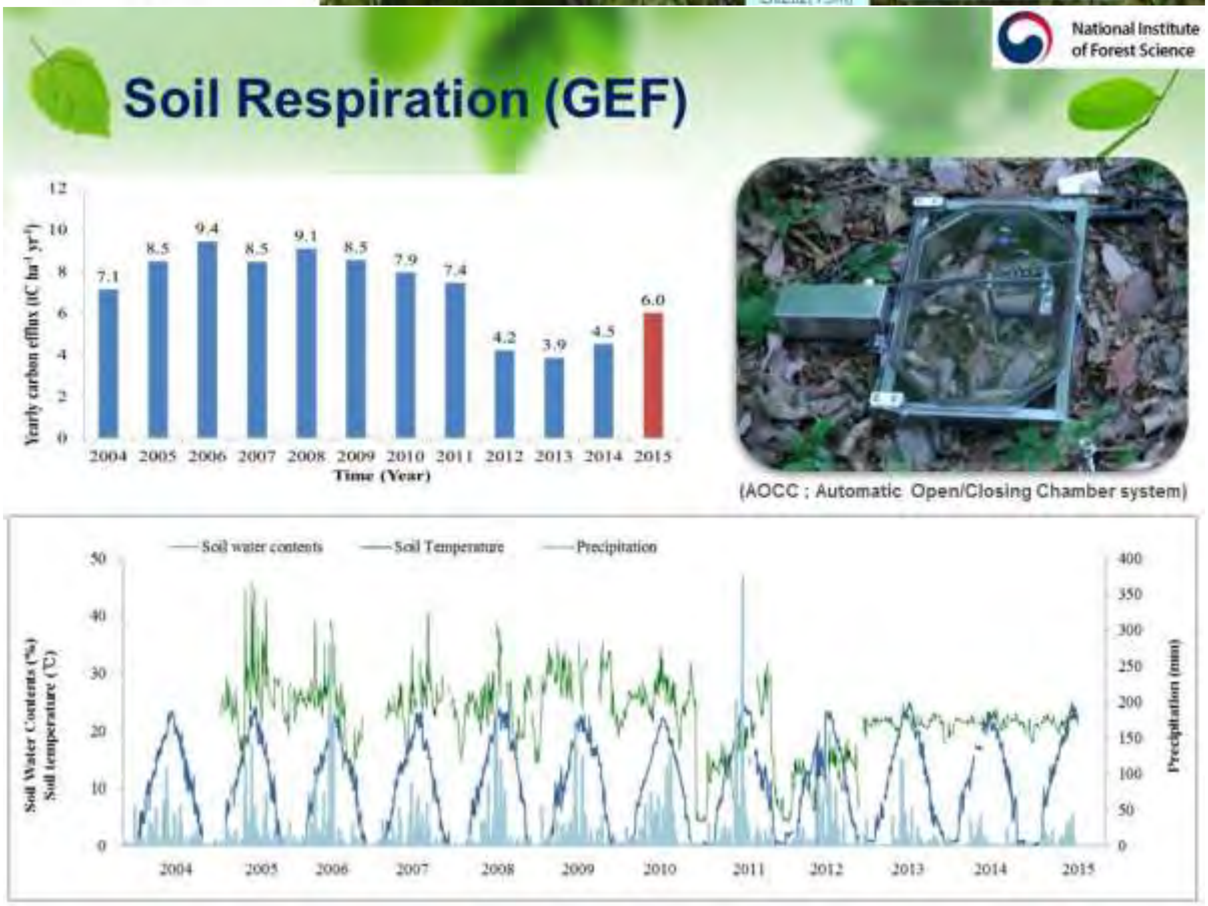
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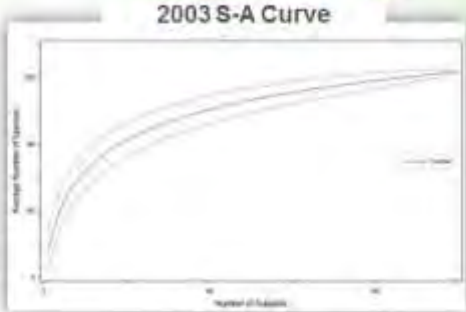
Soil Respiration (GEF)
Yearly carbon efflux (tC ha-1 yr-1)
12
10
8
6
4
2
0
7.1
8.5
9.4
8.5
9.1
8.5
7.9
7.4
4.2
3.9
4.5
6.0
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Time (Year)
(AOCC ; Automatic Open/Closing Chamber system)
Soil water contents
Soil Temperature
Precipitation
Soil Water Contents (%)
Soil temperature (℃)
Precipitation (mm)
50
40
30
20
10
0
400
350
300
250
200
150
100
50
0
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

Plant Species Diversity (GEF)

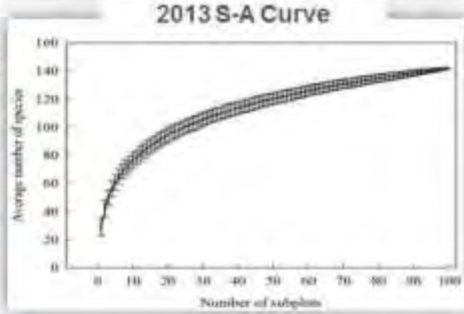
	S	E	H'	D'
2003	15.9	0.91	2.48	0.882
2008	12.8	0.91	2.27	0.859
2013	28.6	0.68	2.28	0.847

S: Average species richness in the plots
E: Average evenness of species values in the plots
H: Average Shannon's diversity index
D: Average Simpson's diversity index

2003 S-A Curve



2013 S-A Curve



Iris minutiaurea

Epimedium koreanum

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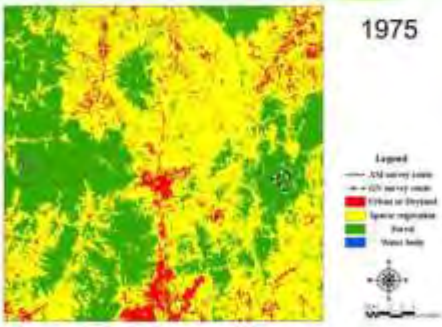
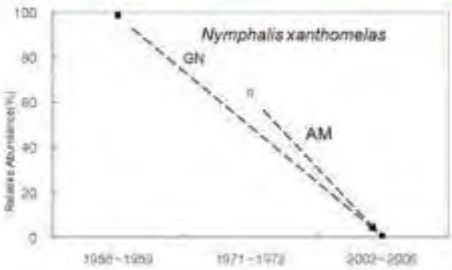
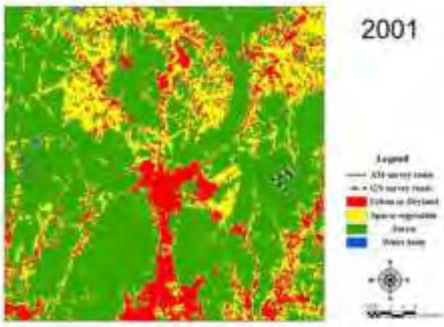
Wildlife Diversity (GEF)







Butterfly monitoring: northern species decrease while southern species increase

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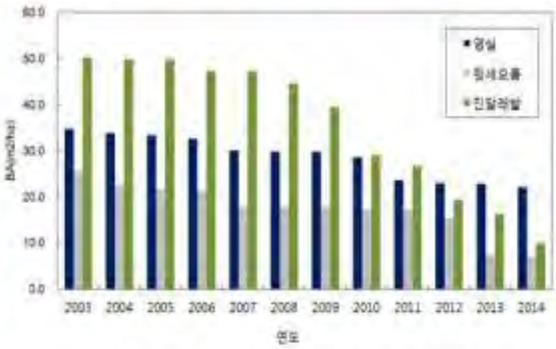
High Mountain Tree Species



- Dieback of Korean fir (*Abies koreana*) on Mt. Hallasan in Jeju island

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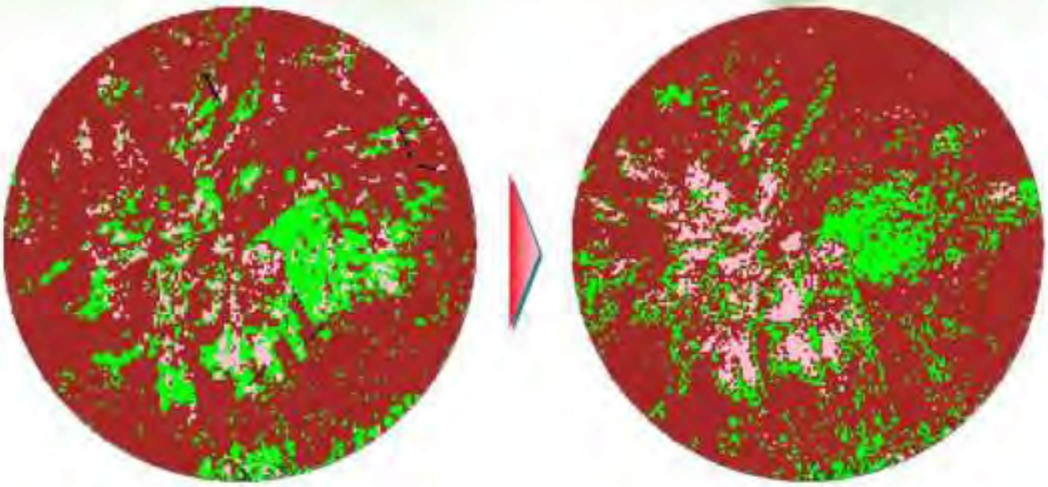
High Mountain Tree Species



1975 2002

- Korean fir(green) decline and grassland(pink) increase around the peak of Mt. Hallasan in Jeju island

Chun, 2006

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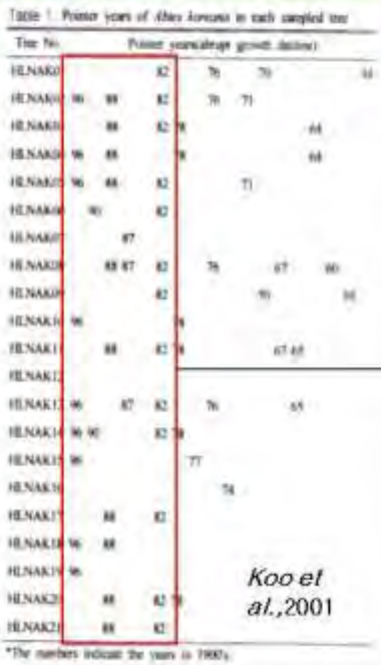
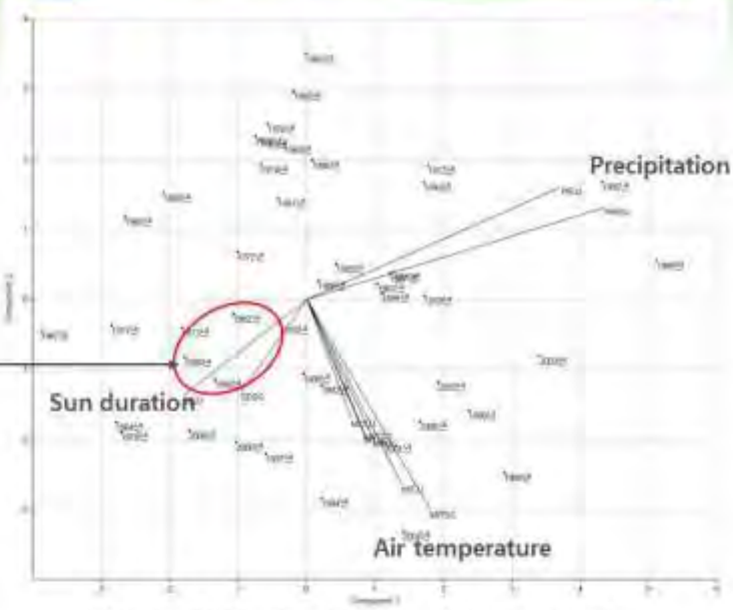
High Mountain Tree Species





PCA using 10 Climatic variables recorded at the Jeju and Seogwipo Weather Stations in Jeju island

Deficit in precipitation seems to be one of the causes of decline.

Phenology – Leaf Growth

Julian Date 112

- Leaf lengths of *Quercus serrata* at GEF on the same dates

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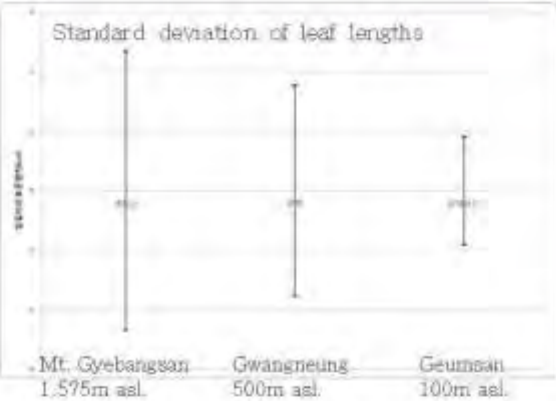
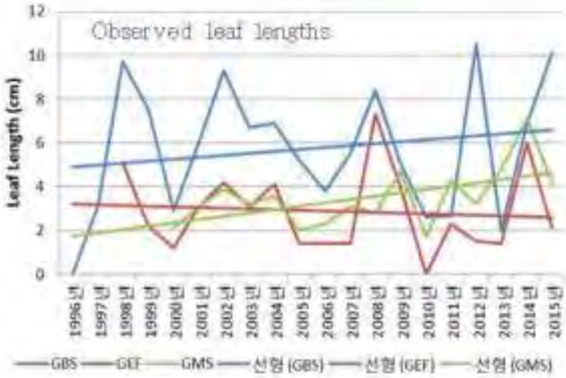
Phenology – Leaf Growth





- It is quite apparent that tree growth in mountainous area is sensitive to the change of weather conditions.

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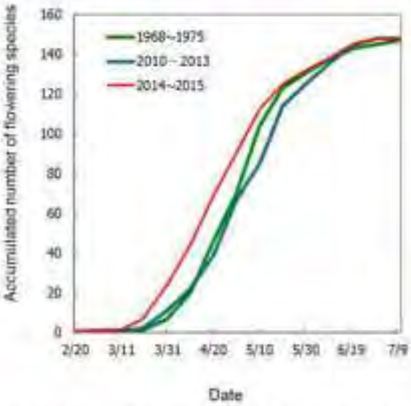
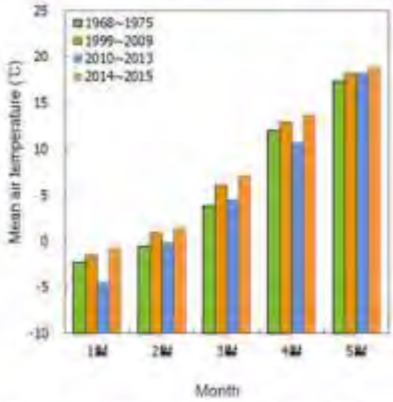
Phenology – Flowering





- Increased mean temperature in Spring has advanced the time of flowering for some species by about 8 days in Hongneung forest in Seoul. But some others were delayed or remain constant.

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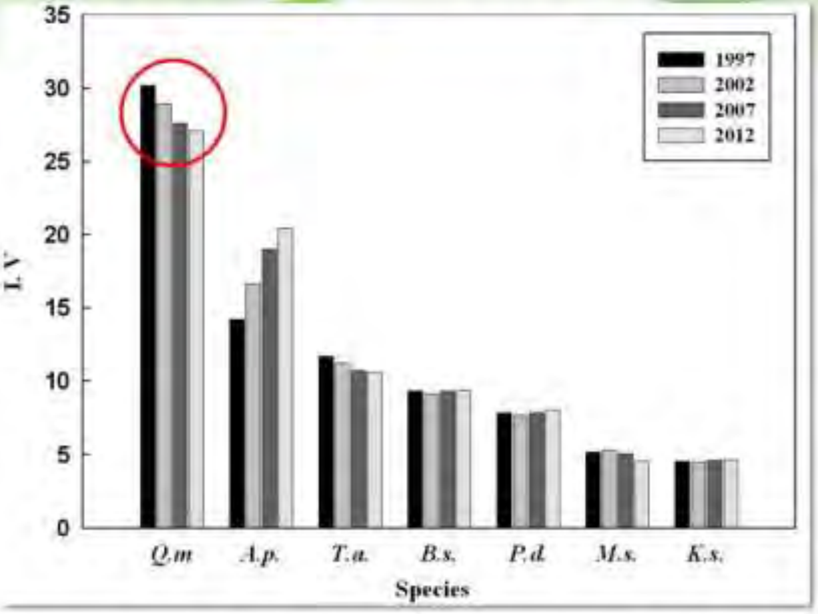
Change of stand structure (GBS)



Q.m.- Quercus mongolica, A. p.- Acer pseudosiboldianum,
T.a.- Tilia amurensis, B.s.- Betula Schmidtiii, P.d.- Pinus densiflora,
M.s.- Maackia amurensis, K.s.-Kalopanax septemlobus

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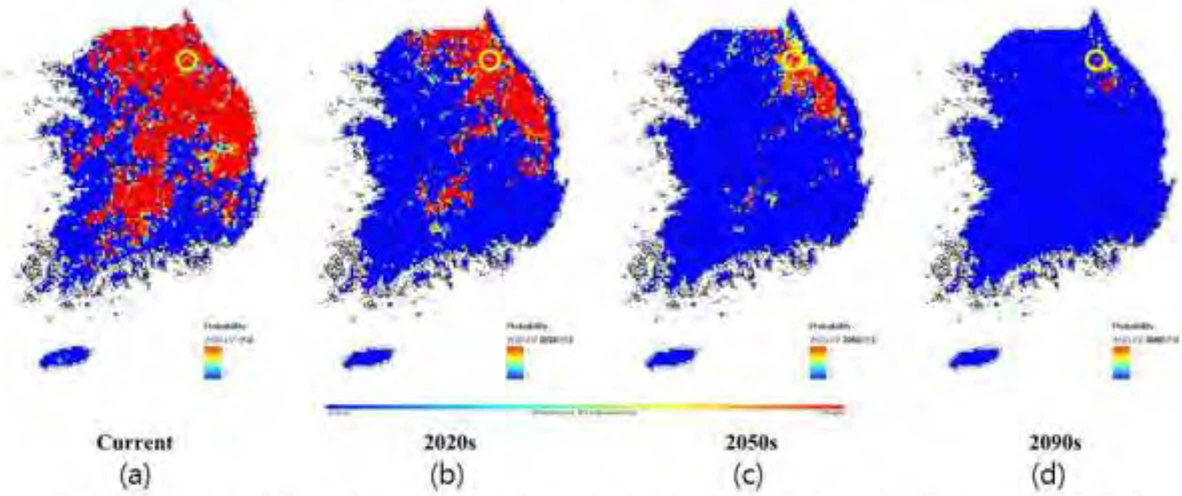
Potential Distribution based on Ecological Niche Model(ENM) and RCP 8.5 climate change scenarios



Potential distribution of *Q. mongolica* ((a) Current, (b) 2020s, (c) 2050s, (d) 2090s)

Yellow circles: Location of GBS LTER site

Chun, 2013

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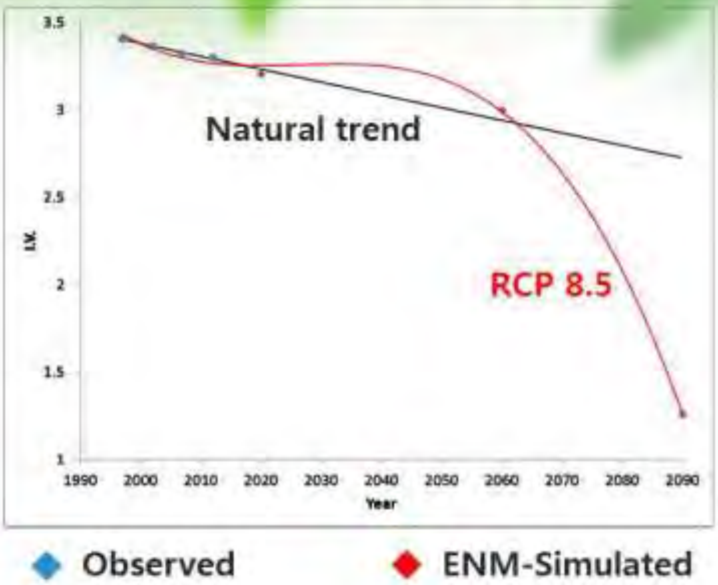
Verification of modeled results



- To see is to believe; Verification feedback based on the field data is needed to correct modeled errors.

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III. Recent approaches

NIFoS

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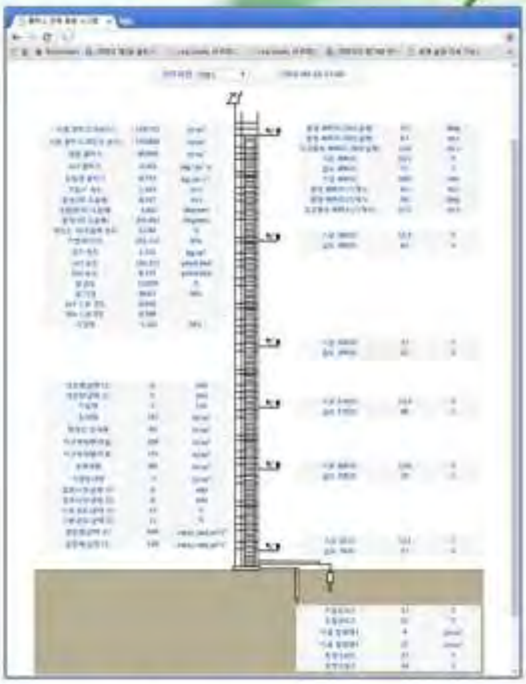
ICT based observation system



- Real time monitoring system for material and energy fluxes and microclimates

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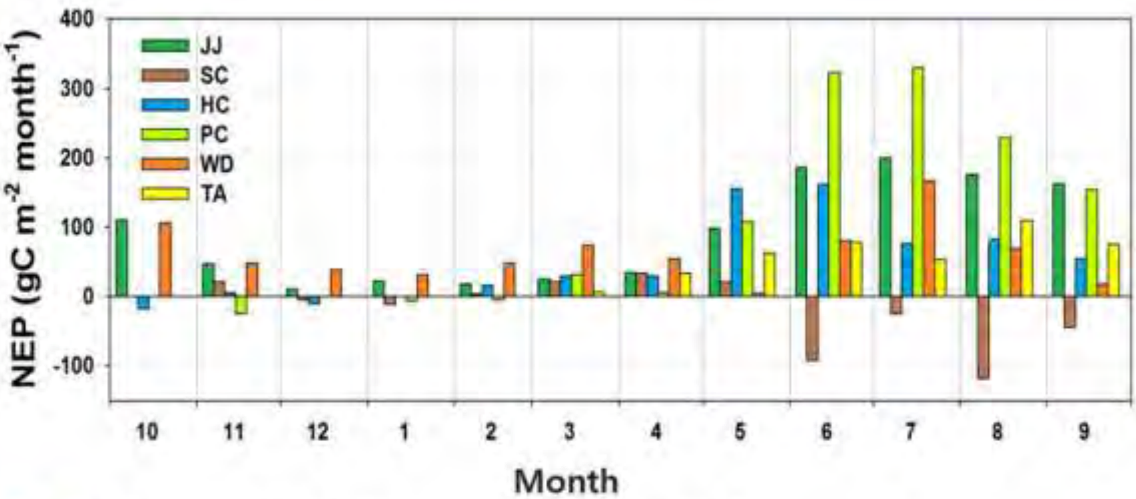
ICT based observation system



- Eddy Covariance Flux Measurement; NEPs of 6 sites(2015)

JJ: Jeju, SC: Samchuck, HC: Hongchun, PC: Pyongchang, WD: Wando, TA: Anmyondo

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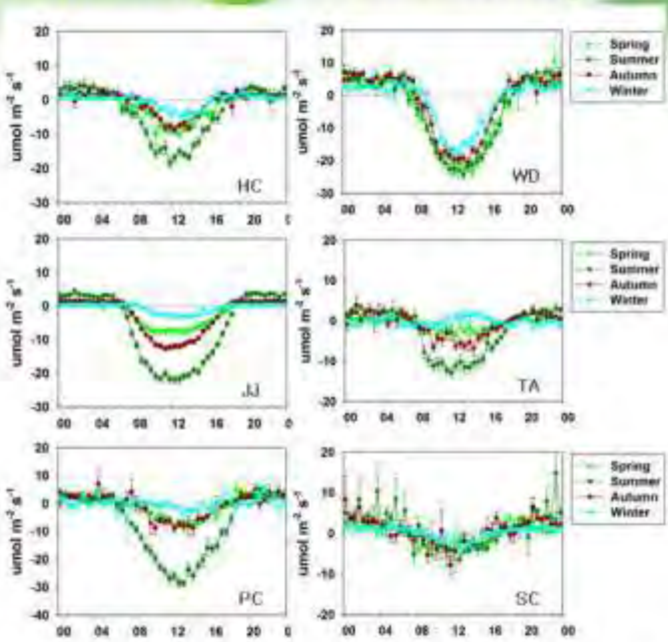
Carbon absorption efficiency



- Eddy Covariance Flux Measurement; NEPs of 6 sites by season(2015)
  JJ: Jeju, SC: Samchuck, HC: Hongchun, PC: Pyongchang, WD: Wando, TA: Anmyondo

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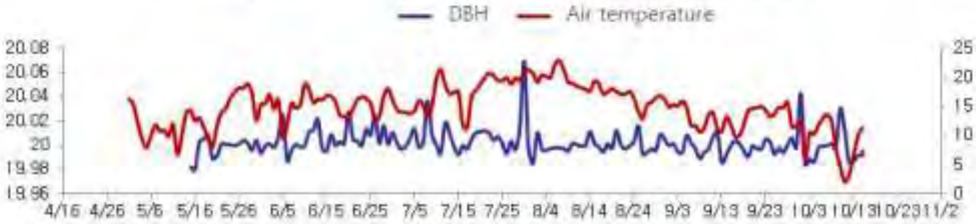
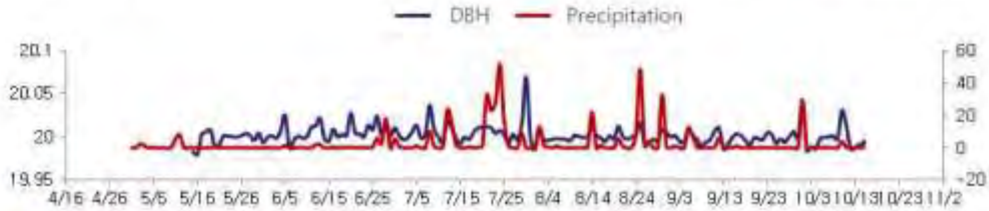
High density automatic observation





- 1 hour interval automatic DBH measurement data of dominant trees

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High density automatic observation

- 1 hour interval phenological monitoring of sites

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Community ecology

Data+ Location+ Weather condition based on smartphone app

- Leaf length data collected by voluntary citizen scientists(2015)

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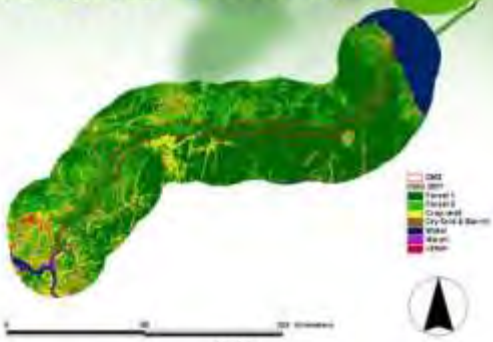
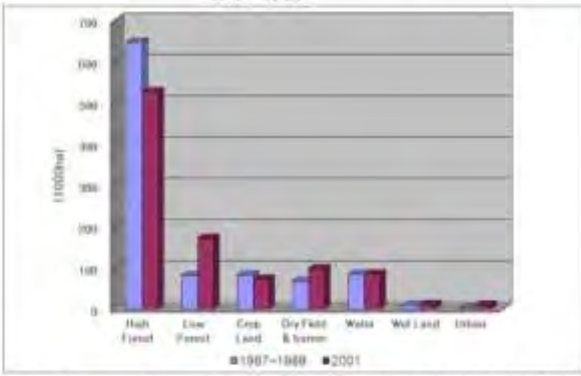
IV. Conclusion

Landuse change faster than climate change

1987-1989



2001



Land cover change between 1987-1989 and 2001(1,000ha)

Forest area change

Chun, 2005

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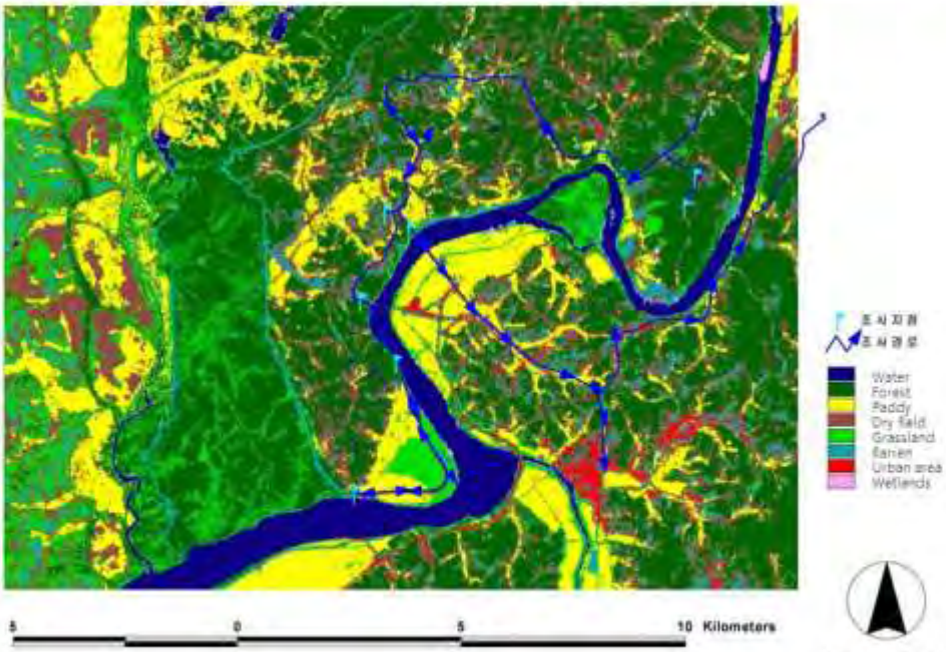
Mainstreaming of Biodiversity: Landscape approach



Chun, 2011

Conclusion

Findings

1. Forest will have a very slow response to climate change because of long life span of trees but the speed of climate change seems to be fast(? according to IPCC) and its effects on forest ecosystem are still uncertain.
2. It is clear that LTER programs and ecosystem models are important tools for both scientists and decision makers in that they provide capability to predict and understandings of responses to environmental change.
3. But, underlying mechanisms how organisms interact with each other and environmental factors and modeling processes still have formidable barriers such as vague assumptions and equations to describe the phenomena in complex systems, insufficient input data and scaling algorithms, and incapacity to meaningfully translate modeled results.
4. Impact assessment of environmental change on ecosystem heavily depends on our understanding of ecosystem structure, function, and process and is inherently associated with uncertainty, so there is a need to generate and compile representative data for different variables in different ecosystems at multiple locations and different scales.

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Conclusion

Recommendation

1. In modern society obsessed with speed, LTER programs requiring relatively long time may seem to slow and inefficient. Nevertheless, we need to keep monitoring, evaluating and verifying the effects of environmental change on the biodiversity and ecosystem services of forest ecosystem to maintain and enhance the quality of life.
2. There is a need to match ecosystem research direction and items to stakeholder and policy needs identifying the gaps between audience expectation and the actual limitations.
3. Observation Networks including LTER programs linking various data producers and research communities including governmental agencies, research institutes and universities are critical to assess the response of ecosystems to drivers of change such as climate change, land use change and pollution etc..
4. Uncertainty, which is associated with data limitations and environmental stochasticity can be accounted for by using ICT-based automatic high density observation systems, quality assurance and control, and generation of data from long-term observations.

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III. Wrap-up Discussion

Minutes on the Wrap-up Discussion

1. Specific theme/topic of workshop

The workshop to be convened in the following years needs to narrow down its covering topic; for example, focusing on specific species, soil or nutrient recycles, etc. This would provide the participants with the opportunity of more in-depth discussion on the specific issue in the forest LTER.

2. Institutional set-up of the LTER network in Northeast Asia

Compared to the relative long history (around 25 years) of the International LTER (ILTER, www.ilternet.edu) network, the LTER network in Northeast Asia is currently in the early stage. At this moment, in order to manage and operate the LTER network in Northeast Asia effectively and sustainably, the relevant institutional set-up is necessary.

For example, the Committee Members (institutional level, for example) from each country will be designated, and the annual Steering Committee Meeting (which consists of the representatives of each Committee Member) will be held to decide the annual major activities/theme to focus (one of the activities will be workshop).

This institutional set-up of the network will be beneficial particularly for the joint publication or collaborative research, which requires continuous communication among the members. Just one-time meeting a year in the form of workshop would be difficult for mid- and long-term collaborative activities that are necessary in the LTER.

This institutional set-up of the network is also expected to have more opportunities of fund-raising or budget-sharing.

3. Collaborative research potentials

The collaborative research potentials/topics were suggested as follows:

1) <u>Comparison studies having same protocol</u>

As one of the potential collaborative activities with this network, the participating institutions can conduct joint research having specific common objectives and targets with same protocol (size, location, measurement method, result indicator, etc.) for data comparison. After data comparison, the participating researchers will be able to discuss about the causes of any specific problems or issues and share the alternatives or solutions upon them together.

The outcome of this collaborative research will be joint publication of research articles.

As for the budget, considering the network in the early stage, the research will be conducted with small-scale having simple protocol. The scale and scope can be expanded depending on the management and operation of this network.

2) <u>Research with Species Distribution Model in response to climate change</u>

Another collaborative research topic can be examination of the change in plant species distribution in response to climate change using Species Distribution Model developed by NIFoS. One of the meaningful outcome of this research will be identifying vulnerable plant species in response to climate change and establishing the conservation plan and strategies of those species in the regional level in Northeast Asia.

In order to run the Species Distribution Model, the existing data on species distribution each country can be compiled first, and the newly collected date can be added later. The focal person for data sharing each country need to be designated.

In addition, the inclusion of North Korean data is highly required for effective and convincing examination.

4. Regular meeting online

One of the alternatives upon the current only one-time annual meeting can be the regular meeting online every month. During the monthly meeting online, the participants can discuss the research progress as well as share the effective methods based on the experiences of each participant.

The necessity and the details about the concept of this regular meeting online need to be discussed further.

5. The 2017 LTER Workshop

Prof. Oyunsanaa suggested convening the 2017 LTER Workshop in Mongolia in the late August, and he briefly shared the two (2) options for the workshop as follows:

Option 1 : The Udleg Forestry Research and Training Center, National University of Mongolia (80km north of Ulaanbaatar city)
- Upper Udleg valley, there are natural forests with main species of Siberian pine, Siberian spruce and Siberian larch forest stands.

- In this case, we choose the workshop and field trip at Udleg FRTC (seminar in Ulaanbaatar and then move to the FRTC). Including arrival and departure date, it can be managed within 4-5 days. - Advantage: close to Ulaanbaatar - Disadvantage: we will not see the forest stands with all main forest tree species in Mongolia
Option 2 : Bugant village, Selenge province, Mongolia (400km north of Ulaanbaatar)
- At the upper Bugant river, there are natural forests that consist of the main forest species of Mongolia, e.g. Siberian pine, Siberian larch, Siberian spruce, Siberian fir, Scots pine, and Poplar forests. - In case, we choose the workshop and field trip in Bugant Village (seminar in Darkhan city and then move to Bugant). Including arrival and departure date, it can be managed within 5-7 days. - Advantage: we will see the forest stands with all main forest tree species in Mongolia - Disadvantage: far from Ulaanbaatar

The workshop contents will be developed further based on the workshop theme/topic to be decided later. Also, the workshop period will be depending on field trip: if we establish a Forest LTER site together, it will take more time; if we just visit and have discussion, the period can be managed in shorter amount of days.

This will be discussed later in detail, and the relevant concept note will be circulated in the early of next year.

IV. Photos

Opening & Presentation Session

21 September 2016

Opening by Dr. Ho Sang Kang

Welcome Address by Dr. Hee Moon Yang, NIFoS

Congratulatory Remark by Dr. Heok-Choh Sim, APAFRI

Congratulatory Remark by Prof. Fengri Li, NEFU

Group Photo

Presentation by Prof. Zhili Liu, Northeast Forestry University, China

Presentation Dr. Hideki Mori, University of Tsukuba, Japan

Presentation by Dr. Anna Vozmishcheva,
Botanical Garden-Institute / Institute of Biology and Soil Sciences,
Far East Branch, Russian Academy of Sciences, Russia

Presentation by Prof. Byambasuren Oyunsanaa,
National University of Mongolia, Mongolia

Presentation by Dr. Jung Hwa Chun,
National Institute of Forest Science, Republic of Korea

Field Trip: Liangshui National Reserve

22-23 September 2016


Protect Pinus koraiensis
International Workshop on Lessons Learnt and Challenges
from Forest Long-term Ecological Research (LTER) in the Northeast Asian Region
21-23 September 2016 / Harbin, China

Appendix

1) Long-term Ecological Research in Undisturbed Forest on the Southern Siknote-Alin Mountain Range

Dr. Olga Ukhvatkina

Researcher, Botanical Garden-Institute, Far East Branch,
Russian Academy of Sciences

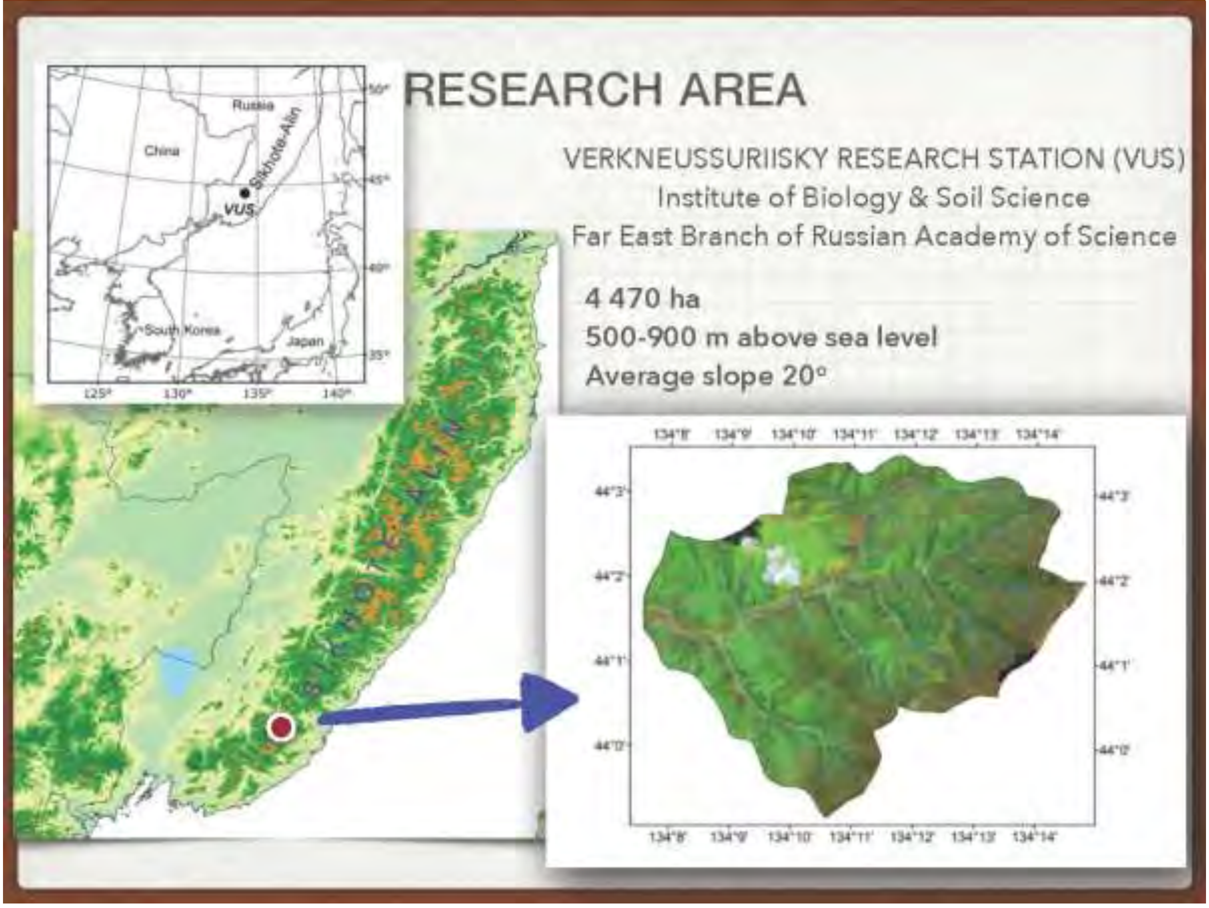
LONG-TERM ECOLOGICAL RESEARCH IN UNDISTURBED FOREST ON THE SOUTHERN SIKNOTE-ALIN MOUNTAIN RANGE

Ukhvatkina Olga, Omelko Alexander

THE FIRST PERMANENT SAMPLE PLOT IN RUSSIA FOR PATTERN STRUCTURE AND POPULATION INVESTIGATIONS OF *PINUS KORAIENSIS* - DOMINETED FORESTS

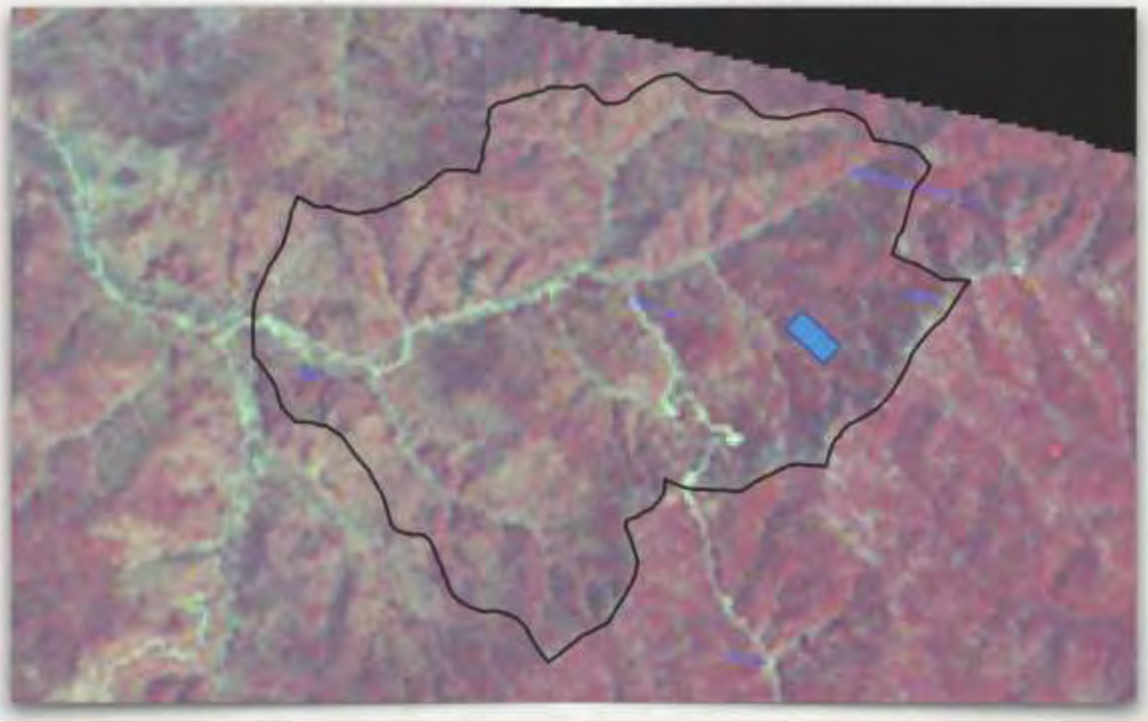
SELECTION OF TERRITORY AND PLACE, SIZE AND HISTORY OF SAMPLE PLOT, VEGETATION


RESEARCH AREA
GEOGRAPHY, HISTORY,
CONTEMPORARY CONDITIONS


RESEARCH AREA
VERKNEUSSURIISKY RESEARCH STATION (VUS)
Institute of Biology & Soil Science
Far East Branch of Russian Academy of Science
4 470 ha
500-900 m above sea level
Average slope 20°
Russia
China
Sikhote-Alin
VUS
South Korea
Japan

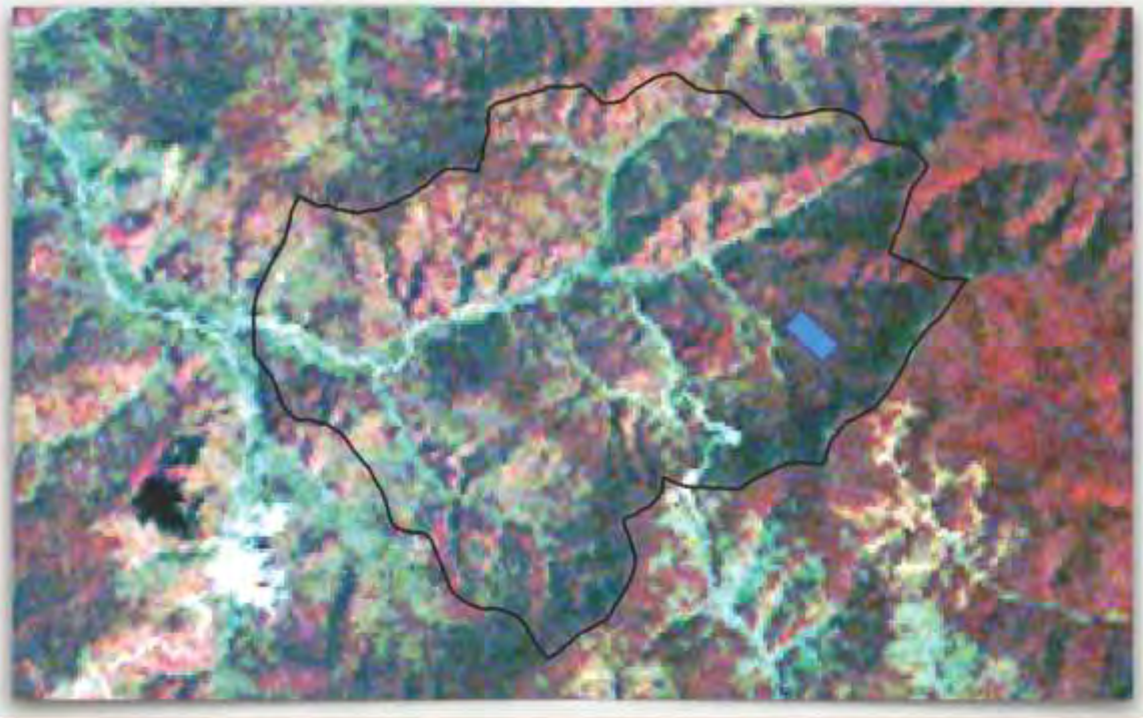
LANDSAT 1973

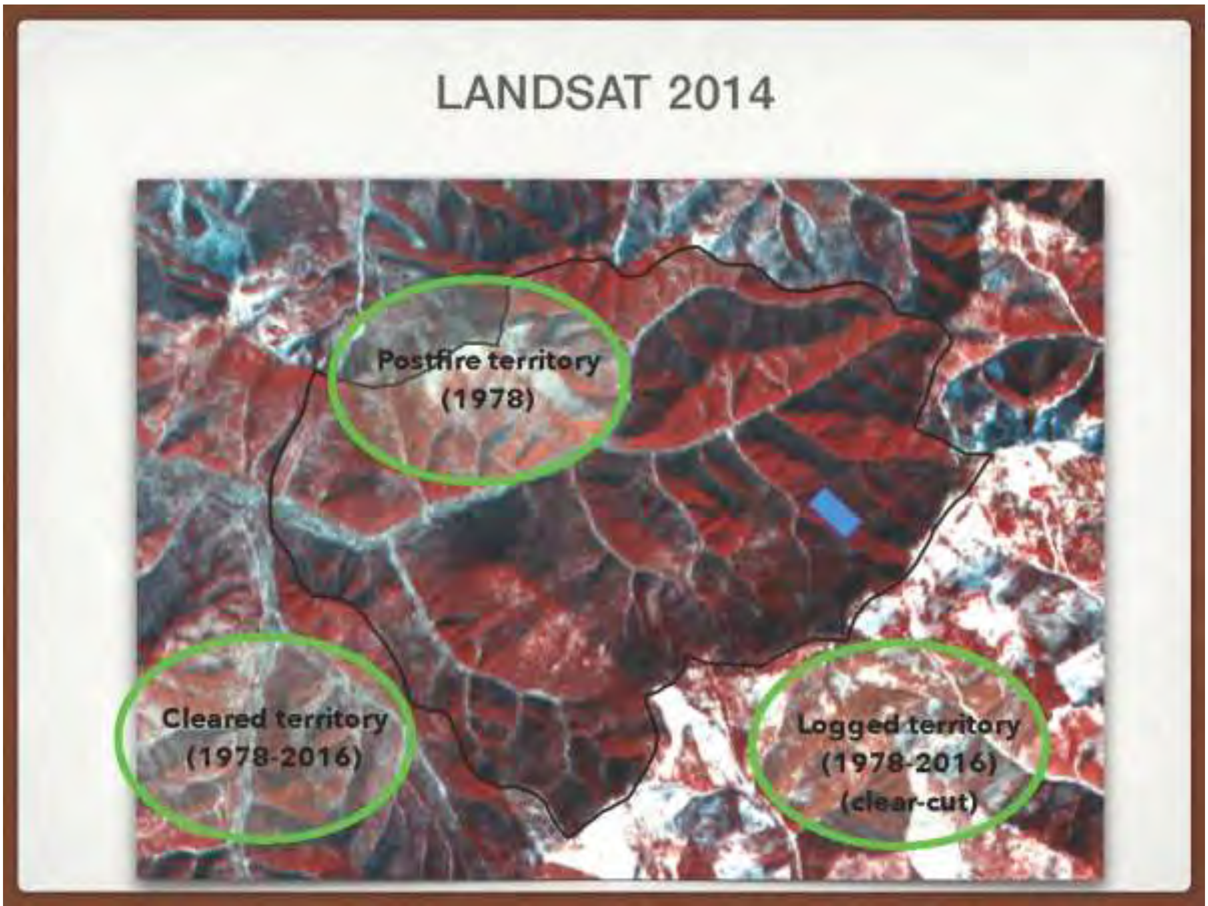
AFTER LOGINS IN 1965, BEFORE LOGINS 1975-2000



LANDSAT 1975

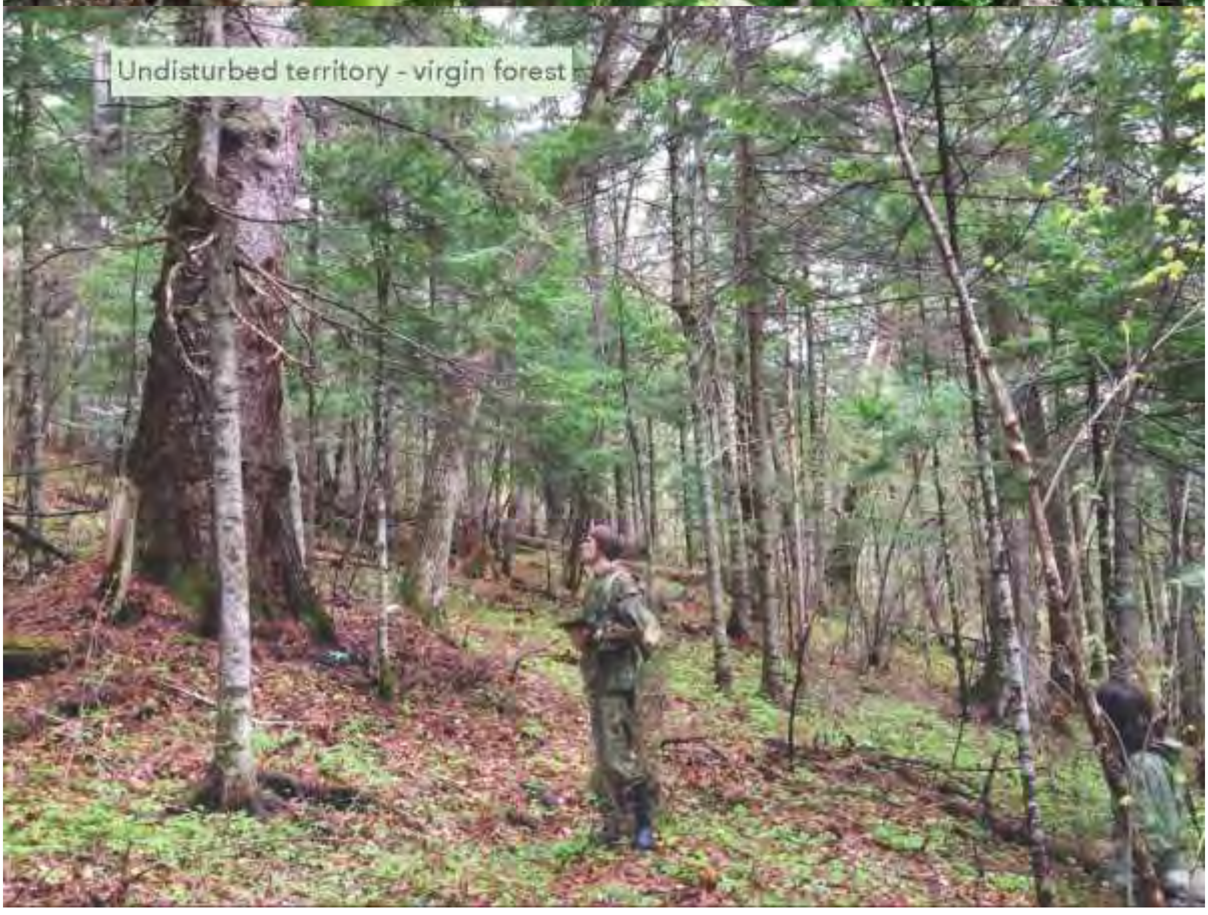
AFTER LOGINS IN 1965, BEFORE LOGINS 1975-2000




LANDSAT 2014
Postfire territory
(1978)
Cleared territory
(1978-2016)
Logged territory
(1978-2016)
(clear-cut)


Clear-cutted stand after 40 years

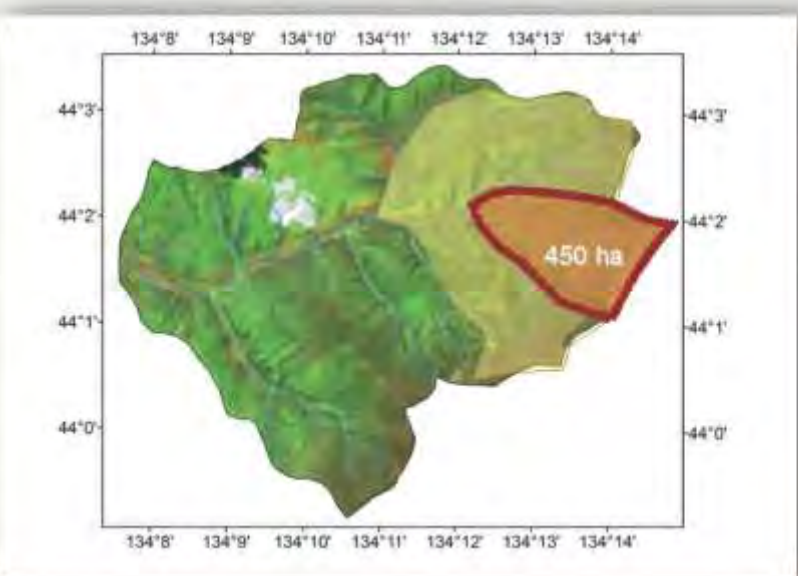

Burned territory (40 years ago)


Undisturbed territory - virgin forest

RESEARCH AREA HISTORY

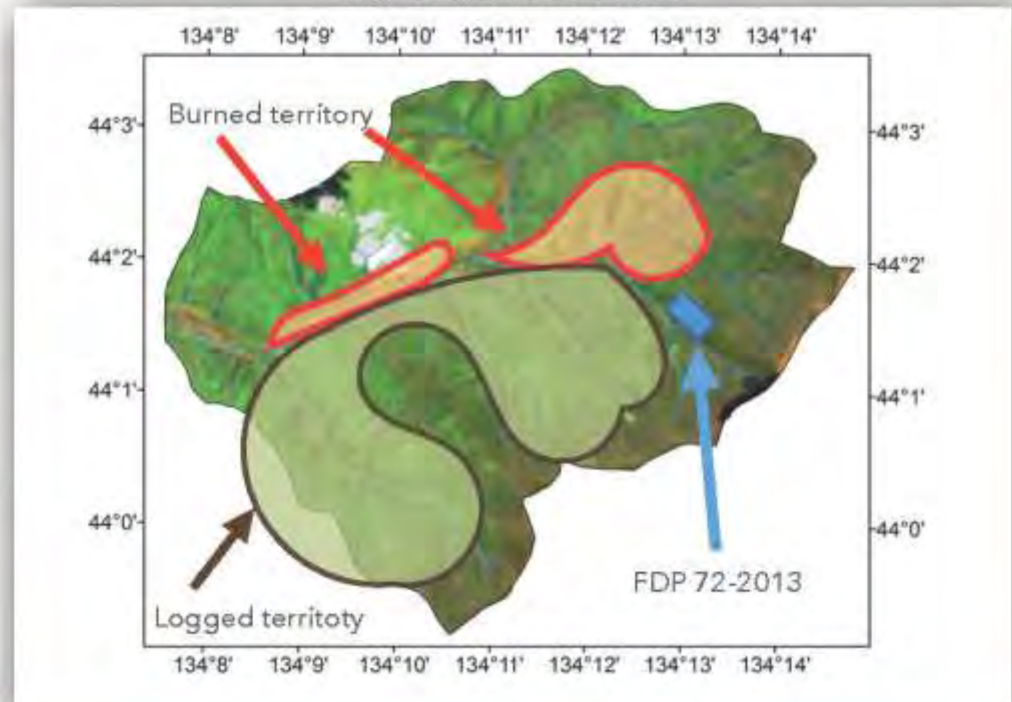
The territory without cutting and fires

Approximately 60% of the Research Station area had been subjected to selective clear-cutting before the Station was established in 1972. The remaining 40% of its area has never been clear-cut and is covered by unique old-growth forest.



IMPACT OF OLD FIRES

500 YEAR OLD FIRE?



Postfire *Pinus koraiensis* - dominated forest

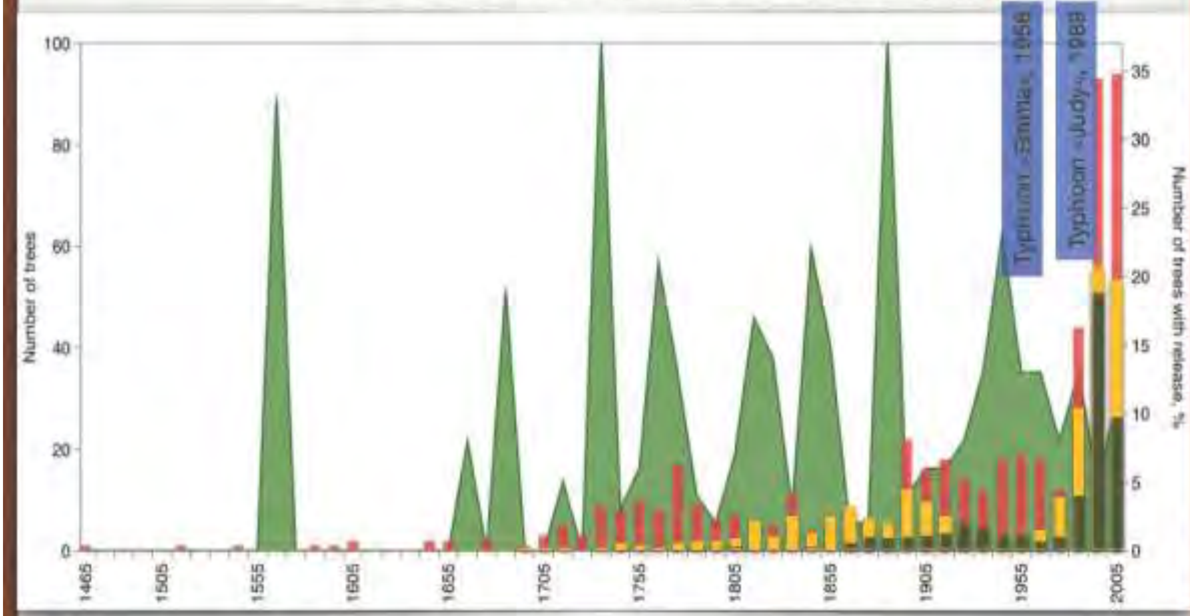
Coals in postfire forest

DISTURBANCE HISTORY OF SAMPLE PLOT

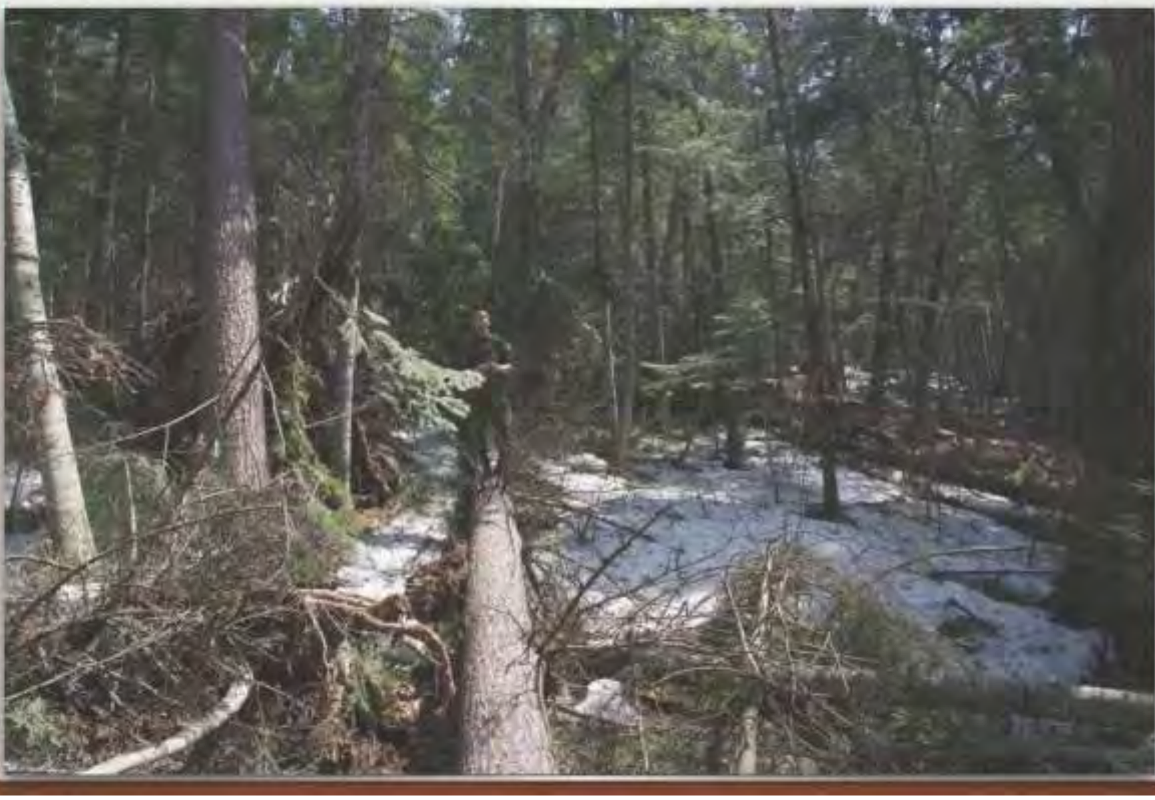
FOREST DEVELOPMENT PLOT 72-2013

600-YEARS STAND DISTURBANCE HISTORY

Based on samples of *Pinus koraiensis* (red), *Picea jezoensis* (yelow), *Abies nephrolepis* (dark green) taken from 6.5 ha territory



IMPACT OF WINDS IN SPRING TIME (EVENT IN 2015)



STAND CHARACTERISTIC

BASAL AREA

BASAL AREA OF COMMON SPECIES

Species	Basal area, m²/ha		Basal area, %		Density, stems/ha		Density, %	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead
Tilia amurensis	14.31	0.00	26.5	2.7	95.8	2.0	10.6	1.9
Pinus koraiensis	11.28	0.02	20.8	11.9	49.8	4.5	5.5	4.2
Picea jezoensis	8.65	0.05	16.0	30.5	156.5	35.0	17.3	32.6
Betula costata	7.55	0.00	14.0	1.8	33.8	1.4	3.7	1.3
Abies nephrolepis	7.23	0.08	13.4	51.0	323.4	52.4	35.6	49.0
Acer ukurunduense	1.77	0.00	3.3	1.7	131.5	5.7	14.6	5.3
Ulmus laciniata	1.29	0.00	2.4	0.1	18.8	0.4	1.5	0.4
Acer mono	1.18	0.00	2.2	0.1	37.4	0.9	4.1	0.8
Total	53.26	0.15	98.6	99.8	847.0	102.3	92.9	95.5

BASAL AREA

BASAL AREA OF MORE RARE SPECIES

Species	Basal area, m^2/ha		Basal area, %		Density, stems/ha		Density, %	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead
Acer tegmentosum	0.20	0	0.4	0.1	11.6	1.0	1.3	1.0
Cerasus maximowiczii	0.14	0	0.3	0.1	11.4	2.3	1.3	2.1
Acer barbinerve	0.11	0	0.2	0.0	32.5	1.1	3.6	1.1
Fraxinus manshurica	0.10	0	0.2	0.0	1.8	0.2	0.2	0.2
Taxus cuspidata	0.09	0	0.2	0.0	0.3	0.0	0.0	0.0
Prunus maximowiczii	0.06	0	0.1	0.0	0.4	0.0	0.0	0.0
Sorbus amurensis	0.03	0	0.0	0.0	1.0	0.1	0.1	0.1
Syringa amurensis	0.01	0	0.0	0.0	2.0	0.0	0.2	0.0
Rhamnus davurica	0.01	0	0.0	0.0	0.1	0.0	0.0	0.0
Quercus mongolica	0.00	0	0.0	0.0	0.1	0.0	0.0	0.0
Total	0.57	0	1.4	0.2	61.2	4.7	7.1	4.5

CHARACTERISTICS OF SPECIES

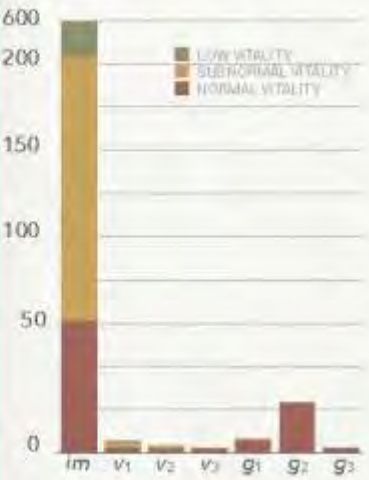
SIZE, AGE, DEMOGRAPHIC, PATTERNS

DOMINATED SPECIES

CHARACTERISTICS OF SPECIES

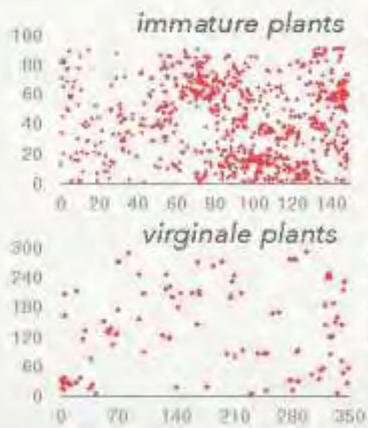
PINUS KORAIENSIS

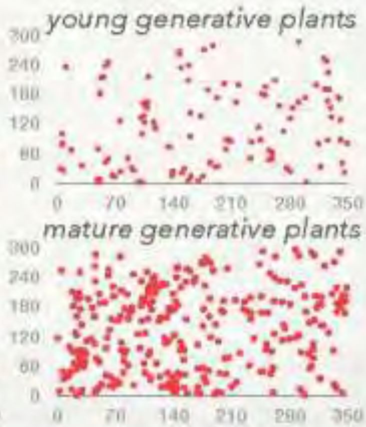
Number of plants on 1 ha



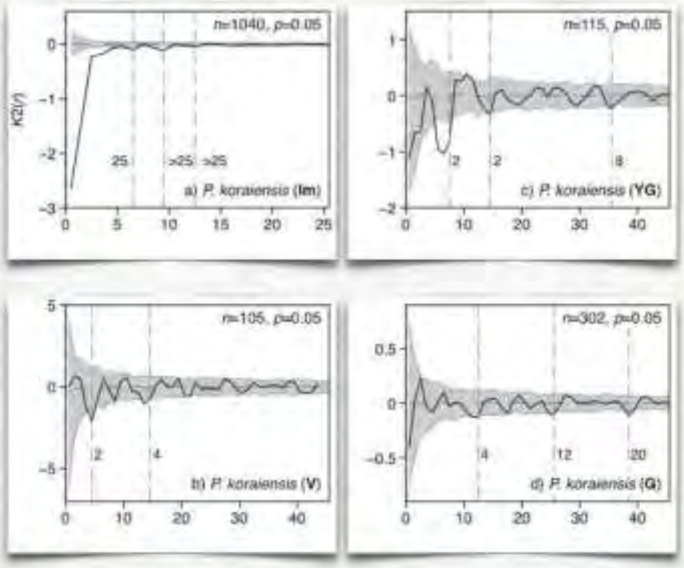
immature (*im*) = seedlings
virginale (v_1, v_2, v_3) = saplings
generative (g_1, g_2, g_3) = adult

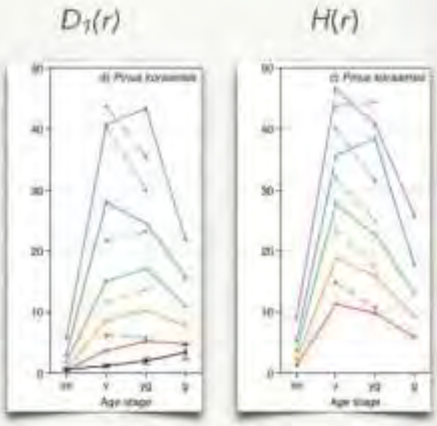
Age max	527 years
H max	38 m
DBH max	150 cm





PATTERN MOSAIC OF *PINUS KORAIENSIS*

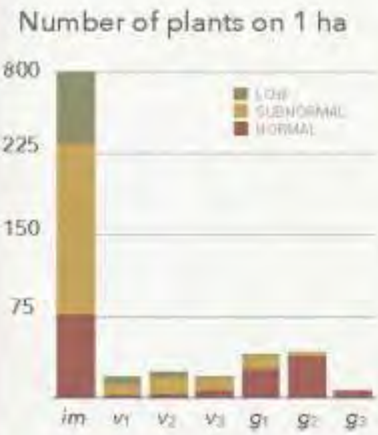




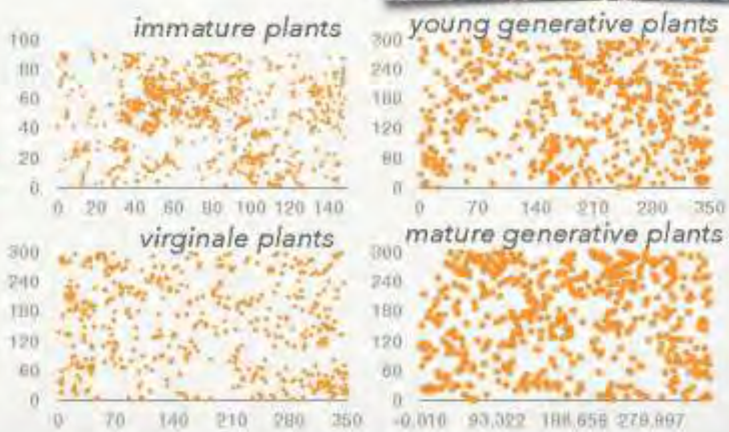
immature (*im*) = seedlings
virginale (*v*) = saplings
young generative (yg) = young adult
generative (*g*) = adult

CHARACTERISTICS OF SPECIES

PICEA JEZOENSIS

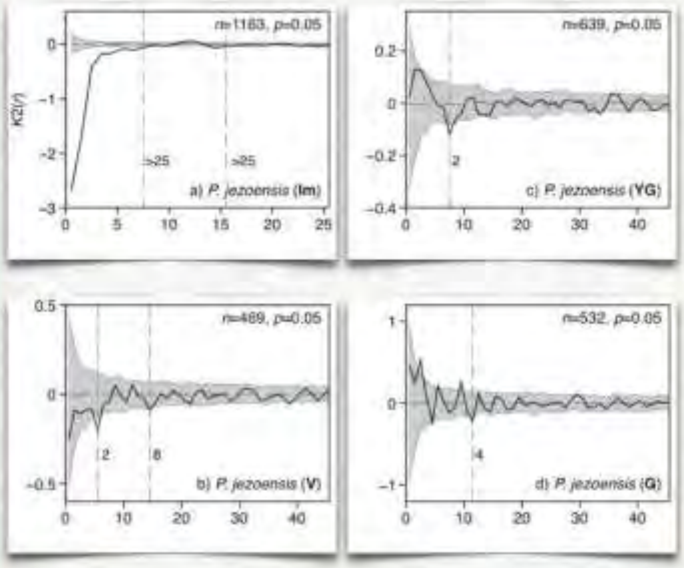


Age max	285 years
H max	35 m
DBH max	75 cm

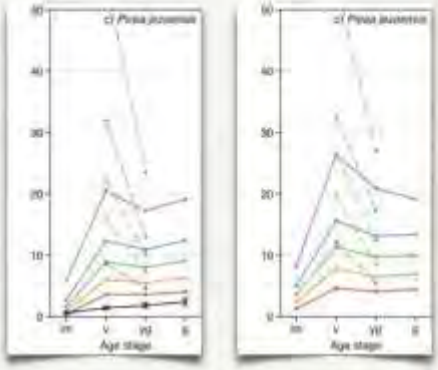


immature (*im*) = seedlings
virginale (v_1,v_2,v_3) = saplings
generative (g_1,g_2,g_3) = adult

PATTERN MOSAIC OF *PICEA JEZOENSIS*



$D_1(r)$ $H(r)$

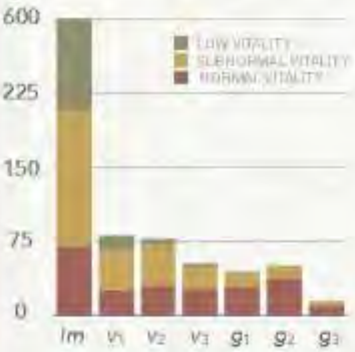


immature (*im*) = seedlings
virginale (*v*) = saplings
young generative (yg) = young adult
generative (*g*) = adult

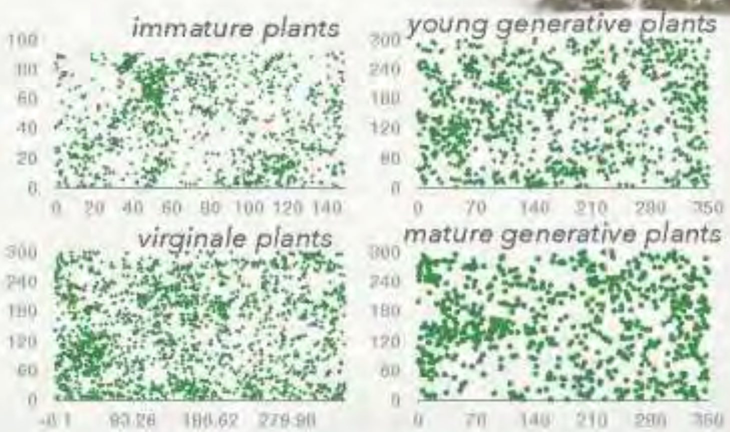
CHARACTERISTICS OF SPECIES

ABIES NEPHROLEPIS

Number of plants on 1 ha

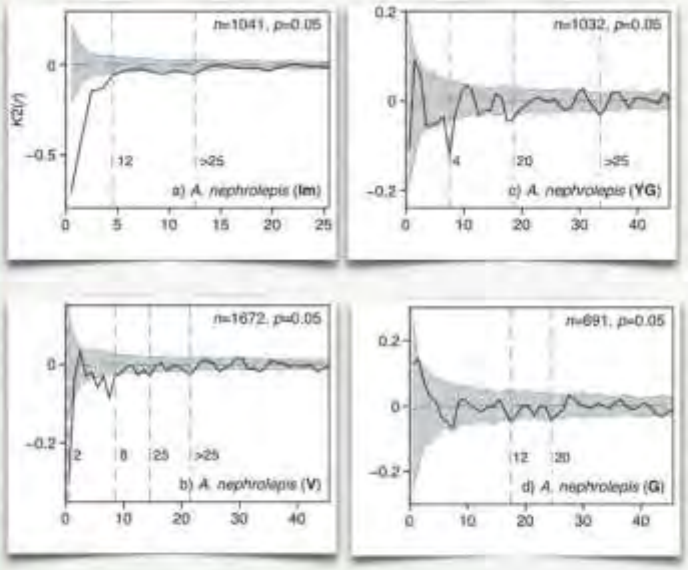


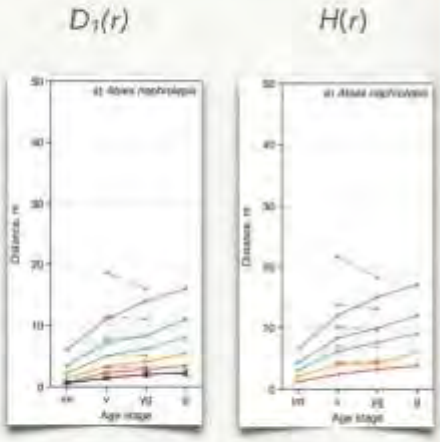
Age max	214 years
H max	29 m
DBH max	54 cm



immature (*im*) = seedlings
virginale (v_1,v_2,v_3) = saplings
generative (g_1,g_2,g_3) = adult

PATTERN MOSAIC OF *ABIES NEPHROLEPIS*



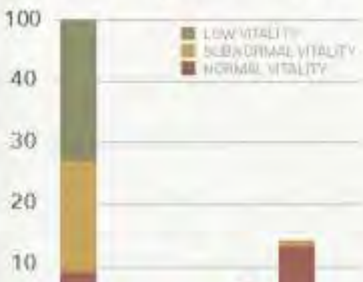


immature (*im*) = seedlings
virginale (*v*) = saplings
young generative (yg) = young adult
generative (*g*) = adult

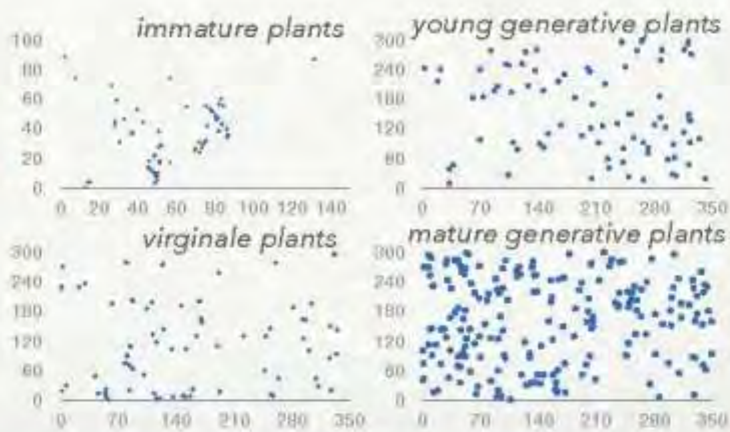
CHARACTERISTICS OF SPECIES

BETULA COSTATA

Number of plants on 1 ha

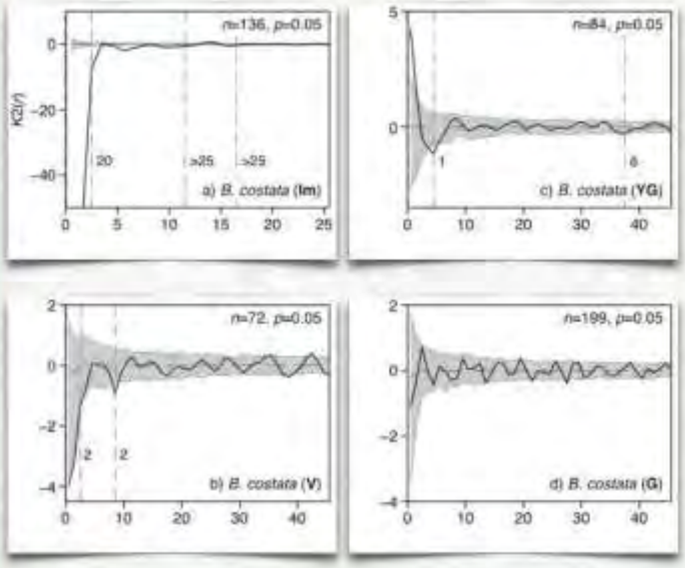


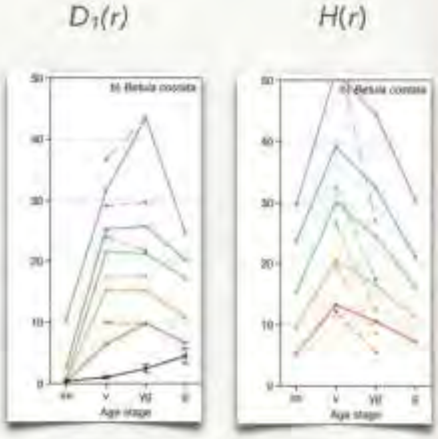
Age max	340 years
H max	29 m
DBH max	80 cm



immature (*im*) = seedlings
virginale (v_1,v_2,v_3) = saplings
generative (g_1,g_2,g_3) = adult

PATTERN MOSAIC OF *BETULA COSTATA*



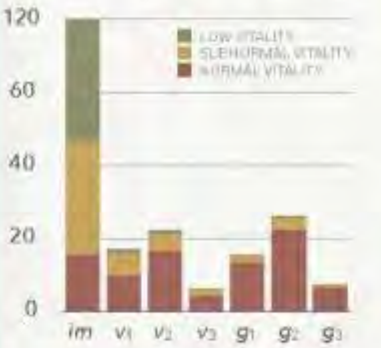


immature (*im*) = seedlings
virginale (*v*) = saplings
young generative (yg) = young adult
generative (*g*) = adult

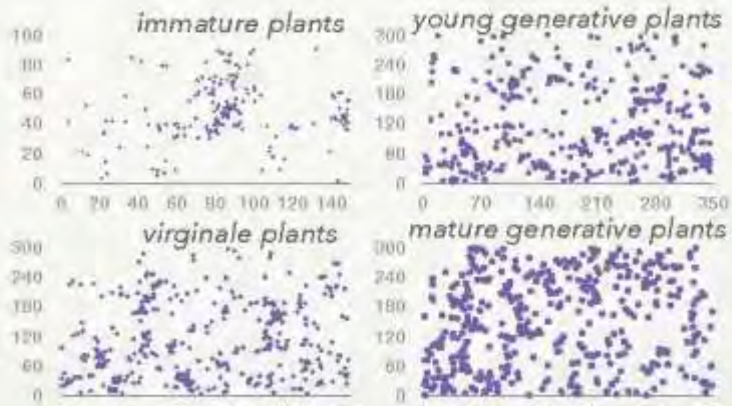
CHARACTERISTICS OF SPECIES

TILIA AMURENSIS

Number of plants on 1 ha

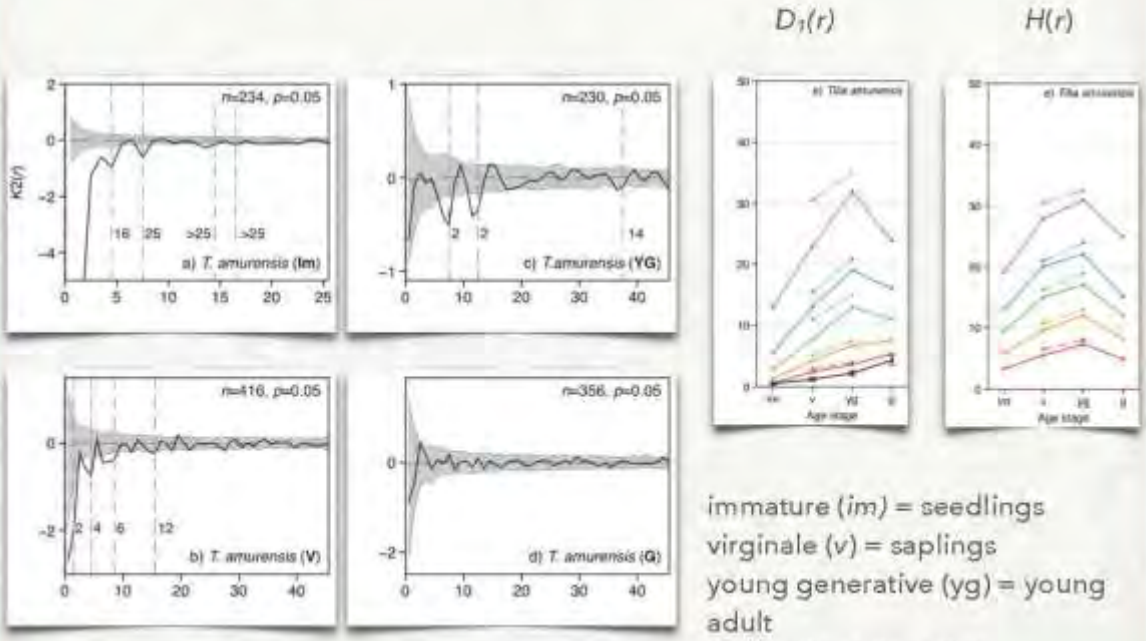


Age max	250 years
H max	28 m
DBH max	84 cm



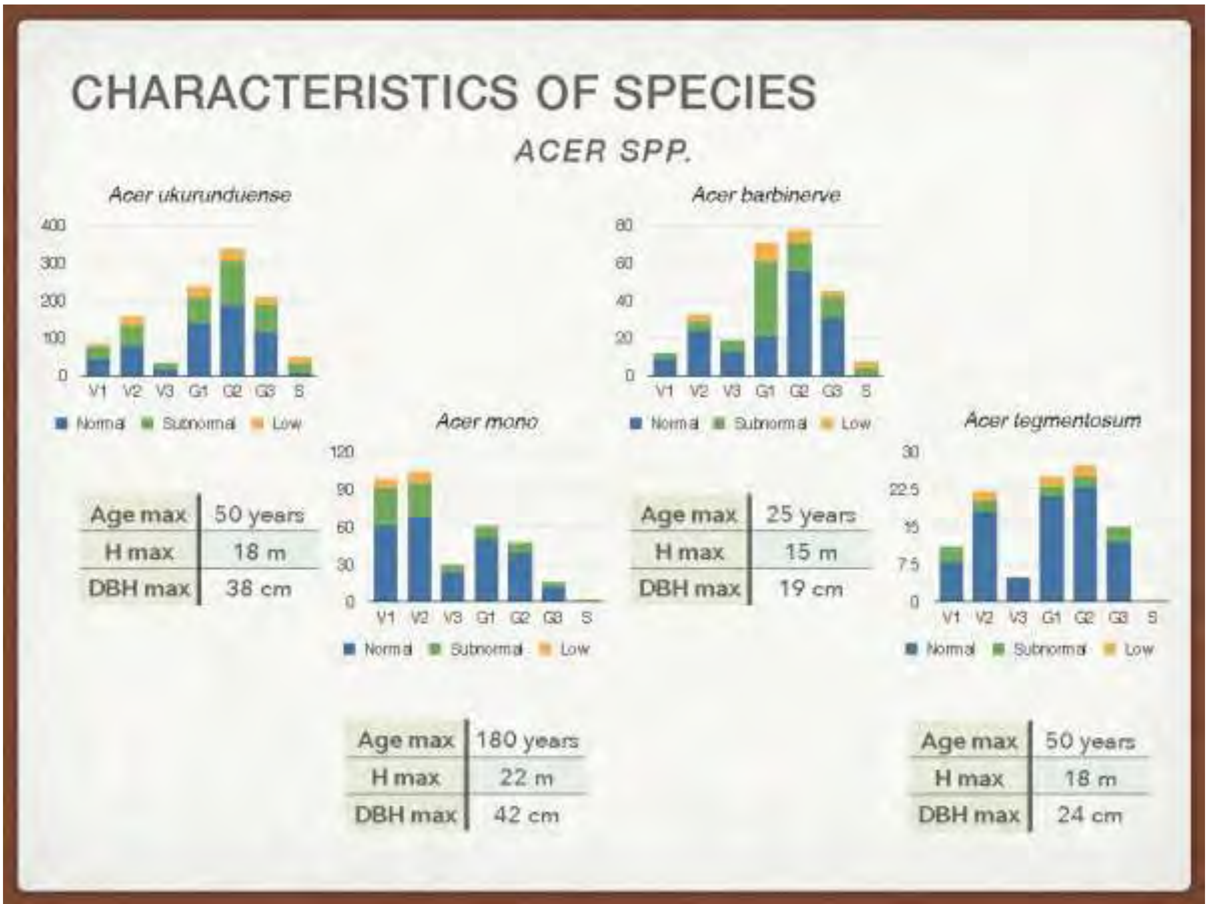
immature (*im*) = seedlings
virginale (v_1,v_2,v_3) = saplings
generative (g_1,g_2,g_3) = adult

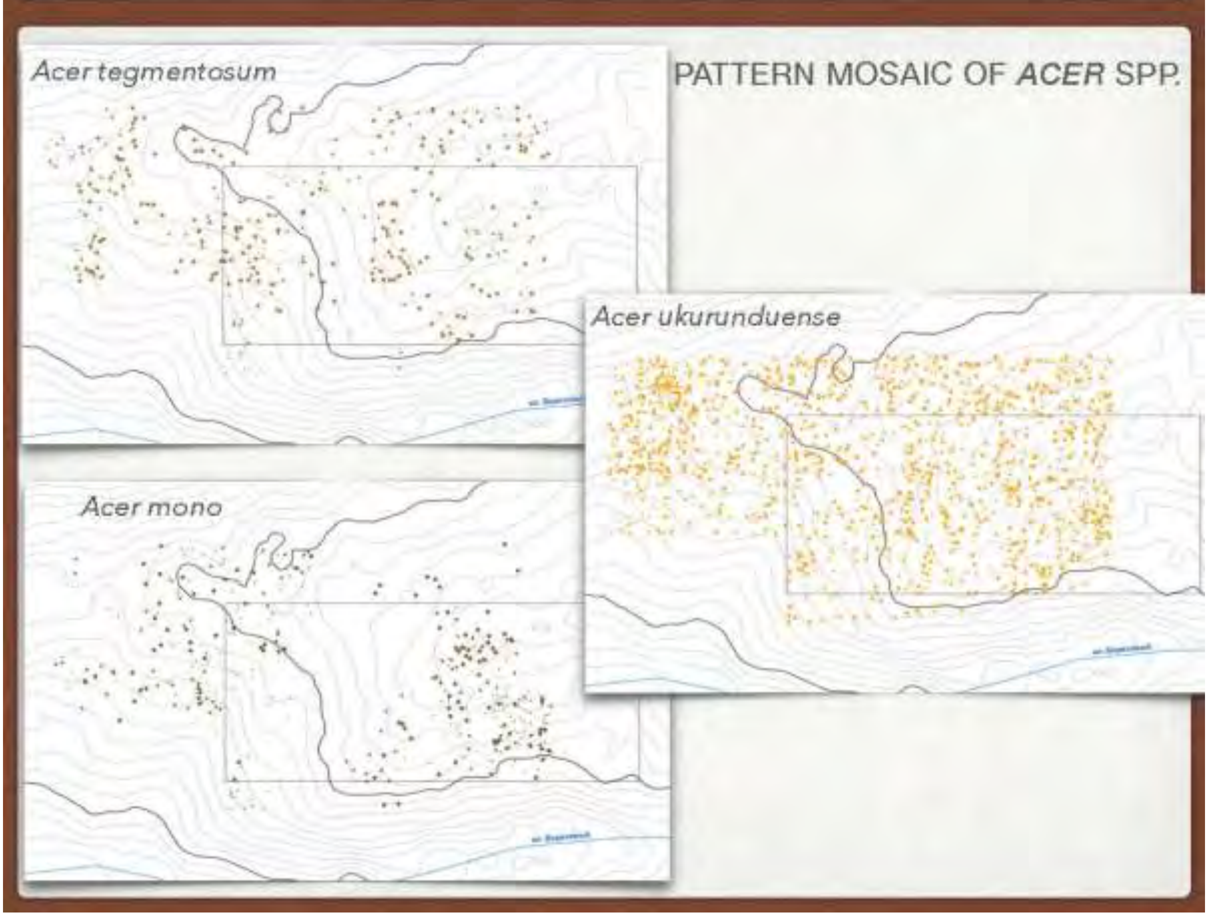
PATTERN MOSAIC OF *TILIA AMURENSIS*



immature (*im*) = seedlings
virginale (*v*) = saplings
young generative (yg) = young adult
generative (*g*) = adult

OTHER SPECIES

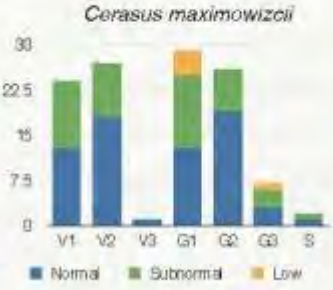

CHARACTERISTICS OF SPECIES
ACER SPP.
Acer ukurunduense
Acer barbinerve
Acer mono
Acer tegmentosum
V1 V2 V3 G1 G2 G3 S
Normal Subnormal Low
Age max 50 years
H max 18 m
DBH max 38 cm
Age max 25 years
H max 15 m
DBH max 19 cm
Age max 180 years
H max 22 m
DBH max 42 cm
Age max 50 years
H max 18 m
DBH max 24 cm


PATTERN MOSAIC OF ACER SPP.
Acer tegmentosum
Acer ukurunduense
Acer mono

CHARACTERISTICS OF SPECIES

COMMON SPECIES

Age max	160 years
H max	25 m
DBH max	48 cm



Age max	60 years
H max	20 m
DBH max	36 cm

Age max	250 years
H max	28 m
DBH max	38 cm

PATTERN MOSAIC OF *ULMUS LACINIATA, FRAXINUS MANSHURICA, CERASUS MAXIMOWICZII*

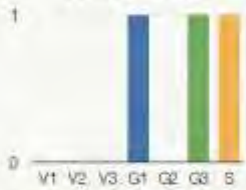
CHARACTERISTICS OF SPECIES

RARE SPECIES

Sorbus amurensis

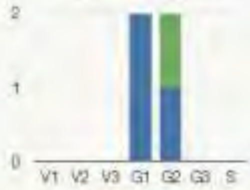
Age max	>60 years
H max	18 m
DBH max	36 cm

Prunus maackii



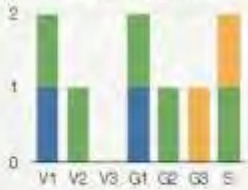
Age max	40 years
H max	12 m
DBH max	22 cm

Taxus cuspidata



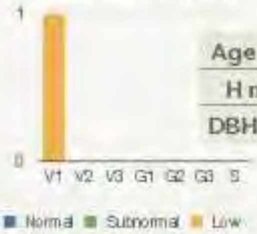
Age max	>600 years
H max	16 m
DBH max	120 cm

Siringa amurensis



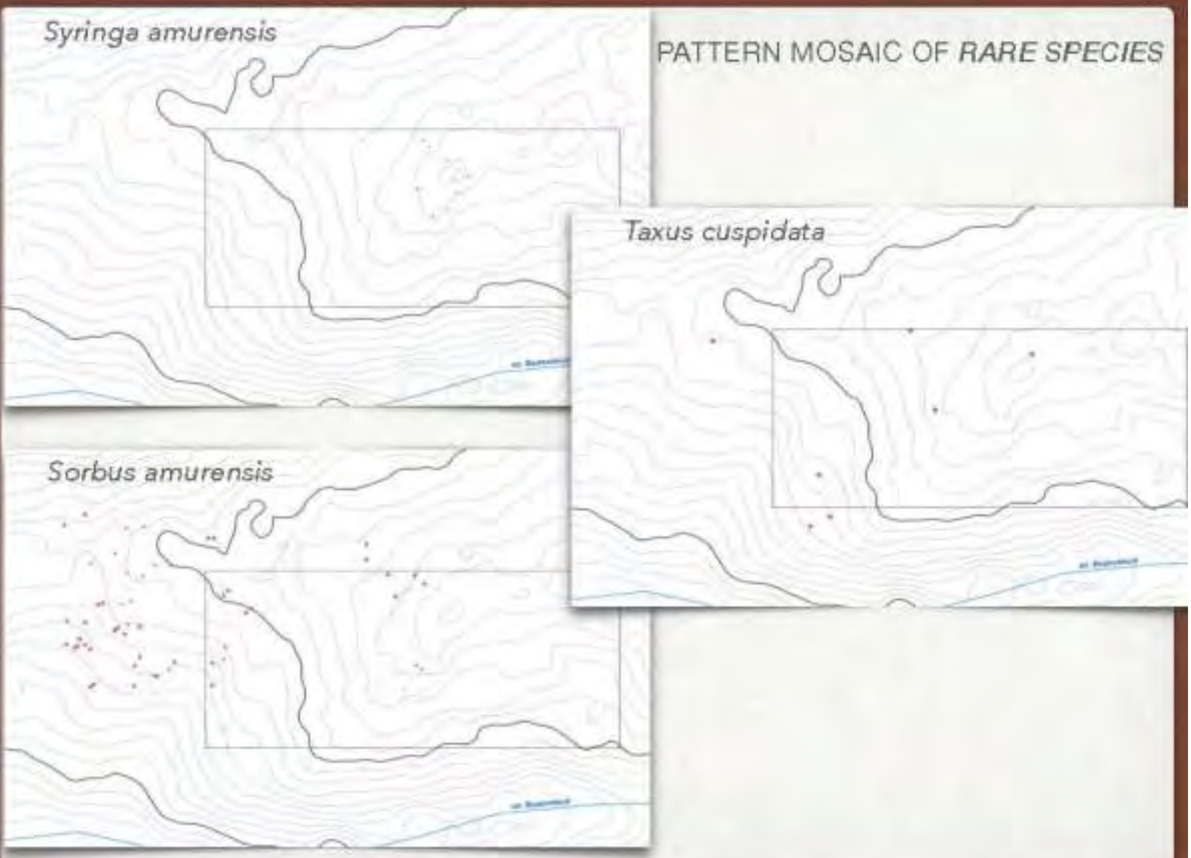
Age max	40 years
H max	12 m
DBH max	22 cm

Quercus mongolica



Age max	30 years
H max	8 m
DBH max	8 cm

PATTERN MOSAIC OF *RARE SPECIES*



TASKS OF OUR WORK

- Ontogeny of plants
- Stand disturbance history, disturbance regimes in virgin forests
- Natural regeneration of trees and shrubs
- Structure of populations mosaics of different tree species, spatial associations, factors influencing structure of the mosaics
- Stand canopy structure
- Conservation old-growth forests and reconstruction of nature forests in Russian Far East

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International Workshop on Lessons Learnt and Challenges from Forest Long-term Ecological Research (LTER) in the Northeast Asian Region

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