MY WILD IDEAS ABOUT FUTURE FORESTRY MANAGEMENT: MEMOIR OF INTERNATIONAL UNION OF FOREST RESEARCH ORGANIZATIONS (IUFRO)

XXVI WORLD CONGRESS, STOCKHOLM, SWEDEN

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Introduction

The International Union of Forest Research Organizations (IUFRO) has successfully organized its XXVI World Congress starting from 23 June 2024 till 29 June 2024 at Stockholm, Sweden. The theme of the Congress was "Forests & Society Towards 2050". It was a sort of the global hub of forest research and knowledge exchange among the well over 4,000 participants from 115 countries. The Congress was inaugurated by His Majesty King Carl Gustaf XVI of Sweden on 24 June 2024. IUFRO President Dr. John Parrotta and Congress Organizing Committee Chair Dr. Fredrik Ingemarson together with high-level representatives of the Swedish University of Agricultural Sciences as local host and Austria as IUFRO host country, and of the key partner organizations FAO, CIFOR-ICRAF and IFSA had welcomed the delegates. There were 200+ sessions and 4,500+ oral and poster presentations. I had the opportunity of chairing two poster sessions and one oral session. It was quite thrilled, but I enjoyed it. This paper presents my wild idea about the future forestry management based on the presentation sessions that I had the opportunity to attend, and some other publications.

Forestry for future

Mother nature has provided us with many benefits through various forms of forest composition besides providing upliftment, and services for maintaining the equilibrium between nature and biodiversity conservation. Forests are one of the important terrestrial ecosystems and embrace all sorts of ecosystems and have a dynamic relationship between small and large trees, biodiversity, and their physical entities. Trees have the potential to absorb about one-tenth of global carbon emissions into their biomass, soils and products and store them in perpetuity. Trees sequester atmospheric carbon through photosynthetic processes. Trees having large trunks and dense wood are the best sequester/store of carbon. In one year, a mature tree can absorb half a metric ton of carbon dioxide equivalent from the atmosphere (National Forest Foundation, Arbor-day, April 26, 2024).

Forests are being managed to obtain various products and services in a normal climatic situation. But since last decade or so, there has been some indication of climate change impacting these. Rise in temperature has been one of the most striking features of climate change. The upward tree line shift is increasingly becoming a universal phenomenon. The magnitude and rate of advancement depends on the local climatic conditions (Kullman 2001, Sturm et al. 2001, Moiseev & Shiyatov 2003, Lloyd 2005, Mazepa 2005, cited in Bhuju et al. 2010). United Nations Framework Convention on Climate Change (UNFCCC) has ranked forestry and land use in fourth place in terms of climate change. It has emphasized that there is a need for adaptation towards climate change.

My personal observations on the pattern of tree flowering, composition of forests, wetlands and other ecosystems in different districts of Nepal, show that climate change is taking its toll in all these aspects of forests, forestry and allied subject matters. I have observed that Rhododendron species, which used to flower during April-May, are flowering in the month of March itself at Tistung (1703m) Makwanpur district of Nepal. Horticulture species such as Mango, Papaya, Banana, which are normally considered as tropical fruits, have started yielding their fruits at higher altitude (above 1300 m) even in Kathmandu (above 1300 m). Detailed studies are further needed but the impact of water stress on these species can be overruled. There has not been a change in the pattern of monsoon rain in this valley. The impacts of climate change have been visible with the upward shift of the Himalaya fir (*Abies spectabilis*) in Nepal (Rana et al. 2017). The world's mangrove forest currently is storing carbon equivalent to over 21 gigatons of CO2. These forests are also facing the consequence of climate change.

Climate resilient forestry

Climate change, especially the rise in temperature, will not decrease, given the present scenario of use of fossil fuels and industrialization. With increased drought and increase in temperature, growing seedlings demand more water, so more water management schemes are necessary. We have to replace trees that demand more moisture and promote those tree species that demand less moisture or improve drought resistance properties in the existing species through genetic improvement.

Species such as *Quercus macrocarpa*, *Juniperus virginiana*, *Ginkgo biloba*, and *Acacia aneura*, are some of the few tree species that resist drought conditions in various parts of the world where they occur naturally and/or are planted. Black pine (*Pinus nigra*) and Douglas fir (*Pseudotsuga menziesii var. menziesii*) are able to cope with drought better than Scots pine (*Pinus sylvestris*) and European larch (*Larix decidua*) (Eilmann and Rigling, 2012). International Union for Conservation of Nature (IUCN) has identified two native species (*Borassondendron borneense*), a palm, and a hardwood (*Eusideroxylon zwageri*) of Indonesia that can resist rise in temperature and good food stuff for Orangutans (IUCN press release, 07 February 2019). A study carried out by University of British Columbia and Asia Pacific Forestry Network, China, have shown that Chinese fir (*Cunninghamia lanceolata*), Chinese pine (*Pinus tabuliformis*), Masson pine (*Pinus massoniana*), Douglas fir (*Pseudotsuga menziesii*) and Blue Gum (*Eucalyptus globulus*) must be protected to avoid drastic socioeconomic losses.

It is certain that climate change will bring some challenges in future forest composition and hence its management. Of the various tending operations, thinning is one of the silviculture measures of managing forests. A study on an experiment carried out by Zhang et al. (2024) worldwide shows that overall thinning enhances forest ecosystem carbon sinks for up to six years. Present silvicultural systems and practices might not be suitable for the future as they include only irregular shelter-wood systems. This is because of the location, timber demand and diversity within and between the location. There is no single prescription that fits all forest management of the world. In Sri-Lanka, timber harvesting is done only in forest plantations, home gardens and other non-forest areas (per. Comm. Dr. Deepani Alawathugoda, Additional Conservator General of Forests, Department of Forest Conservation, Sri Lanka, 2024). A system of clear felling retaining some seed trees of Pine and Birch have been observed in Sweden for mitigating the effect of future climate change (Picture 1).

Picture 1: Clear felling mature trees, Sweden, June 2024

Picture 2: 10 Years old Norway spruce, Sweden, 2024.

It has been observed that a ten-year-old Norway spruce plantation has remarkable growth (Picture 2).

A new threat of Leaf blight and dieback disease is appearing in Eucalyptus plantations in Western Kenya. The Pine Wilt Disease (PWD) caused by the Pinewood Nematode (*Bursaphelenchus xylophilus*) is the major threat for conifer forests worldwide (Luis et al. 2024). The growth of alien and invasive species has been increasing. **Mikania micrantha**, known as mile- minute vine, is invading Nepalese natural forests especially in the lowland region (below 400 m) of Nepal (Picture 3).

Picture 3: Trees are being covered by invasive *Mikania micrantha* species (Bara district, Nepal, 250 m).

The way forward

The International Tropical Timber Organization (ITTO) developed criteria and indicators (C&I) for sustainable forest management (SFM) in the early 1990s (ITTO, 2016). Similarly, Criteria and Indicators (SC&I) for Sustainable Forest Management for European forests has been developed at the forest management unit level by European Forest Institute (EFI, 2001). These C & I have been developed mainly to assist in monitoring and assessing the condition of natural tropical forests and European forests. Because of the change in climate, the nature and composition of forests are expected to change within the next hundred years. Hence, time has come to develop C & I suitable for that type of forest. There is a danger of having dynamic changes in forest composition if biosecurity is not taken into consideration.

The effects of climate change are likely to increase the impacts of these biotic agents and lead to drastic changes in the dynamics of forest ecosystems. If we are thinking of obtaining all types of services and goods from forests as we are obtaining at present, we must strengthen our

networking system between agencies dealing with forests and related issues. The present-day forest monitoring may not be adequate enough to examine forest health and other issues. Hence, we should turn to Artificial Intelligence in managing our future forests.

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