Ann. Bot. Fennici 46: 249–250 ISSN 0003-3847 (print) ISSN 1797-2442 (online)
Helsinki 31 August 2009

Preface to Spatial and Temporal Reflections of Disturbances in Boreal and Temperate Forests

Kalev Jõgiste[1,*], Timo Kuuluvainen[2] & W. Keith Moser[3]

[1)] *Institute of Forestry and Rural Engineering, Estonian University of Life Sciences, Kreutzwaldi 5, 51014 Tartu, Estonia (*corresponding author's e-mail: kalev.jogiste@emu.ee)*
[2)] *Department of Forest Ecology, P.O. Box 27, FI-00014 University of Helsinki, Finland*
[3)] *USDA Forest Service, Northern Research Station, Forest Inventory and Analysis Program, 1992 Folwell Ave., St. Paul, Minnesota 55108, USA*

Disturbances are a natural part of all ecosystems and they are important for the maintenance of biodiversity in forest ecosystems (Attiwill 1994). Periodicity and intensity of disturbances shape the structural characteristics and dynamics of forest landscape mosaics (Turner *et al*. 2001). Natural disturbances increase habitat availability and diversity, particularly for early-successional species, and promote mechanisms of self-regulation which facilitate ecosystem regeneration after abrupt changes.

At a global scale, forest disturbances are closely linked with the climatic system (Dale *et al*. 2001). Natural or anthropogenic disturbance events can set back or retard succession, or invoke phase transitions in forest ecosystems. Abrupt changes of climate can exacerbate these changes via environmental feedback loops (Bonan 2008). For example, higher evapotranspiration can push forests at marginal sites into a state of low growth and elevated risk to biotic disturbance agents. Heavier rainfall, combined with higher winds that will be likely present under a warming climate scenario, increases the area of forests prone to windthrow (Brassard & Chen 2006). More rapid transition between periods of adequate rainfall and drought will probably increase the incidence and intensity of forest health problems, where stressed ecosystems have not fully recovered from the last event before they are impacted by the next one.

As recognized in international agreements, ecological diversity is an important criterion for sustainable utilization of natural resources. For promoting ecological diversity human-caused disturbances can mimic natural disturbances to a lesser or higher degree (Esseen *et al*. 1997, Perera & Buse 2004), but rarely in the exact manner and degree of impact. Therefore, it is important to estimate the consequences of human activity upon successional development of plant communities and upon natural disturbance processes (Jõgiste *et al*. 2005).

The principles of forest ecosystem management are applicable not only to commercial use of the forest but also to conservation issues. Management activities that mimic natural disturbances are preferred under the ecosystem management concept (Frelich 2002) but more importantly are more likely to have a long-term impact with lesser inputs than management that works against ecosystem processes.

Climate change impacts include greater amplitudes in local and regional weather systems, which in turn increase the risk of disturbances. When taking the above into account, special attention should be paid to enhanced resiliency of forest ecosystems (Kremer 2007). Climate change is a first step in a regional and global disturbance cascade. We have observed the resulting shifts in growth trends at many trophic levels (Spiecker *et al*. 1996). For exam-

ple, as the changing climate initially enhances plant production, it may indirectly affect herbivorous species' populations by increasing the supply of available food. Traditional management schemes may need profound re-analysis as forest growth cycles will last well into any future altered climate regimes (Lindner 2007). Long-term predictions require construction of models that will facilitate comparisons of different management scenarios under highly variable climate (Kangur *et al*. 2007).

This special issue of Annales Botanici Fennici contains a collection of papers based on the presentations delivered at the workshop held in Tukums, Latvia, on 3–6 October 2007. The Nordic Forest Research Co-operation Committee, Latvian Forest Research Institute "Silava" and Estonian University of Life Sciences hosted this international meeting. This workshop was an activity of the SNS network "Natural Disturbance Dynamics Analysis for Forest Ecosystem Management", which consists of forest researchers from the Nordic and Baltic Countries in Europe. Researchers from nine countries of the Nordic–Baltic Region and from elsewhere attended the meeting. The papers presented at this meeting represented a broad range of topics from different forest conditions, providing important information on the present state of changes in forest biota in Fennoscandia and North America over space and time.

References

Attiwill, P. M. 1994: The disturbance dynamics of forest ecosystems: the ecological basis for conservative management. — *Forest Ecology and Management* 63: 247–300.

Bonan, G. B. 2008: Forests and climate change: forcings, feedbacks, and the climate benefits of forests. — *Science* 320: 1444–1449.

Brassard, B. W. & Chen, H. Y. H. 2006: Stand structural dynamics of North American boreal forests. — *Critical Reviews in Plant Science* 25: 115–137.

Dale, V. H., Joyce, L. A., McNulty, S., Neilson, R. P., Ayres, M. P., Flanning, M. D., Hanson, P. J., Irland, L. C., Lugo, A. E., Peterson, C. J., Simberloff, D., Swanson, F. J., Stocks, J. & Wotton, B. M. 2001: Climate change and forest disturbances. — *Bioscience* 51: 723–734.

Esseen, P.-A., Ehnström, B., Ericson, L. & Sjöberg, K. 1997: Boreal forests. — *Ecological Bulletins* 46: 16–47.

Frelich, L. 2002: *Forest dynamics and disturbance regimes. Studies from temperate evergreen-deciduous forests*. — Cambridge University Press, Cambridge.

Jõgiste, K., Moser, W. K. & Mandre, M. 2005: Disturbance dynamics and ecosystem-based forest management. — *Scandinavian Journal of Forest Research* 20 (Suppl 6): 2–4.

Kangur, A., Sims, A., Jõgiste, K., Kiviste, A., Korjus, H. & von Gadow, K. 2007: Comparative modelling of stand development in Scots pine dominated forests in Estonia. — *Forest Ecology and Management* 250: 109–118.

Kremer, A. 2007: How well can existing forests withstand climate change? — In: Koskela, J., Buck, A. & Teissier du Cros, E. (eds.), *Climate change and forest genetic diversity: Implications for sustainable management in Europe*: 3–17. Bioversity International, Roma.

Lindner, M. 2007: How to adapt forest management in response to challenges of climate change? — In: Koskela, J., Buck, A. & Teissier du Cros, E. (eds.), *Climate change and forest genetic diversity: Implications for sustainable forest management in Europe*: 31–42. Bioversity International, Rome, Italy.

Perera, A. H. & Buse, L. J. 2004: Emulating natural disturbance in forest management. — In: Perera, A. H., Buse, L. J. & Weber, M. G. (eds.), *Emulating natural forest landscape disturbances: Concept and applications*: 3–7. Columbia University Press, New York.

Spiecker, H., Mielikäinen, K., Köhl, M. & Skovsgaard, J. P. 1996: *Growth trends in European forests: Studies from 12 countries*. — Springer-Verlag, Heidelberg.

Turner, M. G., Gardner, R. H. & O'Nwill, R. V. 2001. *Landscape ecology in theory and practice*. — Springer, New York.