PREFACE

Contrasting Factors Causing Disturbances in Forest Ecosystems: Observations and Experiments

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The causes for disturbances have complex patterns depending on anthropogenic influence on forest ecosystems. The changes in regional or global biological diversity reflect the reactions of organisms in these ecological systems to modified environment conditions. In a global context, sometimes the biologists or economists do not see that "the forests are for the trees" and their responses and development can not be understood without knowledge of the trees and related species (Hansen et al. 2001). The changes in the behaviour of any single species, taxon or geographic region have a number of possible explanations (Parmesan and Yohe 2003) including not only climate change but also globally extensive human-induced land-use changes. Densely human populated areas with altered vegetation pattern have both natural and artificial factors for sudden and random events in forests interpreted as disturbances. Remote areas with less forest resource management display the causes of natural origin.

Different management intensity and pattern are intermixing with disturbances. Intensively managed forest is sensitive to disturbances, and risk is higher. With low intensity the natural processes occur by random pattern. The management implicitly of explicitly involves the disturbances and this has important analysis task to create reliable models (Jõgiste et al. 2005).

The vulnerability of intensive commercially managed forests is obvious. The mixtures are more often developing after the occurrence of natural disturbances. When applying natural disturbance concepts to stand development predictions, spatial and temporal scaling becomes important (Jõgiste et al. 2007). Disturbances operate at multiple spatial scales and often disturbances at the different scales interact, producing multi-scale habitat diversity, from microhabitats to landscape patterns (Lerzman and Fall 1998). Therefore, it becomes important to know the "after-effect" from the creation of artificial mixtures mimicking the natural regeneration processes and patterns. A complex understanding of the disturbance effects on different ecosystem levels is the best base for this approach. In Table 1 the effect of different disturbance agents on three different spatial ecosystem levels are described.

Diversity of ecosystems in mixed stands possibly changes disturbance occurrence risk. On one hand, it can be higher because of increasing number of disturbance threats. On the other hand, the resistance as a whole can be higher. The various reasons for disturbances create complex patterns of forest dynamics. The wild mammalian animals are often drastic factor for altering forest ecosystem processes.

Artificial forest environments are quite unpredictable with their behaviour being even more obscured by changing environment. Natural ecosystems demonstrate compositional adaptations with natural disturbances. Again, the new combinations of environmental factors create scenarios difficult to understand and predict. The emulation of disturbances to management practices needs whole continuity analysis of different factors. However, the multifactor analysis is not easy task.

The information and knowledge about forest dynamics processes and resulting landscape patterns have been collected in piecemeal fashion over the long time periods. One way has been the experimentation. In manipulated experiment, a set of predefined treatments, which allow comparison of the effects/responses resulting from these treatments, provide first descriptions for testing the hypotheses.

A manipulated experiment deliberately imposes treatments on experimental plots with the aim of observing a particular effect/response. This differs from an observational study in which the actual status of a population is to be assessed. A comparative observational study involves collecting and analyzing data from different site conditions but without actively predefining or changing these conditions, i.e. without applying treatments (Kuehl 1994).

Table 1. Disturbances altering forest dynamics in the boreal and hemiboreal regions. Adapted from Ulanova (2000) and Quine et al. (1999)

Category		Agent	Disturbance		
			Single tree	Forest ecosystem	Landscape
Abiotic	Climatic and meteorological	windstorm	stem breakage, uprooting	multiple stem breakage, uprooting	catastrophic windthrow
		snow- and ice storm	top and stem breakage	single or multiple stem breakage	extensive stem breakage
		tornado, hurricane	abrasion, braking, uprooting	multiple stem breakage, uprooting	catastrophic multiple damage
		crownfire	single tree death	multiple tree death	catastrophic tree death
		groundfire	growth reduction, tree death	multiple tree death	catastrophic multiple damage
		drought	tree stress, growth reduction, death	single or multiple tree death	catastrophic tree death
		frost	tree stress, growth reduction, death	single or multiple tree death	catastrophic tree death
	Geologic	volcanoes	single tree death, microsite destruction, growth reduction	multiple tree death, ecosystem destruction, growth reduction	catastrophic tree death, site destruction
		flood	tree stress and death	multiple tree death	extensive tree death, site destruction
		avalanche	single tree death, microsite destruction	multiple tree death, ecosystem destruction, growth reduction	catastrophic tree death and site destruction
		landslide	single tree death, microsite destruction,	multiple tree death, ecosystem destruction	catastrophic tree death, site destruction
Biotic		insect	tree stress, growth reduction, death	single or multiple tree death	catastrophic tree death
		pathogen	tree stress, growth reduction, death	single or multiple tree death	catastrophic tree death
		Invasive species	tree stress	single or multiple composition and structure changes	irrecoverable composition and structure changes
		herbivores	browsing, debarking, young tree death	multiple browsing, debarking, species exclusion	extensive browsing, debarking, species exclusion

Chronological comments on the SNS network Natural Disturbances Dynamics Analysis for Forest Ecosystem Management (2002–2009)

Forestry is an essential component in the ecological, economical, and social structure of both the Nordic Countries and the Baltic States. Sustainable ecosystem management requires an understanding of the generative ecosystem process. These include natural disturbance processes and the responses of ecosystems to disturbances. The overall goal of the SNS (Nordic Forest Research Cooperation Committee) network is to develop and promote an active networking in both the study of natural disturbance regimes and in an ecosystem based approach to forest management in the Baltic region. The aims of the SNS network have been addressed by linking and connecting scientists, researchers, teachers and students working on the field of forest disturbances. For keeping the network contacts alive an annual meetings have been organized. The summary of network meetings is presented on the Table 2. The cooperative activity of researchers between the meetings has been focused on producing and publishing paper collections on forest disturbance studies. Some of these publications have been attached to international journals (as special issues) of high quality and with vide circle of scientific audience.

The First preparatory workshop for network activities has taken place in Hiiumaa, Estonia on 01–04 August 2002. There the need for the establishment of cooperation between Nordic and Baltic countries on the field of forest disturbances was discussed. The meeting was followed by short excursion to wind disturbance sites on Kassari and Kõpu peninsula (Jõgiste and Voolma 2002). As a follow up for the meeting ten higher education and research institutions signed the letters of intent for forming the forest disturbance network.

The Second workshop has been held in Geysir, Iceland on 11 – 15 October 2003. A seminar session with interesting presentations on disturbances and their ecological effects on forests was rounded up with the group work sessions discussing the activities and prospective of the network (Sigurgeirsson and Voolma 2003). The seminar was followed by two-day excursions on Icelandic forest sites serving as a good example for solving problems initiated from history and for developing sustainable forest management for the future. The studies covered at the workshop were published in following year in *The Iceland Forest Research Bulletin* (Sigurgeirsson and Jõgiste 2004).

The network activities continued with a third network meeting organized as an international conference in Marguse (Otepää) Estonia on 27 – 28 May 2004. In two-day plenary sessions the covered topics were dis-

Table 2. Chronology of the Network meetings

Meeting year	Topic	Presentations and Posters	Participants number	Participating countries
2002	Natural disturbances dynamics as component of ecosystem management planning	4/ 0	22	Denmark, Estonia, Finland, Latvia, Lithuania, The Netherlands
2003	Natural disturbances dynamics as component of ecosystem management planning, stage II	10/ 0	21	Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Sweden, The Netherlands
2004	Natural Disturbances and Ecosystem-Based Forest Management	24/ 4	45	Estonia, Finland, Germany, Iceland, Latvia, Lithuania, Russia, The Netherlands, USA
2005	The scale of natural disturbance from tree to stand	12/ 9	30	Belarus, Estonia, Finland, Latvia, Lithuania, Norway, Russia, The Netherlands, USA
2006	Disturbances at the landscape level: ecology and management	12/ 5	22	Canada, Estonia, Finland, France, Latvia, Lithuania, Norway, Poland, Russia, The Netherlands
2007	Disturbance regimes in changing environment	13/ 6	23	Estonia, Finland, France, Latvia, Lithuania, Norway, Poland, Switzerland, USA
2008	Mixed forest disturbances in boreal and temperate zone	12/ 4	21	Estonia, Lithuania, Poland, The Netherlands
2009	Approaches for forest disturbances studies	14/ 3	29	England, Estonia, Finland, Japan, Latvia, Lithuania

cussed in four sections: (1) forest biodiversity, (2) natural wind and fire disturbances, (3) natural defoliation, and (4) anthropogenic disturbance factors (Jõgiste et al. 2005). The conference and post-conference excursions presented the storm damage area in Tudu research site and forest restoration related sites in Karula National Park and North-Eastern Estonia. The proceedings of the conference, including abstracts and extended abstracts from most of presentations were published in the series of transactions of Estonian Agricultural University (Kangur 2004). Selection of the studies was published later in the conference collection supplement issue of *Scandinavian Journal of Forest Research* (Jõgiste et al. 2005).

The Fourth workshop was held in Palanga, Lithuania on 28 – 30 September 2005. Pre-workshop excursion concentrated on the forest disturbances and experiments. The bark beetle and drought influence studies were demonstrated. Ash and oak decline cases were visited on study sites. During the meeting 12 oral presentations were given. Wide array of topics was included. The lively poster session encompassed 9 poster presentations from from different countries. The discussion on further activities was focused on the next meeting and publication procedure. Post-workshop excursion was arranged to Curonian Spit. Different disturbance sites were visited including dune areas of eroded vegetation and Great cormorant (*Phalacrocorax carbo*) colony (Belova et al. 2005). The official website of the network has been active since June 2005, and it can be reached by address: http://ecosyst.emu.ee. The website provokes the exchange of ideas and provides links to the information connected to the disturbance studies and network activities. The main publications compiled under the network framework are listed on the website. The links are provided for publications with free access on the web. Based on presentations delivered at the workshop a collection of papers on the forest disturbances at multiple scales as the basis of forest ecosystem restoration and management was published in the special issue of *Forest Ecology and Management* (Jõgiste et al. 2007).

The Fifth workshop was organized in Tromsų, Norway on 11 – 15 September 2006. The meeting focused on the disturbance studies on the landscape level, particularly on 1) forest biodiversity, 2) effects on wind and fauna and 3) influence from anthropogenic factors. Post-workshop excursion was arranged to Reisa National Park and Kilpisjärvi Research Station in Finland. Different disturbance sites were visited including river basins, birch sites and palsa peatlands. At the Kilpisjärvi Biological Station, Prof. Heikki Henttonen presented results on the dynamics of small mammals. The short papers from the meeting were published in the supplement issue of Lithuanian Forest Research Institute journal *Miškininkystė* (*Journal on Forest Science*) (Brazaitis et al. 2007).

The Sixth workshop has taken place in Tukums (Jaunmokas), Latvia, on 03 – 06 October 2007. The topics presented at the meeting represented a very broad range of research on various forest conditions related to the changes in forest disturbance regimes.

Post-workshop excursion was arranged to coastal area and Slitere National Park. The management of woodland key habitats, dynamics of the costal regions and wildfire effects on wetland sites were visited and discussed. A collection of papers describing the present state of changes in forest biota in Fennoscandia and North America was published in the journal *Annales Botanici Fennici* (Jõgiste et al. 2009).

The Seventh workshop has taken place in Bia³owieæa, Poland, on 06 – 10 October 2008. The topics covered at the plenary sessions were as follows 1) permanent sample plots and long-term observations for disturbance analysis, 2) modelling of changes in mixed forest disturbances, 3) the effect of large herbivores to forest dynamics and 4) ecological consequences of historical anthropogenic disturbances. Post workshop excursion included visits to the nature reserve and museum of Bia³owieæa National Park. Mammal Research Institute experimental sites on herbivore impact to tree regeneration were visited for the continuation of discussion on ecological consequences of historical land use (Belova and Kangur 2008). A collection of papers from the meeting is published in the current issue of *Baltic Forestry*.

The Eighth meeting was held in Vihterpalu, Estonia on 21 – 25 September 2009. This year many of the topics concentrated on the specific study design or methodological setup of research. The studies of forest ecosystem early development or disturbance effects on forest regeneration were presented and discussed. During post workshop excursions the different post-fire study sites and fire affected areas in Vihterpalu were visited. A cultural heritage and land use practices were discussed on the excursion to the Vormsi Island.

Current issue

This issue of *Baltic Forestry* delivers the set of papers from the studies presented at the VII workshop of SNS network Natural Disturbances Dynamics Analysis for Forest Ecosystem Management, given in Białowieża, Poland, on 06 –10 October 2008. This workshop was jointly hosted by the Mammal Research Institute of Polish Academy of Sciences, Estonian University of Life Sciences, Nordic Forest Research Cooperation Committee and Estonian Environmental Investment Centre. This collection of papers represents a vide range of studies from Poland, Baltic Countries and North America aiming to describe the changes in forest conditions for detecting the long-term ecological consequences of changes in forest disturbance regimes. For compiling more comprehensive collection the guest editors of the issue have invited in addition to workshop papers some more manuscripts from network members.

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