forests

Editorial

Natural Disturbance Dynamics Analysis for Ecosystem-Based Management—FORDISMAN

Kalev Jõgiste [1,*], Lee E. Frelich [2], Floortje Vodde [1], Ahto Kangur [3], Marek Metslaid [1] and John A. Stanturf [3,4]

1 Chair of Silviculture and Forest Ecology, Institute of Forestry and Rural Engineering, Estonian University of Life Sciences, Kreutzwaldi 5, EE-51006 Tartu, Estonia; floortje.vodde@emu.ee (F.V.); marek.metslaid@emu.ee (M.M.)
2 Department of Forest Resources, University of Minnesota, 115 Green Hall, 1530 Cleveland Avenue North, St Paul, MN 55108, USA; freli001@umn.edu
3 Chair of Forest Management Planning and Wood Processing Technologies, Institute of Forestry and Rural Engineering, Estonian University of Life Sciences, Kreutzwaldi 5, EE-51006 Tartu, Estonia; ahto.kangur@emu.ee (A.K.); johnalvin.stanturf@emu.ee (J.A.S.)
4 InNovaSilva TpS, Højen Tang 80, 7100 Vejle, Denmark
* Correspondence: kalev.jogiste@emu.ee; Tel.: +372-731-3133

Received: 29 May 2020; Accepted: 9 June 2020; Published: 11 June 2020

Abstract: Forest ecosystems are shaped by disturbances and functional features of vegetation recovery after disturbances. There is considerable variation in basic disturbance characteristics, magnitude, severity, and intensity. Disturbance legacies provide possible explanations for ecosystem resilience. The impact (length and strength) of the pool of ecosystem legacies and how they vary at different spatial and temporal scales is a most promising line of further research. Analyses of successional trajectories, ecosystem memory, and novel ecosystems are required to improve modelling in support of forests. There is growing evidence that managing ecosystem legacies can act as a driver in adaptive management to achieve goals in forestry. Managers can adapt to climate change and new conditions through anticipatory or transformational strategies of ecosystem management. The papers presented in this Special Issue covers a wide range of topics, including the impact of herbivores, wind, and anthropogenic factors, on ecosystem resilience.

Keywords: disturbance ecology; ecosystem legacy; resilience

Disturbances drive forest dynamics in the boreal and temperate regions of Earth [1,2]. Climate change has altered historic disturbance patterns, and the direct and indirect effects of altered climate pose an increasingly uncertain future for forest ecosystems [3,4]. Adding to the uncertainty are two important elements: to what extent are in situ forest ecosystems the outcome of management activities, in terms of altered structure and composition [5,6]? Have altered disturbance regimes resulted in a novel ecosystem [7–9]? Addressing these questions brings to the fore the urgent need to better understand relationships between passively and actively managed forest ecosystems in the face of new climatic conditions with shifts in land use and social expectations.

Ecosystem resilience is a desired ecological property to be embedded in natural resource management systems [10]. Resilience is often described as the resistance of an ecosystem to stress and disturbance, or its capacity to recover to a predisturbance stable state and functioning [11]. Ecosystem management as a relatively new forest management paradigm has set the goal of resilience of the ecosystem to future disturbances by focusing on sustainability and what remains after resource extraction [12–16].

Knowledge of basic patterns of vegetation dynamics can be employed in management after severe disturbances or land use change to direct the ecosystem toward a desired condition. Incorporating resilience into management requires maintaining or creating adaptation mechanisms that shape the recovery trajectory and that result in desirable patterns of ecosystems and landscapes. There is growing evidence that managing ecosystem legacies can act as a driver to achieve goals in forestry [17–19]. Ecosystem legacies are remnants of previous conditions persisting after disturbances [10,20,21] and subsume the varied concepts of biological [22], ecological [23], disturbance [24], soil [25], and land use legacies [26].

The impact (length and strength) of the pool of ecosystem legacies and how they vary at different spatial and temporal scales is a most promising line of further research. In particular, the investigation of how the carbon cycle is directed by legacies is crucial to understanding climate change impacts. Analyses of successional trajectories, ecosystem memory, and novel ecosystems are required to improve modelling in support of forests.

Predictions related to a changing disturbance regime can be derived from legacy functions in the course of recovery of an ecosystem. The potential to support forest resilience to future disturbances can be enhanced by managing the biological components of ecosystem legacies [11,27,28]. For example, refuge areas in managed forest are suggested as mitigation to harmful effects of timber harvest or salvage [17,29].

Often research aims to account for forest ecosystem dynamics resulting from past disturbances. Ecosystem resilience patterns depend on the magnitude of human impact. The nature of disturbances and ecosystem memory (the pool of ecosystem legacies) can be characterized as legacy syndromes, characteristic grouping of legacies that result from differential patterns of editing of legacy elements, which typically can be arranged along a gradient of naturalness [20,21]. For example, forest succession after land use change relies on ecosystem memory, rendering highly varying pathways of vegetation dynamics [26].

Ecosystem resilience is an emerging hotspot of academic discussion; research questions that emerge include the following: Does traditional forest management ensure the resilience (resistance and recovery) of forests with anticipated climate change? Does naturalness of the ecosystem predetermine which legacy syndromes may have resilient patterns? These questions must be addressed in multitudinous specific socio-ecological contexts. Modelling provides methods for depicting ecosystem legacy syndromes and resilience to disturbances and may provide a key to begin to answer these intriguing questions.

Ecosystem restoration has gained international policy importance; the United Nations has declared that 2020 marks the beginning of the Decade of Ecosystem Restoration [30]. Restoration decisions should incorporate a vision of the desired future landscape that resonates with all stakeholders and utilizes the best available science [31]. In addition to the estimated 2 billion hectares of degraded land in need of restoration [32,33], climate change will increase the need for restoration. The unprecedented alteration of the natural environment by humans has raised the specter that planetary boundaries of sustainability have been breached—that we have gone outside safe operating space [34,35]. These concepts of maintaining ecosystem legacies and staying within safe operating space can inform management and explain the continuity of ecosystems over time amidst changes [23,36,37].

The ability to maintain or restore forest ecosystems to historic conditions will depend on the time-course of change driven by altered climate and societal responses, i.e., global change [38]. The nonequilibrium nature of forest dynamics sets the conceptual frame for resilience with novel boundaries [39] and the emergence of novel ecosystems [8,9,40]. Managers can adapt to new conditions through anticipatory or transformational strategies [1,41–43]. Such an approach offers the opportunity for reconciling complex systems with traditional scenario analysis [44].

This Special Issue of the journal *Forests* appears under the title "Natural Disturbance Dynamics Analysis for Ecosystem-Based Management", which is the official name of the network abbreviated by the acronym FORDISMAN. New and old members of the FORDISMAN have exposed their work on various topics in field of forest research. This group of forest researchers from the Baltic and Nordic

Countries met in August 2002 in order to draft a proposal to the Nordic Forest Research Committee (SNS) for network funding. This meeting on Hiiumaa Island, Estonia was the start of the FORDISMAN network that has been active for almost two decades. The network has focused on one essential topic: the impact of natural disturbances on the forests of the region.

Originally, the network excluded anthropogenic disturbances from the array of research questions. It soon became obvious, however, that a long history of continuous forest management in the region has imprinted the forests with signs of human interventions [20,45,46]. Thus, the impact of natural disturbances on forest ecosystems is conditioned by management influences from the past, and they are inseparable in the condition of contemporary vegetation. Since 2011, a shift has occurred in the scientific interests of the group. More attention has been paid to the legacy components of forest ecosystems [21].

A milestone of this research community was a conference in 2014 on "Forest Landscape Mosaics: Disturbance, Restoration, and Management at Times of Global Change" held in Tartu, Estonia [47]. Particularly, the elaboration of theories on land use change and restoration potential was approached in the course of the conference. The role of ecosystem legacies in the course of dynamic processes of forest biomes was a prominent topic, suggesting that a thorough analysis was needed before implementing new silvicultural techniques. An essential feature was the gradient of ecosystem legacy assemblages, constituting ecosystem memory, which represents an ecological array of anthropogenic and natural disturbance patterns. These legacy syndromes, in which ecological memory is impacted by management activity, were suggested as a platform for designing ecosystem management in the future.

Network activities have produced many publications, Special Issues, and book chapters. Among many aspects studied in the frame of this network are questions of plant communities [48,49] together with impact of large herbivores [50]; they set the demarcation lines for the range of research interests. The activities of the FORDISMAN network are chronicled in preface chapters to past Special Issues [47,51]. The objective of this Special Issue is to contribute to the untangling of successional patterns and the driving forces of disturbances dynamics. To this end, scientists were solicited to share their cutting-edge research in ecosystem approaches to forest management.

The research reports of this Special Issue address the question of reintroducing big herbivores [52], and their direct impacts on trees [53,54]. The dynamics of course woody debris in hemiboreal hardwood forest is not well studied: Senhofa and coauthors [55] have addressed this topic using birch stands of different ages. Strong human impact is considered in studies of forest genetic composition [56], drained wetlands [57], and carbon fluxes after timber harvest [58]. Additionally, advance regeneration as an important legacy component is analyzed by Luguza et al. [59]. Economic aspects of windthrow are analyzed in [60].

Author Contributions: Conceptualisation, K.J., J.A.S. and L.E.F.; writing—Original draft preparation, K.J.; writing—Review and editing, J.A.S., F.V., M.M., L.E.F., A.K., and K.J. All authors have read and agreed to the published version of the manuscript.

Funding: FORDISMAN network received multiple grants by SNS-EFINORD. Considerable amount of work was financed by the institutional research funding IUT21-4 of the Estonian Ministry of Education and Research. The support by the projects (P180024MIME, P200029MIME) of the Estonian University of Life Sciences is acknowledged. We acknowledge the support by Latvian Forest Research Institute "Silava".

Acknowledgments: The authors of this paper and editor of the Special Issue "Natural Disturbance Dynamics Analysis for Forest Ecosystem Management" are grateful to all the authors and reviewers of the Special Issue, as well as the support provided by the editors and managers of the journal *Forests* of MDPI.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Stanturf, J.A. Future landscapes: Opportunities and challenges. *New For.* **2015**, *46*, 615–644. [CrossRef]
2. Turner, M.G. Disturbance and landscape dynamics in a changing world. *Ecology* **2010**, *91*, 2833–2849. [CrossRef] [PubMed]

3. Stanturf, A.J.; Frelich, L.E.; Donoso, P.J.; Kuuluvainen, T. Advances in managing and monitoring natural hazards and forest disturbances. In *Achieving Sustainable Management of Boreal and Temperate Forests*; Stanturf, J.A., Ed.; Burleigh Dodds Science Publishing: Cambridge, UK, 2020; pp. 627–716.
4. Seidl, R.; Honkaniemi, J.; Aakala, T.; Aleinikov, A.; Angelstam, P.; Bouchard, M.; Boulanger, Y.; Burton, P.J.; De Grandpré, L.; Gauthier, S.; et al. Globally consistent climate sensitivity of natural disturbances across boreal and temperate forest ecosystems. *Ecography* **2020**, *43*, 1–12. [CrossRef]
5. Lindbladh, M.; Axelsson, A.-L.; Hultberg, T.; Brunet, J.; Felton, A. From broadleaves to spruce−the borealization of southern Sweden. *Scand. J. For. Res.* **2014**, *29*, 686–696. [CrossRef]
6. Nowacki, G.J.; Abrams, M.D. The demise of fire and "mesophication" of forests in the eastern United States. *BioScience* **2008**, *58*, 123–138. [CrossRef]
7. Williams, J.W.; Jackson, S.T. Novel climates, no-analog communities, and ecological surprises. *Front. Ecol. Environ.* **2007**, *5*, 475–482. [CrossRef]
8. Hobbs, R.J.; Higgs, E.; Harris, J.A. Novel ecosystems: Implications for conservation and restoration. *Trends Ecol. Evol.* **2009**, *24*, 599–605. [CrossRef]
9. Radeloff, V.C.; Williams, J.W.; Bateman, B.L.; Burke, K.D.; Carter, S.K.; Childress, E.S.; Cromwell, K.J.; Gratton, C.; Hasley, A.O.; Kraemer, B.M.; et al. The rise of novelty in ecosystems. *Ecol. Appl.* **2015**, *25*, 2051–2068. [CrossRef]
10. Frelich, L.E.; Jõgiste, K.; Stanturf, J.A.; Parro, K.; Baders, E. Natural disturbances and forest management: Interacting patterns on the landscape. In *Ecosystem Services from Forest Landscapes: Broadscale Considerations*; Perera, A.H., Peterson, U., Martinez Pastur, G., Iverson, L.R., Eds.; Springer International Publishing AG: Cham, Switzerland, 2018; pp. 221–248. [CrossRef]
11. Seidl, R.; Spies, T.A.; Peterson, D.L.; Stephens, S.L.; Hicke, J.A. Searching for resilience (review): Addressing the impacts of changing disturbance regimes on forest ecosystem services. *J. Appl. Ecol.* **2016**, *53*, 120–129. [CrossRef]
12. Chambers, J.C.; Brooks, M.L.; Germino, M.J.; Maestas, J.D.; Board, D.I.; Jones, M.O.; Allred, B.W. Operationalizing resilience and resistance concepts to address invasive grass-fire cycles. *Front. Ecol. Evol.* **2019**, *7*, 185. [CrossRef]
13. Díaz-Yáñez, O.; Pukkala, T.; Packalen, P.; Peltola, H. Multifunctional comparison of different management strategies in boreal forests. *Forestry* **2019**, *93*, 84–95. [CrossRef]
14. Grumbine, R.E. What is ecosystem management? *Conser. Biol.* **1994**, *8*, 27–38. [CrossRef]
15. Kuuluvainen, T.; Bergeron, Y.; Coates, K.D. Restoration and ecosystem-based management in the circum-boreal forest: Background, challenges, and opportunities. In *Restoration of Boreal and Temperate Forests*, 2nd ed.; Stanturf, J.A., Ed.; CRC Press: Boca Raton, FL, USA, 2015; pp. 251–270. ISBN 978-1-4822-1196-2.
16. Lackey, R.T. Seven pillars of ecosystem management. *Landsc. Urban Plan.* **1998**, *40*, 21–30. [CrossRef]
17. Waldron, K.; Ruel, J.-C.; Gauthier, S. Forest structural attributes after windthrow and consequences of salvage logging. *For. Ecol. Manag.* **2013**, *289*, 28–37. [CrossRef]
18. Beese, W.J.; Rollerson, T.P.; Peters, C.M. Quantifying wind damage associated with variable retention harvesting in coastal British Columbia. *For. Ecol. Manag.* **2019**, *443*, 117–131. [CrossRef]
19. Kuuluvainen, T.; Gauthier, S. Young and old forest in the boreal: Critical stages of ecosystem dynamics and management under global change. *For. Ecosyst.* **2018**, *5*, 26. [CrossRef]
20. Jõgiste, K.; Frelich, L.E.; Laarmann, D.; Vodde, F.; Baders, E.; Donis, J.; Jansons, A.; Kangur, A.; Korjus, H.; Köster, K.; et al. Imprints of management history on hemiboreal forest ecosystems in the Baltic States. *Ecosphere* **2018**, *9*, e02503. [CrossRef]
21. Jõgiste, K.; Korjus, H.; Stanturf, J.A.; Frelich, L.E.; Baders, E.; Donis, J.; Jansons, A.; Kangur, A.; Köster, K.; Laarmann, D.; et al. Hemiboreal forest: Natural disturbances and the importance of ecosystem legacies to management. *Ecosphere* **2017**, *8*, e01706. [CrossRef]
22. Franklin, J.F. Biological legacies: A critical management concept from Mount St. Helens. In *Proceedings of the Transactions of the Fifty-Fifth North American Wildlife and Natural Resource Conference, Denver, CO, USA, 16–21 March 1990*; McCabe, R., Ed.; Wildlife Management Institute: Washington, DC, USA, 1990; pp. 216–219. ISSN 0078-1355.

23. Johnstone, J.F.; Allen, C.D.; Franklin, J.F.; Frelich, L.E.; Harvey, P.E.; Higuera, P.E.; Mack, M.C.; Meentemeyer, R.K.; Metz, M.R.; Perry, G.L.W.; et al. Changing disturbance regimes, ecological memory, and forest resilience. *Front. Ecol. Environ.* **2016**, *14*, 369–378. [CrossRef]
24. Seidl, R.; Rammer, W.; Spies, T.A. Disturbance legacies increase the resilience of forest ecosystem structure, composition, and functioning. *Ecol. Appl.* **2014**, *24*, 2063–2077. [CrossRef]
25. Kostenko, O.; Bezemer, T.M. Abiotic and biotic soil legacy effects of plant diversity on plant performance. *Front. Ecol. Evol.* **2020**, *8*, 87. [CrossRef]
26. Foster, D.; Swanson, F.; Aber, J.; Burke, I.; Brokaw, N.; Tilman, D.; Knapp, A. The importance of land-use legacies to ecology and conservation. *BioScience* **2003**, *53*, 77–88. [CrossRef]
27. Bryant, T.; Waring, K.; Sánchez Meador, A.; Bradford, J.B. A framework for quantifying resilience to forest disturbance. *Front. For. Glob. Change* **2019**, *2*, 56. [CrossRef]
28. Trumbore, S.; Brando, P.; Hartmann, H. Forest health and global change. *Science* **2015**, *349*, 814–818. [CrossRef]
29. Weldon, J.; Grandin, U. Major disturbances test resilience at a long-term boreal forest monitoring site. *Ecol. Evol.* **2019**, *9*, 4275–4288. [CrossRef]
30. Young, T.P.; Schwartz, M.W. The decade on ecosystem restoration is an impetus to get it right. *Conserv. Sci. Pract.* **2019**, *1*, e145. [CrossRef]
31. Stanturf, J.; Mansourian, S.; Kleine, M. (Eds.) *Implementing Forest Landscape Restoration, a Practitioner's Guide*; International Union of Forest Research Organizations: Vienna, Austria, 2017; p. 128. ISBN 978-3-902762-78-8.
32. Bastin, J.-F.; Finegold, Y.; Garcia, C.; Mollicone, D.; Rezende, M.; Routh, D.; Zohner, C.M.; Crowther, T.W. The global tree restoration potential. *Science* **2019**, *365*, 76–79. [CrossRef]
33. Scholes, R.; Montanarella, L.; Brainich, A.; Barger, N.; ten Brink, B.; Cantele, M.; Erasmus, B.; Fisher, J.; Gardner, T.; Holland, T.G.; et al. *IPBES (2018): Summary for Policymakers of the Assessment Report on Land Degradation and Restoration of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*; IPBES secretariat: Bonn, Germany, 2018; p. 44. ISBN 978-3-947851-04-1.
34. Rockström, J.; Steffen, W.; Noone, K.; Persson, A.; Chapin, F.S., III; Lambin, E.; Lenton, T.M.; Scheffer, M.; Folke, C.; Schellnhuber, H.; et al. Planetary boundaries: Exploring the safe operating space for humanity. *Ecol. Soc.* **2009**, *14*, 32. Available online: http://www.ecologyandsociety.org/vol14/iss2/art32/ (accessed on 10 June 2020). [CrossRef]
35. Steffen, W.; Richardson, K.; Rockström, J.; Cornell, S.E.; Fetzer, I.; Bennett, E.M.; Biggs, R.; Carpenter, S.R.; de Vries, W.; de Wit, C.A.; et al. Planetary boundaries: Guiding human development on a changing planet. *Science* **2015**, *347*, 1259855. [CrossRef]
36. Donato, D.C.; Campbell, J.L.; Franklin, J.F. Multiple successional pathways and precocity in forest development: Can some forest born complex? *J. Veg. Sci.* **2012**, *23*, 576–584. [CrossRef]
37. Swanson, M.E.; Franklin, J.F.; Beschta, R.L.; Crisafulli, C.M.; DellaSala, D.A.; Hutto, R.L.; Lindenmayer, D.B.; Swanson, F.J. The forgotten stage of forest succession; early-successional ecosystems on forest sites. *Front. Ecol. Environ.* **2011**, *9*, 117–125. [CrossRef]
38. Vitousek, P.M. Beyond global warming: Ecology and global change. *Ecology* **1994**, *75*, 1861–1876. [CrossRef]
39. Mori, A.S. Ecosystem management based on natural disturbances: Hierarchical context and non-equilibrium paradigm. *J. Appl. Ecol.* **2011**, *48*, 280–292. [CrossRef]
40. Lugo, A.E.; Abelleira Martinez, O.J.; Medina, E.; Aymard, G.; Heartsill Scalley, T. Chapter two—Novelty in the tropical forests of the 21st century. *Adv. Ecol. Res.* **2020**, *62*, 53–116. [CrossRef]
41. Hulvey, K.B.; Standish, R.J.; Hallett, L.M.; Starzomski, B.M.; Murphy, S.D.; Nelson, C.R.; Gardener, M.R.; Kennedy, P.L.; Seastedt, T.R.; Suding, K.N. Incorporating novel ecosystems into management frameworks. In *Novel Ecosystems: Intervening in the New Ecological World Order*, 1st ed.; Hobbs, R.J., Higgs, E.S., Hall, C.M., Eds.; John Wiley & Sons: West Sussex, UK, 2013; pp. 157–171. [CrossRef]
42. Kowarik, I.; Hiller, A.; Planchuelo, G.; Seitz, B.; von der Lippe, M.; Buchholz, S. Emerging urban forests: Opportunities for promoting the wild side of the urban green infrastructure. *Sustainability* **2019**, *11*, 6318. [CrossRef]
43. Perring, M.P.; Standish, R.J.; Hobbs, R.J. Incorporating novelty and novel ecosystems into restoration planning and practice in the 21st century. *Ecol. Process.* **2013**, *2*, 18. [CrossRef]
44. Bergeron, Y.; Chen, H.Y.H.; Kenkel, N.C.; Leduc, A.L.; Macdonald, S.E. Boreal mixedwood stand dynamics: Ecological processes underlying multiple pathways. *For. Chron.* **2014**, *90*, 202–2013. [CrossRef]

45. Jõgiste, K.; Metslaid, M.; Uri, V. Afforestation and land use dynamics in the Baltic States. In *Restoration of Boreal and Temperate Forests*, 2nd ed.; Stanturf, J.A., Ed.; CRC Press, Taylor & Francis Group: Boca Raton, FL, USA, 2016; pp. 187–200. [CrossRef]
46. Tomson, P.; Kaart, T.; Sepp, K. Role of 19th-century rotational slash-and-burn cultivation in the development of boreal forests in southern Estonia and implications for forest management. *For. Ecol. Manag.* **2018**, *409*, 845–862. [CrossRef]
47. Jõgiste, K.; Jonsson, B.G.; Kuuluvainen, T.; Gauthier, S.; Moser, W.K. Forest landscape mosaics: Disturbance, restoration, and management at times of global change. *Can. J. For. Res.* **2015**, *45*, v–vi. [CrossRef]
48. Parro, K.; Köster, K.; Jõgiste, K.; Vodde, F. Vegetation dynamics in a fire damaged forest area: The response of major ground vegetation species. *Balt. For.* **2009**, *15*, 206–215.
49. Ilisson, T.; Metslaid, M.; Vodde, F.; Jõgiste, K.; Kurm, M. Vascular plant response to windthrow severity in Norway spruce-dominated *Myrtillus* site type forests in Estonia. *Ecoscience* **2006**, *13*, 193–202. [CrossRef]
50. De Chantal, M.; Granström, A. Aggregations of dead wood after wildfire act as browsing refugia for seedlings of *Populus tremula* and *Salix caprea*. *For. Ecol. Manag.* **2007**, *250*, 3–8. [CrossRef]
51. Vodde, F.; Köster, K.; Metslaid, M.; Kuuluvainen, T. Preface to the special issue: The impact of ungulates and other mammalian herbivores on forest ecosystems. *Boreal. Env. Res.* **2013**, *18*, 1–3.
52. Marozas, V.; Kibiša, A.; Brazaitis, G.; Jõgiste, K.; Šimkevičius, K.; Bartkevičius, E. Distribution and habitat selection of free-ranging European bison (*Bison bonasus* L.) in a mosaic landscape—A Lithuanian case. *Forests* **2019**, *10*, 345. [CrossRef]
53. Krisans, O.; Saleniece, R.; Rust, S.; Elferts, D.; Kapostins, R.; Jansons, A.; Matisons, R. Effect of bark-stripping on mechanical stability of Norway spruce. *Forests* **2020**, *11*, 357. [CrossRef]
54. Snepsts, G.; Kitenberga, M.; Elferts, D.; Donis, J.; Jansons, A. Stem damage modifies the impact of wind on Norway spruces. *Forests* **2020**, *11*, 463. [CrossRef]
55. Šēnhofa, S.; Jaunslaviete, I.; Šņepsts, G.; Jansons, J.; Liepa, L.; Jansons, Ā. Deadwood characteristics in mature and old-growth birch stands and their implications for carbon storage. *Forests* **2020**, *11*, 536. [CrossRef]
56. Rungis, D.; Luguza, S.; Baders, E.; Škipars, V.; Jansons, A. Comparison of genetic diversity in naturally regenerated Norway spruce stands and seed orchard progeny trials. *Forests* **2019**, *10*, 926. [CrossRef]
57. Potapov, A.; Toomik, S.; Yermokhin, M.; Edvardsson, J.; Lilleleht, A.; Kiviste, A.; Kaart, T.; Metslaid, S.; Järvet, A.; Hordo, M. Synchronous growth releases in peatland pine chronologies as an indicator for regional climate dynamics—A multi-site study including Estonia, Belarus and Sweden. *Forests* **2019**, *10*, 1097. [CrossRef]
58. Rebane, S.; Jõgiste, K.; Kiviste, A.; Stanturf, J.A.; Metslaid, M. Patterns of carbon sequestration in a young forest ecosystem after clear-cutting. *Forests* **2020**, *11*, 126. [CrossRef]
59. Luguza, S.; Snepsts, G.; Donis, J.; Desaine, I.; Baders, E.; Kitenberga, M.; Elferts, D.; Jansons, A. Advance regeneration of Norway spruce and Scots pine in hemiboreal forests in Latvia. *Forests* **2020**, *11*, 215. [CrossRef]
60. Samariks, V.; Krisans, O.; Donis, J.; Silamikele, I.; Katrevics, J.; Jansons, A. Cost-benefit analysis of measures to reduce windstorm impact in pure Norway spruce (*Picea abies* L. Karst.) stands: A case study in Latvia. *Forests* **2020**, *11*, 576. [CrossRef]