

Potential practice-relevant research questions for (forest related) BE projects

Dear colleagues,

This is a collection of practice-relevant research questions mentioned by regional stakeholders in the field of forest management and forest nature conservation. The questions were collected within the framework of several knowledge transfer activities: (a) personal communication of the Local Management Teams with stakeholders, (b) the survey and interviews of the Knowledge Transfer Project, and (c) the stakeholder workshop at the last BE assembly. For the list below we selected, summarized, split or reformulated the original questions to focus them to the main objectives of the BE as far as possible. Questions that obviously cannot be investigated within the conceptual framework of the BE or that are far beyond the scope of the BE are not listed here (e.g. questions concerning effects of non-native species, wind turbines or hunting).

We would like to encourage you to consider these questions when writing your proposals for the upcoming project phase of the BE. To optimize the communication within the BE, and between the BE and the stakeholders it would be great, if you could send us a short notice when you are planning to integrate one or more of these questions in your next BE project. If you are interested in a direct cooperation with stakeholders, we will be happy to support you in finding a contact person in forestry and/or nature conservation.

Kind regards,

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Direct Effects of Forest Management on Biodiversity

Different management regimes and total protection

1. Which management regimes are the best for which species or species groups?
2. What are the effects of uneven-aged forestry on biodiversity compared to even-aged forestry? Can clear cutting support biodiversity?
3. Which specific forest structures, habitats and microclimates are needed by which species or species groups? Which forest structures do rare species need?
4. How important are forest gaps for biodiversity? How important are the size of the gaps and the alteration of open and dense canopies?
5. Is the biodiversity of mixed stands always higher than that of pure stands?
6. How important are conifers compared to deciduous trees for biodiversity?
7. What is the optimal size and distribution of protected forests? How much unmanaged and managed forested area would be needed for maximum biodiversity protection?

8. Does total forest protection (cessation of any forest use) increase or decrease the biodiversity of forests? Which species or organismic groups profit from total protection, which lose?
9. Which conditions (e.g. stand structure, microhabitats and-climate) would be needed to enrich managed forests with species that were found only in unmanaged forests?
10. Does soil compaction (increased bulk density) by harvesting machines effect the soil biocenosis, and consequently soil functions? How deep do harvesting machines affect soil bulk density and soil biocenosis on skidding trails? How long do the effects last?
11. How do the net of skidding roads and trails influence the biodiversity of managed forests?
12. Which forest species are most affected by thinning and harvesting? Which activities or changes in detail affect them? For example, are they affected mostly by the time of harvesting, by changes in the light regime, or by soil disturbances due to the harvesting machines? Has the increasing use of large harvesting machines negative impacts on forest biodiversity?
13. Have also forest insects decreased over the last decades? What are the major reasons for the decrease of insects?
14. Are there changes in the biodiversity of the BE-plots over the last years? If yes, do these changes differ among the regions, management types or intensities?
15. What are the effects of the large-scale dieback of ash (*Fraxinus excelsior*) on biodiversity? How to deal with this problem considering particularly biodiversity protection goals?

Old trees, habitat trees and dead wood

16. Which species depend on old or habitat trees? On which microhabitats of the trees do they depend? Are there substitutional microhabitats or structures that may ensure the survival of species if the main microhabitats are (temporally) missing?
17. When should a tree be labeled as "old"? (species-specific) When does an old tree start to be a habitat tree?
18. Which tree species provide the most suitable microhabitats?
19. Which factors influence the quality of tree microhabitats (e.g. wood or bark characteristics of the host tree, microclimate)?
20. How many old or habitat trees are needed in the exploratory regions to support biodiversity continuously and in the long run? (thresholds)
21. How should the trees be distributed within a single stand, forest district or enterprise and landscape (e.g. should the habitat trees be regularly distributed or grouped, what should be the maximum distance between single habitat trees or groups)?
22. Which factors determine the current abundance and distribution of habitat trees? (e.g. historical management, traditional, cultural or ethic concerns)
23. How to ensure and manage the dynamics and continuity of old trees, habitat trees and dead wood at different spatial scales?
24. Which amount and quality of dead wood is needed to protect or increase associated biodiversity? What is more important for biodiversity: the amount of deadwood, its quality or exposition? (ranking of influencing factors)
25. At which spatial scale is the management of old and habitat trees most effective with respect to biodiversity conservation, costs and safety (for forest workers)?
26. Would it be reasonable to create future habitat trees by artificial cutting (damaging) of single young trees in forest districts where old trees and stands are rare?

27. What are the economic costs of an anticipatory protection of old trees and later on of habitat trees? What is the ecological, economic and social value of a habitat tree? How can these values be considered in potential subsidies?
28. Which detrimental species (pests) are supported by habitat trees or dead wood? How could their development be limited without impairing the other species?

Biodiversity and Climate Change

29. How will our native tree species and their associated biodiversity respond to climate change? Which species will profit from the expected climate change, which will lose?
30. Are there already changes in the abundance of single species or the composition of species communities since the beginning of the BE which can be related to the ongoing climate change or single weather extremes (wind throw, drought, heat)?
31. Do the species communities in the exploratory regions show similar or different relationships with climate variables?
32. Can we estimate potential changes in species communities with a changing climate based on certain species traits (e.g. drought tolerance) or the natural geographic distribution of species?
33. Which native tree species in combination with which management regimes could ensure sufficient timber production and forest stability under a changing climate? Are there synergies or trade-offs between high biodiversity and high stand stability against drought and wind throw?
34. Are there relationships between stand structure, species diversity and the effect of weather extremes on ecosystem functions, goods and services?
35. Are there differences in the resilience or resistance to weather extremes between mixed and pure stands, managed and unmanaged stands?
36. Which are currently the most important factors influencing the biodiversity of forest ecosystems? Could climate change (or weather extremes) dominate over all other factors in the future?
37. How could negative effects of tree harvesting on aboveground species (mainly birds) on the one hand and soil fauna and functioning on the other hand be minimized, when the winter will get warmer and shorter and the spring will onset earlier in the future?
38. How do stand types differ in stand-based evapotranspiration? Can we estimate effects of future extreme weather periods or events on evapotranspiration? Can we influence the stand-based evapotranspiration by management?

Socio-ecological assessment of biodiversity, and monitoring the success and efficiency of measures for biodiversity conservation

39. Which forest species are endangered in the exploratory regions, which have already been lost? Which species should be protected or supported in the exploratory regions?
40. How much biodiversity is needed for what? How much biodiversity is wanted by the society or different groups of the society?
41. What are the costs of biodiversity protection?
42. What are the synergies and trade-offs between biodiversity protection and other ecosystem goods and services, mainly timber production and carbon sequestration?
43. What are the best measures and the adequate spatial and temporal scales to quantify, monitor, assess and manage biodiversity (not just single species)?

44. How can the costs and success of additional activities to protect or increase biodiversity be monitored and assessed? Are there key species that can be used as indicators to monitor the success?
45. Can biodiversity be used as an indicator for naturalness?
46. What is the role of rare species (e.g. relicts of primary forests (*Urwaldreliktarten*)) for the overall biodiversity of forests and their functions, goods and services?
47. Does an increase in biodiversity provide also economic benefits (revenues)?
48. How can the effects of biodiversity on ecosystem functions, goods and services be monetized? How can the landowners and managers be rewarded for their efforts to protect biodiversity?
49. What are the costs of total forest protection (cessation of forest use) and what are the benefits in ecological, economic and social terms?