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CENTRAL EUROPEAN REGIONAL OFFICE AND THE
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integrate project news

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Foreword

Dear Integrate network members and colleagues,

thank you for your contributions to our 2nd issue of the Integrate Project news! After the 1st issue we have received an overwhelming feedback from you and it was really difficult to make a selection among the incoming contributions for this issue. Nevertheless, this 2nd circular again contains very interesting examples of integrative approaches, research and management aspects of forests and other ecosystems that are dealing with similar challenges. The diversity of the different topics which we included in this newsletter reflects the complexity of the topic in general and shows where potentially controversial issues will have to be discussed. We hope you enjoy reading this and keep sending in your contributions!

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Reappearance of old growth elements in lowland woodlands: do the associated species follow?

by Kris Vandekerkhove

Belgium - The forest cover of the western European lowland plain has been very low for centuries. As early as the 13th century, forest cover in Flanders (northern Belgium) was already reduced to about 10% of the total land cover.

Remaining forests were intensively managed, primarily as coppice or coppice with standards, and old-growth elements like veteran trees and coarse woody debris were absent. Even small dead branches and roots were removed.

Only over the last decades have these elements progressively redeveloped in parks, lanes and forests, and have now probably reached their highest level over the last 500-1000 years.

We estimated the number of large trees and the average amount of dead wood in Flemish forests by means of the dataset of the Regional Forest Inventory. On average, the forest stands contain about 13 m³/ha of dead wood.

Most of this consists of small dimensions, with only 20% of the volume originating from trees >40 cm DBH. The total number of 'large' trees (trees > 95cm diameter) is estimated at about 19.000 trees. This means about 1 tree every 7 ha, or 1% of what would be expected in natural forests, but still much more than in the past. These old trees are not regularly spread over the forest landscape, but are mainly concentrated in a number of 'hotspots'. The two biggest of these sites (Sonian Forest and Meerdaal forest) together cover about 6000 ha, and contain about half of these trees.

Biodiversity associated with these old-growth elements makes up an important part of overall forest biodiversity. For centuries the required habitat of these species has been absent, so it can be assumed that also the species have disappeared or were reduced to small relic populations. Now that the dead wood and old trees are re-emerging, there is a potential for recolonisation. The ability of species to recolonize the newly available habitat is however strongly determined by limitations in their dispersal and establishment, and may cause a delay (or impossibility) to establish populations, the so-called colonization or immigration credit (as opposed to the 'extinction debt'). We analysed the process of recolonization by means of specific cases, focussing on saproxylic fungi and beetles, and also combined it with other information on birds and saproxylic hoverflies.

Good dispersers that are not too selective in their habitat, like most cavity-nesting forest birds, clearly showed an increase in their populations. Species like Tawny owl or Nuthach have tripled or even quadrupled their populations over the last four decades. Even more demanding species like middle spotted woodpecker recently managed to recolonise and gradually build up a breeding population of now over 100 pairs. There are also indications that saproxylic hoverfly populations are increasing and expanding their range.

Fungi are also good dispersers, but are not able to actively detect new habitat. Moreover, two spores need to colonise the same object in order to produce fruit bodies. Their colonisation will be more determined by coincidence, thus by the density of suitable habitat. Our results show that there is an overall increase of saproxylic fungi. Highly selective species of coarse dead wood and veteran trees are still rare, but also show a distinct increase. They are mainly found at sites with high densities and amounts of old and dead large trees.

On saproxylic beetles only data from specific sites are available. These often indicated a much higher species richness than expected. Especially sites with high amounts of large and dead trees, going back for several decades are the richest, and even contain species that are often associated with a very long continuity of habitat. It is assumed that these species (often related to wood mould) managed to survive in old orchard and pollard trees in the countryside and recolonised suitable adjacent forest habitat from there. As this alternative habitat has strongly declined over the last 50 years, the re-established forest habitat will probably prove to be essential for the survival of many species, and may for some even come too late.

Our results show that 'hotspots' of secondary old growth, even isolated small patches, may have more potential for specialized biodiversity than expected, and may provide important new strongholds for recovery and recolonization of an important share of old-growth related species. The recent history, not only of the forest itself, but also of the surrounding countryside are important determinants of this potential, especially for poor dispersers.

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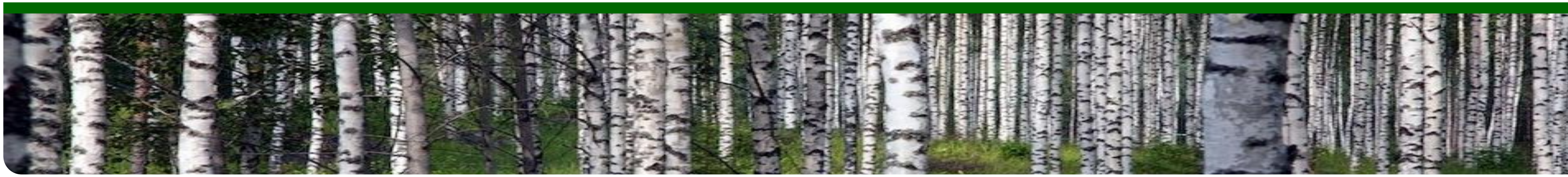


Avalanches create habitats

by Christian Rixen

Switzerland – Avalanches represent a critical hazard in mountain regions, for back-country skiers, for settlements, roads and infrastructures. But what does the disastrous disturbance imply for animals and plants? Are avalanches a threat for them as well, or do avalanches create a valuable and divers habitat? The subalpine forest belt would be rather dark and uniform was it not partly interrupted by the numerous avalanche tracks. The Federal Institute for Forest, Snow and Landscape Research in Davos, Switzerland, investigated in several research projects how avalanches influence the diversity of plant species and habitats in the subalpine spruce forest.

Species richness in avalanche tracks

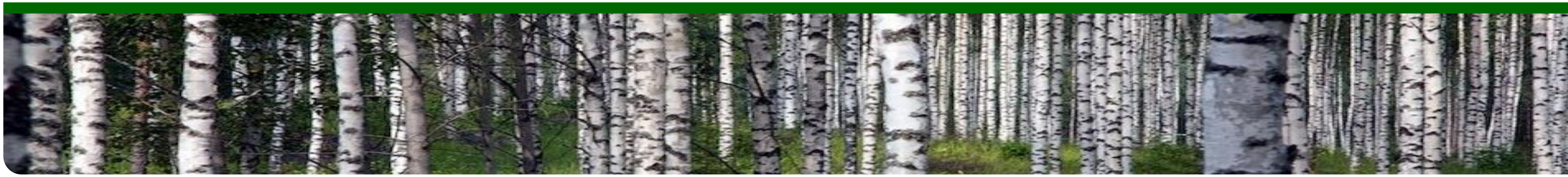
First, our goal was to understand which and how many plant species occur in avalanche tracks compared the undisturbed forest. Second, we were interested if the frequency and intensity of avalanches influenced diversity. In our approach, we studied the vegetation in avalanche tracks with different avalanche frequencies and in areas of the avalanche tracks with different disturbance intensities (central zone, transition zone and edge zone of track). Interestingly, we found most plant species (c. 30 per m2) in tracks where avalanches occurred every year. Were avalanche events rarer than every year, only half or one third of the species could be found. And the species distribution within avalanche tracks also indicated a positive influence of avalanche disturbance: most species were found in the central zone of a track, less in the transition zone and least in undisturbed forest.

There were no specific „avalanche species“, i.e. plant species, which occur only in avalanche tracks. However, avalanche tracks harboured species from many different habitat types: we found species from shady and open habitats, competitive species from low elevations as well as weak competitors from the Alpine, propagules of which were probably distributed by the avalanches themselves. Most importantly, avalanches created a mosaic of habitats where the dominant and dark forest was removed. In the open terrain, snow melts early in some areas but only in late summer in others. This pattern creates habitat for very different plant species including some alpine specialists that can otherwise only survive in much higher elevation. It is likely that many typical meadow and pasture species originate from avalanche tracks. In times before human utilisation in the Alps, avalanche tracks were probably among the few open unforested habitats where meadow species could thrive.

More and denser forest

In the last century, more and more avalanche tracks were equipped with snow supporting structures to protect inhabitants of alpine valleys. Subsequently, but also due to land-use changes, the forest cover has increased. In the community of Davos, Switzerland, we found not only that the total forest cover had increased but also that the forest had become more uniform, i.e. there were less areas with different tree densities. The reasons were primarily land-use changes, secondly forest increase in avalanche tracks and only in third place increasing temperature due to climate change. Divers and semi-open forest habitats are of critical importance for threatened animal species such as the Capercaillie (endangered in Switzerland) or the Black Grouse (near threatened).

Avalanche tracks interrupt the otherwise uniform subalpine forest belt and create diverse and species-rich habitats.



But also in other mountain regions of the world, avalanche tracks provide important habitat: in North America, Brown bears, whose diet is primarily vegetarian, inhabit preferably avalanche tracks in summer – probably a consequence of higher plant and food diversity.

Natural dynamics of ecosystems

These findings of course do not mean to say that avalanche protection measures should be reduced at the cost of human safety. But the research finding should help us to understand the functioning of ecosystems where natural large-scale disturbances play an important role. In other ecosystems of the world, for instance fire or wind storms provide this natural disturbance. In near-natural regions like the Swiss National Park, these disturbances should hence be understood as part of natural processes, which are destructive in the short term but create valuable habitat for plants and animals in the long term.

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Protection despite ultilization – the biodiversity concept of the Ebrach State Forest Enterprise

by Ulrich Mergner and Daniel Kraus

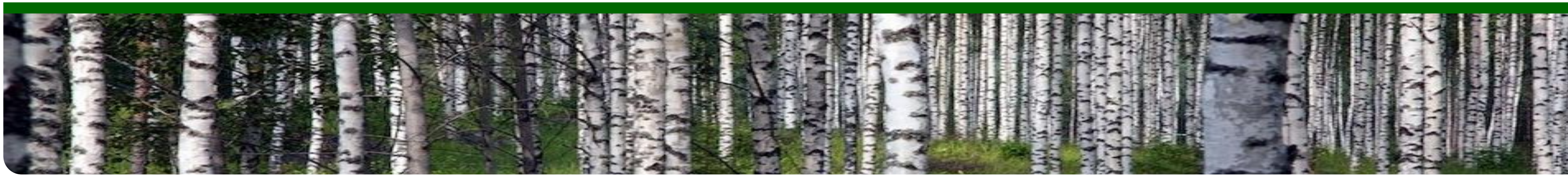
Germany - Ebrach State Forest Enterprise, located in the Keuper uplands of Franconia in Bavaria, is responsible for one of the most important beech forests in Germany in terms of conservation of forest dwelling species. Biodiversity conservation, especially of forest dwelling species, is central to its conservation concept with a special emphasis on saproxylic beetles of which approximately 480 species occur in the whole Steigerwald region. The conservation of those key indicator species group ensures the existence of all other species groups in our beech forests.

The Ebrach concept is often coined “protection despite utilization” and can be described as an integrative approach which strives to ensure a side by side of biodiversity conservation and timber production on the whole productive forest area of the state enterprise. To ensure a diversity of forest dwelling species, structural diversity and access to wood of living and dead trees is crucial. However, the dead wood concept is not only important for the conservation of forest dwelling species. Latest scientific evidence suggests that wood remaining on the area is crucial to ensure sustainable nutrient cycling in a forest: mainly cations like potassium, calcium, phosphor and magnesium are stored in wood and may serve as long-term fertilizer since they are released continuously and are thus available for tree growth again. Additionally, dead wood stores a lot of water while decaying or in the form of humus later on. In the light of a changing climate and forecasted prolonged drought periods this important attribute of dead wood may be also seen as a measure to secure the future of our forests.

The heart piece of the concept is a carefully selected and cross-linked system of both **abandoned** and **extensively managed** areas. Forest stands of high ecological value fall under abandoned forest area which comprises the following categories:

- 429 ha strictly protected nature reserves
- 403 ha step stone habitats
- 96 ha wet forest biotopes
- 6 ha of thermophilous dry forest biotopes
- 63 ha forest edges

Altogether 997 ha or 6% of the productive timber area are abandoned from forest management on a long term. In abandoned forest areas all timber use and silvicultural activities is waived, only measures to ensure public safety and to prevent forest damage are allowed.



These abandoned areas may serve as the basic safe-guarding of biodiversity and as donor areas for temporal colonization of habitat structures such as habitat trees and dead wood that automatically also occur in productive forests. Additionally step stone habitats as punctual and forest edges as linear elements complement the cross-linking of dispersed habitats.

Another important element of the concept is extensively managed areas. Extensification is mainly realized in old stands or younger stands with a high number of old trees. Currently, extensification of forest management activities affects 3.824 ha and is assigned to the following categories:

- 37 ha of class 1 forests (near-natural stands over 180 yrs)
- 3.062 ha of class 2 forests (near-natural stands between 140 and 180 yrs)
- 725 ha of class 3+ forests (near-natural stands under 140 yrs with high number of old trees)

Extensification in old stands is foreseen in class 1 forests as an abandonment of use of old trees to a large extent and as maintaining a persistent amount of 40m³/ha of dead wood in class 2 forests. In class 3+ forests all old trees which are remnants of the previous stands remain on the area, in all other class 3 forests a systematic build-up of dead wood is planned with the aim of having constantly 20m³/ha from the age class 100 onward. In the frame of the extensification of forest management it is also foreseen to have 10 habitat trees per hectare of the total productive area (i.e. 15.500 ha, without abandoned and non-wooded areas) that are allowed to grow old and live a completely natural life cycle including their decay after a natural death. Even if only 50 m^2 (a value ranging on the lower end) are assumed for the canopy cover of each tree crown, an additional 750 ha of abandoned area could be accounted for. Altogether 10% of the whole forest area would be left to natural processes and forest development then.
All other stands are managed according to legal requirements regarding nature protection and species conservation, e.g. it is already taken care during pre-commercial thinnings to ensure the persistence of sufficient future habitat trees.

The loss occurring through measures in the frame of biodiversity conservation mounts up to nearly 12.000 m^3 per year, including losses occurring in legally protected areas (nature reserves) as well as through abandonment of areas as step stone habitats. In abandoned areas the losses amount to 7.000 m^3 per year, whereas in extensification areas an amount of 4.700 m^3 per year occurs because of the build-up of dead wood.

The Ebrach concept also comprises nature conservation in open habitats as well as riverine habitats and buildings. Targeted conservation programmes for bats, crawfish or stag beetles are developed additionally.

Timber use and conservation of forest dwelling species is not necessarily a contradiction: standing and fallen dead wood in a forest enterprise that harvests more than 100.000 m^3 of timber

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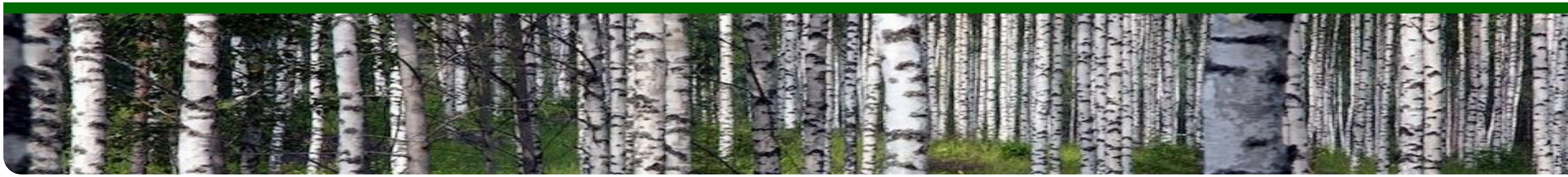


Conservation of lichens - Integration vs Segregation

by Heribert Bradtka

Germany - Epiphytic lichens belong to the prominent indicator groups for changes in forest ecosystems. Owing to a finely balanced but disturbance-prone symbiontic relation between fungi and algae, lichens react quicker and more sensitive to changes in site conditions and their direct environment than higher plants, fungi and animals. A main factor for the decimation of lichen biota besides the air pollution during the last decades is modern forestry practices. The conversion of broadleaved and mixed forests to coniferous forest types, clear cuts, site amelioration due to fertilizing and compensation liming, the use of biocides and the consequent removal of all fallen and standing deadwood lead to a severe impact on lichen synusia on a long term. The intensive coverage of forest roads, skidding roads and tracks, the extensive draining of wet forest sites and peat bogs as well as frequent and intensive thinning practices changed the stand climate which is so important for many lichen species and lead to an enormous decline of lichens.

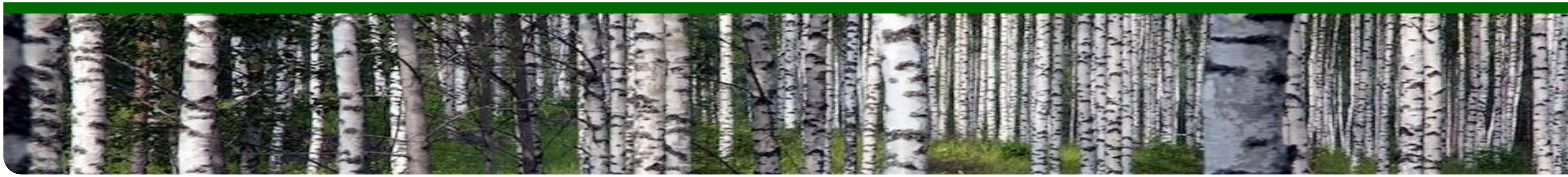
Another reason for the decline of lichen species is currently shortened rotation periods or early harvesting of economically important tree species. Those trees are usually removed in establishment and removal cuts long before specialized lichen species are able to colonize potential deadwood candidate trees. The successional stage for typical lichen of old-growth forests cannot be established or is interrupted abruptly and therefore, many specialized species lose their habitat and go extinct. A recent study in the National Park Bavarian Forest in Southern Germany suggests that old and near-natural forests have a significantly higher diversity of lichen compared to forests which experience a stronger influence of management. The sample areas in the managed forests contained 4 species on average whereas the samples in old forests exhibited 13 epiphytic species, a clearly lower diversity. An explanation for these findings may be that the old-growth phase of the managed forests is about 150 years shorter than in near-natural stands. The typical decaying phase of primary forests with a large proportion of deadwood and high biodiversity is completely lacking in those managed forests.

As a conclusion might be said that even a multi-functional forest management is not able to ensure a sustained diversity of lichen biota. For the conservation of epiphytic lichens segregative as well as integrative measures will be necessary:

Protected areas for specialists with rare habitats (**segregation**):

- Evenly distributed and cross-linked strictly protected nature reserves on a large scale in all forest associations
- New National Parks centered in the realm of natural beech forests as future habitats and as indispensible gene reservoir for relict species of primary forests.

Sclerophora peronella.This species of only a few millimeters in size is extremely rare in Europe and can only be found in larger protected areas (e.g. National Park Bavarian Forest) or in old, near-natural managed forests with a long continuity of ecological processes. It grows in bark scissures of decaying broadleaved trees (beech, sycamore maple). This lichen is threatened globally and in Germany close to becoming extinct (red listed species). Photo by L. Stridvall



Conservation standards in managed forests for habitat management for generalists (**integration**):

- Creation of diverse forest structures with a high proportion of broadleved species
- Minimal impact forestry with a reduced impact on changes of the meso-climate through selection cutting and other single-tree or small-group methods
- Increasing the amount of large diameter deadwood
- Permanent preservation of evenly distributed habitat trees and old tree groups
- Strict protection of old trees
- Maintenance of traditional silvicultural methods and other special sites
- Reduced reforestation of clear-cuts
- No large-scale fertilizing

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Conservation through utilization

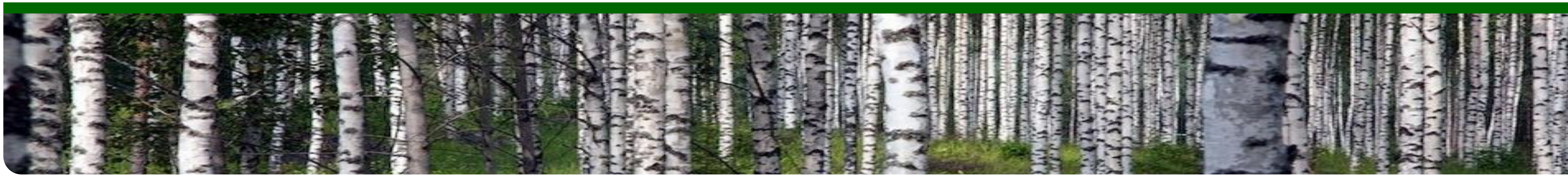
by Patrick Pyttel and Jürgen Bauhus

Germany - Coppicing is a traditional silvicultural management system applied all over the world. In rural environments of Central Europe, coppice stands often represent important elements of the cultural landscapes until today. In the past these forests were traditionally used for the production of firewood and various non-timber forest products. Across Central Europe this practice was abandoned in the first half of the last century due to socio-economic changes. Until today the abandonment of periodic coppicing led to passive transformation of the remaining stands. In this process the stands lose their typical coppice characteristics and increasingly resemble high forests. Subsequently the specific ecological value of coppice forests decreases and an important element of the cultural landscape gradually disappears.

Today managed coppiced forests (i.e. younger than 40 years) cover only 75,000 ha of Germany which represents 0.7% of the total forest area (BMELV 2004). One way of preserving the ecological, cultural and historical value of coppice forests would be to resume coppicing in aged coppiced forests which would additionally benefit light and warmth demanding species and can increase biodiversity.

Ongoing initiatives by the European Union (EU) call for a substantial increase in the use of renewable energy sources. It is aimed that by 2020 one fifth of the European energy consumption is from renewable sources. Of all renewable energy currently consumed in the EU, 47% is generated from forest biomass (i.e. wood and wood waste). The resulting demand for biomass as energy source has stimulated interest to resume coppicing of forests that had undergone this management in the past.

Although coppice forests are nowadays regarded as cultural heritage, potential source of fuel wood and known to be a valuable habitat for many plants and animal species re-activation of coppicing, particularly of aged coppice forests has proceeded slowly for various reasons. There are broad public concerns over the ecological sustainability fostered by the media’s focus on perceived environmental damage through clearfelling. Additionally, the fact that remnant coppice forests are often found on sites of low growth potential (steep slopes) makes coppicing economically difficult to justify. The often chosen (and less laborious) possibility of converting aged coppice stands into high forest reinforces the recent situation. One major obstacle for the resumption of coppicing is the wide-spread belief amongst forest managers and practitioners that oaks in aged coppice forests are not able to re-sprout vigorously enough from the stump to ensure successful regeneration and the assumption that coppicing causes a reduction in soil fertility.



Although most of these assumptions lack scientific underpinning some doubts are certainly not unjustified. However, the fact that coppicing is the oldest type of a regulated forest management can be considered as a clear indicator of its environmental compatibility. We found out that aged coppice forest can generally managed in accordance to the pan-European criteria for a sustainable forest management and that a carful utilization of aged coppice forest can preserve valuable and rare tree species like *Sorbus torminalis* and *Sorbus domestica*. For all concerned forest managers it is necessary to identify basic situations from stand to landscape level at which coppicing is economically justified and needed in order to meet conservation goals.

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Along the big rivers Rhine and Moselle aged coppice forests are dominating the landscape until today

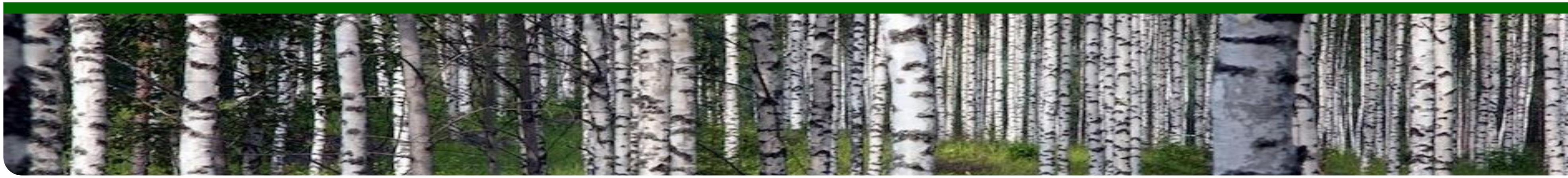
The Spöl Project: Application of Ecological Optimal Discharge

by Christopher T. Robinson

Switzerland - The Spöl is a canyon-confined river flowing through the Swiss National Park in southeastern Switzerland. The river originates from Livigno reservoir (Lago di Livigno) at Punt dal Gall dam (1805 m a.s.l., 130 m high, 540 m wide) on the Swiss-Italian border. The Spöl's discharge was reduced from 6–12 m^3/s (peak flows up to 120 m^3/s) before regulation to a constant residual flow of 1.45 m^3/s in summer and 0.55 m^3/s in winter.

Since 2000 this constant residual flow is interrupted by 1-3 experimental floods each year to test the potential for water reuse with respect to optimal ecological discharge. Optimal ecological discharge describes discharge pattern in terms of minimal base flow requirements and the timing, duration, magnitude and frequency of high flow and flood events most suitable for creating sustainable habitat conditions for resident biota under different management strategies and climate change.

The primary goal of the Spöl study was to test whether implementing a novel disturbance regime through experimental floods would cause a regime shift in ecosystem properties of a flow-regulated river, where the flow regime has been relatively constant for over 30 years. We predicted that ecosystem properties would change in response to the new habitat template of the river that resulted from a more variable flow regime. We evaluated this prediction by testing different population-, community-, and ecosystem-level hypotheses.



The floods had little effect on the physico-chemistry of the river because the water source (i.e., hypolimnetic release from the dam) was the same as before the floods. The floods reduced standing stocks of primary producers and eliminated attached moss on bed sediments. The floods scoured bed sediments and dislodged the moss within the first two years. The pre-flood stream bed was highly armored and the floods reduced armoring and increased the porosity of bed sediments. Although the Spöl is nutrient rich, the floods maintained low periphyton biomass by scouring filamentous algae from bed sediments. The experimental floods reduced benthic and transported organic matter in the river. Benthic organic matter decreased because the bed sediments were mobilized by the floods and benthic particulates were flushed from the system. Seston (particulate organic matter) levels decreased because the floods reduced standing stocks of benthic organic matter and periphyton that are the primary instream sources of seston.

The floods reduced benthic macroinvertebrate density, biomass, and taxon richness, resulting in higher proportions of smaller sized organisms. Disturbance-prone taxa such as large-bodied sessile taxa (e.g., *Gammarus fossarum*) decreased in abundance and disturbance-resistant taxa such as small-bodied, highly mobile taxa (e.g., *Baetis* sp.) increased in abundance from the floods. Lastly, measured properties initially became more variable and then less variable as the ecosystem regime shift occurred. The regime shift was observed by a change in mean values, along with an increase in variation (as coefficients of variation, CV) during the shift. The variation decreased after the shift, although it was still higher than before the shift because of the immediate flood effects that caused reductions in organism density and biomass. The regime shift was related to changes in the composition of benthic macroinvertebrates. Initial floods had a greater impact than later floods of similar magnitude because of the regime shift in ecosystem properties and changes in macroinvertebrate composition.

The Spöl flood project in the Swiss National Park documents that a flow regime management action can be used to improve the ecological integrity of a flow regulated river. The study further shows that a long-term perspective is necessary as these flow regulated systems often have multiple stressors influencing their ecology. The Spöl river, for example, is fragmented by upstream and downstream reservoirs that constrain the dispersal of aquatic invertebrates as well as influencing the fishery, thus affecting response trajectories in the river. Regardless, the overall ecology of the river has been improved by the adaptive management of the flow regime that integrates ecology with the socio-economic needs of the region.

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