habitat data and ecological prioritization tool (Zonation) allowed us to move from habitat specific cost-efficiency to multi habitat (67 different habitat types) cost-effectiveness. Instead of looking at habitat specific improvement costs per unit of area, we aimed to identify protected areas where restoration and management actions would provide largest increase in the total ecological value of the protected area network. The presented analysis demonstrates a systematic planning process to cost-effectively approach the 15% restoration target. In addition to identifying high restoration and management potential on maps, the systematic analysis method offers quantitative measures to investigate the trade-offs related to complex conservation decision making processes. Results of the analyses are currently used in real-life planning processes by the Parks and Wildlife Finland, governing the protected Natura 2000 areas in Finland.

O-15-Ecological engineering

O-15.1

Innovation and Challenges for Soil Bioengineering in a Changing World

André EVETTE[1], Fanny Dommanget[2], Renaud Jaunatre[2], Vincent Breton[2], Alain Recking[2], Paul Cavaillé[2], Catherine Lavaine[2], Solange Leblois[2]
[1]Irstea, SAINT MARTIN D'HÈRES CEDEX, France

Riverbanks are assuming a large number of important ecological functions: biodiversity support, resistance to invasion, ecological corridors, biomass production, water purification, temperature regulation, flood control, and recreation. Besides hard engineering, soil bioengineering techniques for riverbank protection are very old nature based solutions and have been used for centuries throughout the world. First thought of mimicking nature to fulfil the function of erosion control, soil bioengineering techniques are now also formed to assume some of the other important ecological functions of riverbanks.
Using mostly concepts and tools from restoration and functional ecology (but also from engineering and hydraulic), we conducted a set of studies and experiments (in greenhouse and on real works) that aimed at characterising and maximising the contribution of riverbank bioengineering techniques to some of these ecological functions, including biodiversity support, resistance to invasion, resistance to drought and erosion control.
We assessed the capability of several types of managed and mineral riverbank to support both common (terrestrial plants and beetles, macrobenthic communities) and endangered biodiversity (*Myricaria germanica* and *Typha minima*). Regarding resistance to invasion, we studied the potential of bioengineering techniques to resist to the pressure of an invasive rodent (*Myocastor coypu*), and to outcompete Japanese knotweeds. Summer drought should increase with climate change, and is a major threat for bioengineering success; we then studied the resistance of *Salicaceae* and *Tamaricaceae* populations to harsh drought. Finally we worked to maximize erosion control function of these techniques by implementing bioengineering works in steep slope rivers (5-10%), and by assessing past shear stress resistance to flood.
Our results show that soil bioengineering techniques can be definitely thought as a nature based solution for assuming both erosion control and main ecological functions of riverbanks, and are thus promising in the achievement of these complex human goals in a context of global change.

O-15.2

Long-term effects of liming on soil microarthropods in forest soils

Henk Siepel[1], Roland Bobbink[2], Arnold Van den Burg[3]
[1]Radboud University, NIJMEGEN, Netherlands
[2]B-Ware, NIJMEGEN, Netherlands
[3]BSP producties, EDE, Netherlands

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Henk Siepel, Roland Bobbink, Arnold van den Burg
Liming is used as a restoration measure for the remediation of acidification due to atmospheric deposition of sulphur and nitrogen (NO_x and ammonium) compounds. In 1985 and 1986 lime has been applied in a Dutch Scotch Pine forest stand on a mineral poor and weakly buffered soil. In a randomized block design 4 levels of liming have been applied. Each treatment has been replicated three times. Liming quantities were: 3, 6, 9 and 18 tons per hectare and an untreated control, so in total 15 plots. Plots are $550m^2$ in size and were sampled in October 2017, 32 years after application of lime treatments. In each plot 4 samples were taken following a standard procedure. All specimens have been identified to the species level and grouped into life-history strategies and feeding guilds. Recent results from other ecosystems on dry mineral poor soils revealed P limitation under continuous N deposition and acidification, including the loss of the soil buffering capacity and release of aluminium. Liming however, may limit P availability even more. We observed not only significant differences in soil chemistry, litter stratification, and the forest understory, but also in density and species composition of soil microarthropods. The long-term consequences of liming as restoration measure on mineral poor soils will be discussed.

O-15.3