Safety by nature: development of erosion resistant and species-rich river dyke vegetation through adapted management

Bart Vandevoorde[1], Piet Thys[2] and Erika Van den Bergh[3]

[1] Research Institute for Nature and Forest (INBO), Belgium, Bart.Vandevoorde@inbo.be
[2] De Vlaamse Waterweg, Belgium, Piet.Thys@vlaamsewaterweg.be
[3] Research Institute for Nature and Forest (INBO), Belgium, erika.vandenbergh@inbo.be

Dykes are constructed as a flood control measure. However, when thoughtfully designed and managed they represent considerable ecological potential as habitat and corridor at the same time. Grasslands on the dense network of dykes in Flanders (Belgium) form a continuous grassland of more than 1,000 hectares and will expand even more in the future by the implementation of the actualised Sigmaplan. Nowadays, this network of dykes shows a wide range of vegetation types, erosion resistance, and above-ground biomass (considered as a proxy of maintenance cost, the lower the above-ground biomass, the lower the maintenance cost). We researched the relationship between vegetation patterns and abiotic conditions. From there, we proposed design and management guidelines to optimise the combined flood control and ecological functions of the dykes under acceptable maintenance costs. These guidelines are then spatially specified in a proposed management plan for the dykes. Based on 219 vegetation plots, five types of grassland vegetation were distinguished and described. In each of these percentages of cover (as a measure of erosion resistance), above-ground biomass (as a measure of maintenance cost), and soil nitrogen and phosphorus contents (as a measure of trophic condition) were measured. Species-rich grassland and species-rich *Arrhenatherum*-grassland combine the best erosion resistance with low maintenance cost and high ecological value. Therefore, they are proposed as target vegetation types for the top- and landsides of the dykes. Guidelines for maintenance management are described for the target grassland vegetation types, as well as guidelines for restoration management towards the development of the target vegetation types from species-poor *Arrhenatherum*-grasslands, deteriorated *Arrhenatherum*-grasslands, and stinging nettle vegetation. The proposed management measures are both general (concerning fertilisation, use of pesticides, breeding birds, entomofauna, and rare plant species) as well as vegetation specific (mowing, grazing). A vegetation map has been created and then conversed into a management proposal. For every mapped unit, management measures follow the implementation of the general guidelines according to the specific situation. A monitoring plan to assess the evolution of the distance to target vegetation is proposed to allow for adaptive management.

Summary

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Dykes are constructed as a flood control measure. Nowadays, this network of dykes shows a wide range of vegetation types, erosion resistance, and above-ground biomass. We researched the relationship between vegetation patterns and abiotic conditions. Species-rich grassland and species-rich *Arrhenatherum*-grassland combine the best erosion resistance with low maintenance cost and high ecological value. From there, we proposed to design and management guidelines to optimise the combined flood control and ecological functions of the dykes under acceptable maintenance costs. These guidelines have then been spatially specified in a proposed management plan for the dykes.