Peatland Recultivation - a Case Study of a Commerical Tree Plantation in a Former Peat Extraction Area

Establishment of a tree plantation on a cutaway peatland in the central part of Latvia

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The Aim and Scope

Testing of the tree cultivation as an after-use type for cutaway peatlands, and identification of the most effective, optimal dose of biological fertilizer - wood ash – for various tree species was the aim of designing this experimental site.

Introduction

In countries where peat extraction is of economic importance, planting or sowing of trees as an after-use of former extraction areas is considered an economically, viable and environmentally friendly solution. It is more reasonable if the area was covered by forest before the peat bog formed since during extraction the layer containing ancient tree remains is reached.

If the peat extraction is continued while the drainage system is operating, the rare cannot be restored. Silta, Modris Okuneva, Ginta Spalva, Andis Lazdina, Kniaps Makovskis (2014). The peat layer remaining after the extraction is likely to have unbalanced nutrient element composition and wood ash can be used for soil improvement, liming and nutrient input (Mandere et al., 2010; Kiekkaži et al., 2013; Olo et al., 2017).

Vegetation development after spreading of wood ash in the topsoil changed rapidly - ground vegetation was formed; herbaceous plants took root. A total of 33 - 53 taxa depending on the dose of fertilizer were recognized and counted. In addition to herbaceous plants, a natural afforestation process began. Naturally occurring trees - Betula pubescens, B. pendula, Populus tremula var. Salix spp. including 35 species. In areas where no additional nutrients with wood ash were applied, the vegetation was solitary or in groups, lower species were counted.

Methods

Recultivation of the cut-away peatland was performed in the spring of 2017 on a 0.1 hectare area (97.42x4.71 m, 23.4°53.9'61.7). Before planting the collection of trees the adjacent ditches were cleaned. After removal of the vegetation from the sides of the ditches, which are mainly consisted of trees and reeds, wood ash was spread. For the liming and fertilization the choice of wood ash was made due to its high pH and it has a skin on the ones recommended in Finland and Sweden 5

Methods

Fertilization of the waterlogged and un-fertilized control plots (Figure 1). With P. sylvestris can be seen in Figure 2.

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Since the cutaway peat layer in demo area is thicker than 30 cm and the water level is adjusted using ditches, according to the forest site type classification in Latvia such plantation corresponds to the type - forests on drained peat soils. Depending on the composition of planted and naturally occurring tree species, it is expected that in the future these woodlands will correspond to forest site types Myrtillus turf. med. or Quercusfuscafurf. med. with their characteristic vegetation (Zalītis, 2006).

In fields where the soil was not improved, the planted trees were less vigorous during the second vegetation season. Leaf and needle color indicated a lack of macronutrients, so that additional nutrient input was necessary in order to keep trees in the plantation.

If the field ditches and collection ditches in the plantation areas are not maintained in the future, the development of conditions characteristic for forests on wet peaty soils. Sparsiatiosa or Caricinosphragmosis type woodlands are expected and the corresponding forest types will probably develop. Current soil density can be seen in Figure 3.

Conclusions

Significant differences in tree height and vitality were observed after the second growing season. To keep the unfertilized trees alive, fertilization is needed.

After the use of wood ash the peat layer is enriched with P, K, Ca, Mg and pH levels increased depending on the wood ash dosage used.

A variety of vegetation is recorded in the first and second year after wood ash is applied.

The plantation will provide further economic benefits, promote soil shading and the following long-term carbon sequestration in tree biomass.

Keywords
Cutaway peatland, recultivation, natural vegetation, Populus, P. sylvestris, Alnus glutinosa, Betula pendula, Populus spp.

Table 1. Difference in soil acidity and P, K, Mg and Ca content in the soil two years after the fertilization with wood ash fertilization

<table>
<thead>
<tr>
<th>Wood ash applied</th>
<th>pHH2O</th>
<th>P kg/ha</th>
<th>K kg/ha</th>
<th>Mg kg/ha</th>
<th>Ca kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>3.5</td>
<td>16.2</td>
<td>0.1</td>
<td>39</td>
<td>1.1</td>
</tr>
<tr>
<td>5 t ha-1</td>
<td>3.5</td>
<td>16.2</td>
<td>0.1</td>
<td>42</td>
<td>1.2</td>
</tr>
<tr>
<td>10 t ha-1</td>
<td>3.5</td>
<td>16.2</td>
<td>0.1</td>
<td>45</td>
<td>1.3</td>
</tr>
<tr>
<td>15 t ha-1</td>
<td>3.5</td>
<td>16.2</td>
<td>0.1</td>
<td>47</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Figure 1. Average weight and diameter of trees and shoots. A - shoot; B - shoot; C - shoot; D - shoot; E - shoot; F - shoot; G - shoot; H - shoot; I - shoot; J - shoot.

Figure 2. Scots pine tree seedlings in the study plots with various dose of wood ash fertilization (0 t ha-1, 5 t ha-1, 10 t ha-1 and 15 t ha-1).

Figure 3. Soil density in the experimental plot. Measurements marked at the ditches and the contour map made by using the measured neighbor method.

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