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Processes in Plant-Soil System of Coastal Grasslands Induced by Management Practice

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Processes in plant-soil system of coastal grasslands induced by management practice

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Key words: productivity, soil organic carbon, restoring of coastal grasslands

Introduction Coastal grasslands, on the west coast and islands of Estonia, are widespread but during the last 50 years reeds and bushes have overgrown the area, causing decrease in open coastal areas. The cause of diminishing coastal grasslands in Estonia is changes in agriculture. Agricultural practice has switched from extensive land use to intensive use to ensure the stable quality and increasing productivity of fodder. The quality and yield from coastal grasslands is highly variable, dependent on soil properties, weather conditions, and plant associations, as well as on management practice. Management in coastal areas comprises mostly grazing but also cutting in some areas where the conditions for use of machinery are suitable. The goal of the work was to investigate the influence of management on coastal grasslands plant associations and soil characteristics.

Materials and methods In the West-Estonia coastal district 14 areas were selected with regard to coastal grassland management: continuously managed, restored, and not managed for long (for at least 15 years). Sample squares (20 in every 10 meters) were placed in an transect to investigate plant association parameters: botanical composition, species density, and productivity. By soil development, a depth of humus horizon was measured, and samples were taken to analyse the content of organic carbon (by Tjurin method). The stock of carbon was calculated according to the bulk density, depth of humus layer and content of organic carbon.

Results and discussion Soil- and biomass-forming conditions will change markedly based on management practices, cutting, or grazing. The trampling of cattle and their consuming biomass will change the amount of litter, the microclimate, soil moisture, and air conditions—the humification process will accelerate. Plant associations dominating in managed grasslands were *Deshampsia-Caricetum nigrae*, *Elytrigietum repentis* and *Junco-Claucetum*. By restoring of coastal grasslands the changes in plant cover are fast, the biomass production will be lower mostly due to disappearing of plant associations having huge biomass like *Phragmitetum australis* and *Festucetum arundinaceae-Phragmitetum* prevailing in not managed grasslands. The number of species was highest on managed grassland and lowest in not managed whereas the restored grassland stayed between of them. Biomass productivity was similar for managed and restored grasslands (3 t ha⁻¹) and was much higher in not managed grasslands (6.3 t ha⁻¹) (Figure 1B).

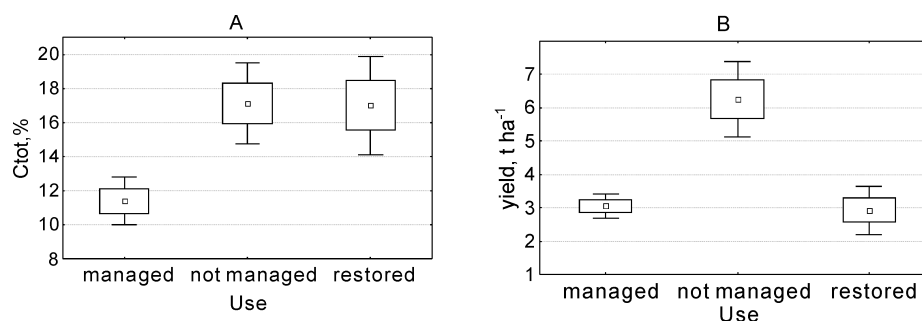


Figure 1 The content of organic carbon in top layer of coastal grassland soils (A); and the plant biomass (yield t ha⁻¹) (B) by different management regime; mean, mean ± SE, mean ± 1.96* SE are presented on the figures.

By restoring the management practice in coastal grasslands the speed of changes in soil characteristics is quite slow despite to remarkable reduce of organic matter added to the soil. The content of organic carbon in topsoil shows similar values (17%) by not managed and restored grassland being significantly higher as in managed grassland soil (11%) (Figure 1A). Wet (stagnic) conditions are not favourable for organic matter mineralization and therefore these areas are restoring carbon. The stock of organic carbon in managed grasslands reached up to 67 t ha⁻¹ where the share of carbon accumulated to the top layer of soil was 66%. Carbon sequestration was similar for not managed (136 t ha⁻¹) and recently restored grasslands (122 t ha⁻¹). The share of carbon in top layer was between 24 and 30%, so that mostly the carbon was stored in deeper horizons in soil profile.

Conclusions Restoration of coastal grasslands will have quick influence on aboveground biomass and number of species, changing it more similar to the managed grasslands. Soil characteristics have not so quick response to the restoration of management, as the most investigated indicators stayed similar to the not managed grasslands.