Ecosystem services in short rotation coppice in agricultural land in Latvia.

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Agroforestry for the transition towards sustainability and bioeconomy
Abstract
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Abstract

Global efforts to mitigate climate change and reduce greenhouse gas emissions from fossil fuel combustion, places an expanded use of renewable energy high on the political agenda (Sridhar et al., 2014). There is an increased demand in the European Union for wood supply, and particularly for bioenergy (Nabuurs et al. 2014). Furthermore, the European Union has set a target to increase the contribution of renewable energy up to 20% of total supply till 2020 (European Commission, 2014). Implementation of short rotation tree plantations (coppices) in agricultural land is an agroforestry method offers approach to replace fossil fuels as an energy source (Weih and Dimitriou, 2012) with a potentially carbon neutral supply of energy (Sridhar et al., 2014). Increased supply of wood resources for bioenergy can be ensured by planting fast growing tree species such as Alnus incana, Betula pendula, Salix spp. and *Populus tremuloides* x *Populus tremula* in a short rotation coppice system in agricultural land. While the main benefit of these plantations is renewable wood energy, such type of agroforestry systems are believed to provide also a number of other ecosystem services.

The research object (experimental plantation) was established in agricultural land in the central part of Latvia (in Skriveri district, 56°41 N and 25°08 E) in hemiboreal region in the spring of 2011. Trees were planted in former arable land used for seed production of annual crops. Total area of research object was 16 ha. Soil types according to the World reference base for soil resources 2006 are *Luvic Stagnic* Phaeozem, *Hypoalbic* and *Mollic Stagnosol, Ruptic, Calcaric, Endosiltic*. The dominant class of soil texture is loam and sandy loam at 0–20 cm depth and sandy loam at 20–80 cm deep. The research object was fenced in autumn 2012. Soil was ploughed last time in 2011. Within the study we evaluated ecosystem services – benefits provided by non-woody plants ingrown naturally in an experimental short rotation coppice plantation where fast growing tree species (*Alnus incana*, *Betula pendula*, *Salix spp.*, *Populus tremuloides* x *Populus tremula*) were planted in rows Trees between grasses finally managed as intercrop agroforestry system. Planted trees and naturally established meadow plants were cultivated as agroforestry. The first vegetation survey was conducted in summer 2014 (in the third year after establishment of experimental plantation), the second survey was conducted in autumn 2015 (in the fourth year after establishment of experimental plantation).

In the studied short rotation coppice plantations established in agricultural land, meadow plants dominated in the herb layer, in total 98 vascular plant species were recorded. Medicinal plants (e.g. *Achillea millefolium*, *Aegopodium podagraria*) and forage for livestock feed (e.g. *Trifolium pratense*, *Agrostis tenuis*) were indicated as the main provisioning ecosystem services provided by the herb layer.

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The most suitable short rotation coppice plantations for forage were *Betula pendula* and *Salix spp.* plantations. In total 34 forage plant species were indicated in the research object, 29 of them

found in *Salix spp.* plantations. Medical plants were more frequent in *Salix spp.* plantations. A large number of the dominant herbaceous plant species (in total 20 different species) in the research object were nectar plants (e.g. *Centaurea jacea* and *Trifolium arvense*) which flowered from May till 1September coinciding with the entire period of nectar collection by bees. Another important regulating ecosystem service provided by the short rotation coppice plantations was N fixation by legumes. In total 12 different species of legumes, which improve soil conditions due to association with N-fixing bacteria, were found. The amount of the plants suitable for phytoremediation is similar in all plantations. The continuous plant cover of coppice plantations is expected to improve soil quality (organic matter and nutrient content, aeration).

Activities are continuing thanks to in European Development fund support where set of Salix alba agroforestry systems will be established during next years, as well seminars for local farmers including visits of experimental demo fields -new ones as operated since 2011 will be organized as project "Installation of innovative white willow-perennial grassland agroforestry systems fertilized with mixtures of wood ash and less demanded peat fractions" (Nr. 1.1.1.1/19/A/112).

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Figure 1. Agroforestry system below canopies of trees