

Short Rotation Woody Crops (SRC) plantations for local supply chains and heat use

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Identification of suitable growing areas SRC in the Zlín Region

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1. Introduction

Growing trees on agricultural land does not have such tradition in the Czech Republic as in southern Europe, for instance. The trend of sustainable agriculture involves less intensive farming and promoting practices beneficial for the climate and the environment. Growing SRC is among these procedures. Farmers may implicate SRC in plans restructuring the production, but they suffer from lack of the practical experience and comprehensive know-how. Generally information about real yields of biomass is missing as well. There are primarily commercial presentations provided by the suppliers of planting material SRC now and then, though.

Necessary steps have to be undertaken to implement an effective model for sustainable biomass production which will be acceptable across all relevant groups in the Czech population:

- Establish a new and comprehensive awareness in the field of SRC
- Disseminate truthful information
- Present best practices in their complexity

2. List of areas under consideration

Based on the research undertaken in previous steps, six areas of the Zlín Region were considered for the SRC cultivation in the Zlín Region. The considered areas were

- Uherský Brod – Bánov
- Bojkovice
- Holešov
- Hostětín
- Jarcová
- Slavičín – Brumov-Bylnice

After the proper analysis described in documents made prior to this strategy (SRC Potential in the Zlín Region, Strategy for sustainable SRC in the Zlín Region, Implementation concepts for SRC production in the Zlín Region) two areas were selected as the two most promising areas for project implementation establishing plantations for energy use:

a. Uherský Brod – Bánov

b. Slavičín – Brumov-Bylnice

3. Evaluation of each area in the Zlín region

While respecting the basic starting points of the local approach to the use of alternative energy sources, five main aspects of sustainability of production plantations for the Zlín Region were set out:

- Recoverability of resources
- Minimizing negative impacts on environment
- Sociological and economic stability
- Synergy with the landscape character of the region
- Legislative framework and know-how

Each of these aspects has specific manifestations, which are described below.

Recoverability of resources

Management of SRC plantations is based on a system that is very similar to that used for centuries of farming in coppice forests. Above-the-ground biomass is removed during the harvest in regular intervals. New growth arises on the stump due to well-developed root system, and new biomass is being developing. While the restoration was not paid any care in coppice forests, a good management of plantations includes the necessary care to preserve soil fertility and thus supports high biomass yields and the long-term production is still derived from the same plants that were planted only once. Lifetime of well-maintained plantation is about 20 years. The land is possible to restore after the completion of the profitable production of biomass. It is also possible to plant a new plantation and continue in production this way.

Minimizing negative impacts on the environment

Negative impacts are those that could impair the quality of any component of the environment. The following section describes the impact of plantations on individual components of the environment and improving their quality due to good management practice in plantations. To date, no known studies are showing negative impacts of any of existing plantations.

Soil

Soil is among the most important components of environment. Soil degradation leads to significant restrictions on the ability of soil to produce crops. The reason of the land degradation is mostly a bad management – removal of natural vegetation, incorrect rotation, no-tillage technology, frequent use of heavy machinery etc. Degraded land has impaired physical and chemical properties, it is susceptible to water and wind erosion. In the Czech Republic the largest proportion of highly vulnerable soil erosion has long been recorded in the Zlín Region. Europe compliance control system for farmers (Cross compliance) was introduced because of the need to protect soil and standards of Good Agricultural and Environmental Conditions (GAECs) and Statutory Management Requirements (SMRs) were established. Extension GAEC 2, focusing on limitations of wide cultivation of crops on soils at risk of erosion slightly, is effective from 1st July 2011.

The measures to minimize the negative impact on the environment need to be included in the preparation of projects establishing SRC plantations. It is the most important aspect of sustainability of plantation from any perspective. Plantations can be based on soil of slight erosion, however, erosion control measures need to be considered. Properly developed plantation becomes a stabilizing element in the agricultural landscape, which will fulfill the long-term erosion control function. Although this leads to a slight reduction in production acreage, non-productive importance of growth SRC is increasing at the same time. The value of this importance can be calculated by price of safeguarded land.

The soil in plantations is regularly mechanically cultivated in depth due to a weeding and aeration. Unlike conventional crops after the foundation of SRC plantation any pesticides are not used in the coming years. Every year all the litter from trees decays in soil. It improves the physical and chemical properties of the soil. At the beginning of each new growing cycle, which is usually four years, it is possible to add nutrients to the plantations by fertilization based on soil analysis.

Along with proper selection of land, crops and compliance with the recommendation of cultivation technologies there is no risk of negative impacts on the quality of agricultural land. Conversely, plantations perform ameliorative function, because they are permanent crops with less intensive management in terms of categorization of types of land.

Water

In the Zlín Region there is a lack of functional elements for intensively cultivated agricultural landscape. These elements facilitate retention and water infiltration. Rainwater is drained before it is used by plants and crops suffer from drought. Green belts have been removed in the past when there was a land consolidation into large plots. SRC will create the missing element of ecologically stable areas. Improving land management becomes fully functional part of the European System EFA – Ecological Focus Area in accordance with long-term trends. There is no risk of negative impacts on the quality of ground water on plantations with proper management.

Forest ecosystems

In the Zlín region only forest harvesting residues are used as biomass energy. Removal of this biomass from the forest has its quantitative limits. The logging slash must always remain in the forest. The decomposing forest biomass enriches the soil with nutrients and creates a favorable microclimate for activity of soil microorganisms. Rising demand for biomass would increase pressure on its acquisition of the forest. Establishing SRC plantations and targeted cultivation of biomass creates a balance between supply and demand plus chips from plantations has greatly improved the quality parameters of chemical composition, therefore, it is better to burn than often used waste from felling coniferous forest.

Biodiversity

The growths of plants help to maintain and enhance biodiversity landscape, provide natural shelter to a number of animal species, creating stable niche than field crops and thereby contribute to improving the ecological stability of the area. In protected areas specialized institution must assess the impact of plantations. This institution has the results of an inventory of the presence of protected species of plants and animals. If all measures required by the legislation on the protection of biodiversity are followed, there is no risk of negative impact in this sense.

Protection of existing resources

In the Zlín region there are various natural sources of drinking water. Absolute priority is keeping of present protection regime in all actions in the landscape, including the growing of SRC.

Farmland is also a resource that is irreplaceable. In the Zlín region up to 1108 ha of arable land can be used for growing energy crops, including tree species to be still in line with maintaining the food security. This data are derived from the Biomass Action Plan prepared for the Czech Republic which states that the Czech Republic needs 2.07 million ha of arable land for food production and 977,000 ha can be made available for the production of energy crops. However, this “expendable” area involves a large amount of land that is unsuitable for SRC and their cultivation would not bring the expected results.

In compliance with the relevant legislative measures there is no risk of negative impacts of plantations of SRC on the quality of existing natural resources.

Socio-economic stability

An important aspect of the sustainable biomass production from SRC plantations SRC is the economic sustainability of regional projects. As this is a completely new element in the economy with long-term return high initial investment, state efforts to ensure support for this field. It helps partially to a positive perception of this issue by the public. However, the Czech agriculture is relatively conservative and new approaches are being developed very slowly.

Only requirements for restructuring of agricultural production are beginning of the way towards diversification in production and the introduction of alternative farming methods.

To succeed, it is important to present SRC plantations of SRC as:

- Social investment
- Social protection of the rural population
- Way of increasing the energy self-sufficiency of the Zlín region

Energy utilization of woody biomass in the Zlín region has a long tradition and in recent years is the increase trend due to increase in prices of other energy sources. Small landowners have already begun with cultivate of SRC for their own use. This natural evolution is one of the prerequisites for sustainability.

Another prerequisite is the inclusion of SRC cultivation among the supported way of farming on agricultural land not only in terms of production, but also in terms of meeting environmental function.

SRC growers receive financial contribution from direct payments to farmers – unified rate to the surface, so-called SAPS (Single Area Payment Scheme) since 2004. From 2015 it should be implemented in the Czech Republic so-called greening (EFA – Ecological Focus Area, statute no. 1307/2013), that will also include SRC. When applying the rules of greening growers of SRC will obtain relevant annual allowance as payment for the fulfilment of the conditions of agricultural practices beneficial for the climate and the environment.

Synergies with the landscape character of the region

In the Zlín region there are very few modern urban agglomerations and the majority of the population living in the countryside retains a close relationship with traditional local values, including the maintenance of the landscape. This strongly supports the efforts of long-term activities of the two protected areas – the White Carpathians and the Beskids. Successful development of growing biomass from SRC is therefore to some extent dependent on the mutual respect of all entities whose activities may intersect in this area.

SRC plantations are the culture that provides incomparably more non-productive effects than conventional agricultural crops. At the same time they are not permanent vegetation such as forest culture. They become the element that complements and helps to create a mosaic landscape, strengthens the role of elements, which partially eliminate the negative impact of monoculture field.

Legislative framework and know-how

Growing of SRC on agricultural land is gradually gaining the necessary legislative framework in the Czech Republic. Particular phases of production and distribution of the planting material are controlled by the law no. 219/2003 on circulation of seeds and seedlings. Establishment of plantations is regulated in terms of nature protection by the law no. 114/1992 on nature and landscape protection, which restricts the cultivation of derivative species in protected areas. State administration uses the list of recommended tree species for its decisions; this list includes a relatively wide range of native and derivative species, including several cultivated varieties. A specific problem in the Czech Republic is insufficient research in this sphere, which would be implemented in practice.

Other validated species, characterized by a high biomass production would be acceptable at the same time from the nature conservation point of view. Sustainability of the cultivation of

SRC requires increase knowledge by consistent and long-term verification of the suitability of other species and varieties of trees, which will be a guarantee of the safety biomass production in the long term period.

Knowledge and improving of know-how for plantation management is a prerequisite for successful cultivation of appropriately selected species for the specific conditions of the region as well as a prerequisite for the sustainable economic viability of all projects.

Prepared amendment of Act no. 334/1992 Sb. on protection of agricultural land is expected to define a maximum period of growing one kind of SRC on farmland, maximum age of harvested biomass, and directions for land restoration after completion of the cultivation of biomass. Beneficiary of SAPS subsidy is obliged to respect the maximum length of the harvest cycle, which is determined by regulation of the Ministry of Agriculture. It is 5-8 years for each species of poplar. The reason is the sustainability of agricultural production in a complex concept.

In the Czech Republic it is necessary to obtain the state administration approval before the establishment of any SDR plantations, especially from authorities of landscape and nature protection. The law is providing this way a qualified assessment of the elementary risks for all components of the environment resulting from projects.

4. Evaluation of the selected areas in the Zlín region

4.1. Area 1 - Uherský Brod – Bánov

The area is situated the altitude of 250-350 m. Climate region is slightly warm, slightly muggy. Annual precipitation represents 594 mm, in the growing season it is 366 mm of precipitation. The average annual temperature is 9.1°C. Predominant soils are medium creditworthiness, clay and till, in the vicinity of watercourses are alluvial soils. The center area is the town Uherský Brod (49°1'N; 17°38'E), greater community Bánov is 8 km from the Uhersky Brod. Area includes the land register of smaller communities as Šumice, Nezdenice, Suchá Loz a Nivnice. There are approximately 22,000 inhabitants. Area 1 meets the selected criteria for assessing the potential of the growing SRC.

It is suitable for the cultivation of all cultivated and domestic poplar species, for example:

Populus maximowiczii x Populus nigra 'MAX 4'

Populus x euroamericana 'AF2'

Populus x generosa 'AF8'

Populus x generosa x Populus nigra 'Monviso'

Populus nigra.

Projected revenues may be around 12 tones of dry matter/ha/year.

The recoverability of sources

Natural conditions in the area allow highly efficient cultivation of biomass on agricultural land. It is important to follow the right technology and perform the biomass harvesting timely and recovery of growth at regular intervals. At the end of the crop lifetime the land reclamation is carried out by standard technology and replanting plantations or planting other crop. Lands remain the farmland eventually.

Minimizing the negative impacts

Natural conditions allow the cultivation of all kinds of SRC. The choice of species is not necessary to subordinate to requirements of environmental protection. With a good management there are no negative impacts on soil and water or on species diversity. In areas with intensive agricultural production there are long-term problems with soil erosion, which will be reduced thanks to the planting of SRC plantations. Vegetation of SRC improves drainage conditions in landscape, increases the infiltration of rainwater into the soil. Larger area plantings could improve the microclimate of the landscape.

Socio-economic stability

In the area there is a potential private investor with a long-term outlook to grow SRC on the potential area up to 500 ha of farmland. Planting 20 ha plantations started around Bánov in 2012 and continued further with another 20 ha in 2014 in the altitude of 350 m. Depending on the situation on the local biomass market and other circumstances there is a potential for other SRC plantations in this area and the EAZK will focus to promote and initiate this development in next months and years.

New jobs to ensure plantation maintenance would be created in cooperation with local farmers. The production of wood chips and wood would be designed for the regional market as the part of the strategy to increase the energy independence of municipalities as well as of the whole Zlín region.

Synergies with the landscape character of the Zlín region

The explored area is currently used for large-scale agricultural production with all its negative impacts as well as with a minimal amount of landscaping elements which would reduce the impact of agricultural monocultures on the environment. New SRC plantations would create the new element in the landscape of mature vegetation which would become a new integral part of the landscape mosaic and natural corridors for wildlife migration.

Legislative framework and know-how

The investigation of the suitability of vegetation has already been done in the area by state administration authorities related to the nature conservation with a positive result. Pilot project is feasible without significant legislative restrictions.

This project on plantations of SRC would be unique in its scope in the region. So it is important to present a demonstration of the best ways of establishing and maintaining SRC plantations. Optimally it should include planting of several species of SRC to ensure diversity in plantations.

4.2. Area 2 - Slavičín and Brumov - Bylnice

The area is situated at the altitude ranging from 350 to 450 m. The climate of region is slightly warm, slightly damp. Average annual rainfall is 600 mm. The average annual temperature is 7°C. Prevailing main soil units are cambisol (brown soil). The area consists of two towns Brumov-Bylnice and Slavičín, other eleven villages are located here as well.. Altogether approximately 20,000 residents are living in this area. Area 2 meets the well the selected criteria for assessing the potential of the growing SRC.

Domestic species would be the preference in this area. They are *Populus nigra*, *Salix alba* and together with long-term grown hybrid poplar clones *MAX (Populus maximowiczii x Populus nigra)*, which achieve higher biomass production than domestic species (poplar black) and they are tolerant to a colder climate.

The recoverability of sources

Natural conditions in this area allow highly efficient cultivation of biomass on agricultural land. It is important to follow the right technology and perform harvesting of the biomass timely and recovery of growth at regular intervals. At the end of the crop lifetime the land reclamation is carried out by standard technology and replanting plantations or planting other crop. Lands remain the farmland eventually.

Minimizing the negative impacts

In this area there is not available fund of unused arable land for cultivation SRC. A large amount of land is grassed and registered as permanent grassland or pasture. The planting of SRC can be carried out only on places with minor surface of area up to 5 ha, for example on the unused pastures. Suitable cultivation technologies including the establishment of erosion control will be introduced to ensure the protection of soil from erosion as well as the protection of drinking water sources. Vegetation of SRC will improves drainage conditions in the country, increase the infiltration of rainwater into the soil. With a proper management of plantations there are no negative impacts on soil and water here.

Natural conditions allow the cultivation of main types of SRC, especially poplars. The selection of particular species will need to comply with requirements of nature protection

authorities. Impacts on biodiversity must be assessed in this case by specialized Administration of the White Carpathians.

Socio-economic stability

In this area there are already four points of consumption of biomass for energy purposes – two central heating system supplying with heat the buildings in Slavičín and Brumov-Bylnice municipalities and two big boiler-rooms supplying with heat private companies that still use waste biomass from forest exploitation and wood processing.

The aim of the foundation of SRC plantations is create the stabile supply of purposeful grown biomass from SCR with better chemical properties for combustion. Another alternative use of SRC is growing it for the self-supplying production of firewood for households which is the country's still more desired commodity for local heating. Growing SRC would serve as replenishing energy mix in this economically weaker area of the Zlín region. The well-developed content of this energy mix will rise in importance hand in hand together with constantly increasing of the prices of fossil fuels.

Currently, the usage of agricultural subsidies for the maintenance of grasslands is economically advantageous for the owners and renters of land. Where the subsidies provided are in adequate amount for farming in less favoured areas. Increased awareness of the benefits of growing SRC would be efficient by starting some pilot project on small-scale plantations up to 2 ha.

Synergies with the landscape character of the region

The area is located in the White Carpathians. Plantations will create a new element in the landscape of mature vegetation, so it is very important to pay attention to this fact at the stage of project preparation. Optimal localization plantations will be in places, where the plants will complement the landscape mosaic of the missing elements of the green.

Legislative framework and know-how

Disposable agricultural land can be used for biomass production, while respecting the legislative restrictions, because this area is located in the White Carpathians natural protected area. Therefore domestic tree species should be used for the establishment of plantations. Size of plantations will be optimized so that they formed elements similar to the current landmark character. Design of plantation should be carried out by an expert in the field in cooperation with authorities in charge of protection of the nature.

5. The conclusions and recommendations

93% of municipalities of the Zlín Region are connected to the natural gas grid. Nevertheless, the use of biomass energy has its rightful place in the energy policy of the Zlín Region. Biomass is considered to be the important part of the energy mix and it is expected that this importance will grow in next strategic planning periods proportionately with searching for scenarios for of sustainable energy supplies. There are several areas where the existing agricultural land can be reasonably and effectively used for establishing of SRC plantations.

The largest potential pilot project area of several hundred hectares is located in the area of Bánov municipality in the Uherský Brod district. Depending on the situation on the local biomass market and other circumstances there is a potential for other SRC plantations in this area and the EAZK will focus to promote and initiate this development in next months and years.

Another promising area will be of smaller acreage and they will be adapted to local environmental and legislative conditions in the terms of sustainability and respecting the local environment, just like in the area of Slavičín and Brumov – Bylnice, for instance.

6. Further proposals for sustainable cultivation of SRC in the region

The objective is to maximize positive and avoid negative impacts in the Zlín Region. Any errors in the cultivation of SRC are derived from the corresponding negative impacts. The errors arise mainly from:

- Ignorance of the issue
- Lack of easily available, reliable and relevant information
- Implementation of non-professional recommendations published by the media

For the sustainable cultivation of SRC it is currently necessary to launch an effective information campaign on a high professional level which specifically means:

- Truthfully inform the public and potential growers of biomass on all aspects of proper cultural practices.
- Cooperate with successful growers of SRC in other regions
- Create usable and helpful information materials and present them through seminars, workshops, media etc.
- Cooperate with public authorities involved in the decision-making processes in the cultivation and exploitation of biomass in order the SRC cultivation became the attractive area both from an environmental and economic perspective

7. Sources

www.bilekarpaty.cz

<http://eagri.cz/public/web/mze/zivotni-prostredi/obnovitelne-zdroje-energie/biomasa/akcni-plan-pro-biomasu/akcni-plan-pro-biomasu-v-cr-na-obdobi.html>

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