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ECONOMICAL AND ECOLOGICAL IMPACT OF SHELTERBELTS

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Abstract

For the last several decades, ecologists have been warning the public about the issues of overuse and damage of natural resources, resulting in loss of biodiversity, and the need for environmental conservation. Vojvodina is a flat and deforested territory, characterised by strong winds causing wind erosion. Since planting forests on soils belonging to the first three categories was forbidden by the law, planting shelterbelts can provide a solution. They can provide relatively cheap and long-term solution. When properly planned, shelterbelts provide numerous economic, social and environmental benefits. They reduce wind impact, control snow spreading trapping it, protect livestock, buildings and gardens. Shelterbelts also provide habitat for wildlife and decorate the environment.

Key words: *shelterbelts, Vojvodina, agriculture*

Introduction

The number of people is increasing in the World, followed by an increased lack of food. According to FAO's data world's population is over 6.6 billion. On the other hand, urbanization and industrialization constantly causes reducing of agricultural soil.

Favorable natural conditions such as fertile soil and favorable continental climate, make agriculture most significant branch of economy in Vojvodina. Agricultural fields cover 84% of its total territory. Vojvodina is a flat area, with an elevation of about 60-100 meters above the see level. It is vastly deforested (*figure 1*) and characterised

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by strong winds causing wind erosion (*Letić i sar., 2009*). Afforested areas in Vojvodina are small and irregularly distributed (*Pekeč et al., 2008*). According to *Vlahović, 1986*, optimum percentage of forest covered areas in Vojvodina should be 14.3%.
Since planting forests on soils belonging to the first three categories is forbidden by the current law, planting shelterbelts can provide a solution.

Shelterbelts can be a link between productive agriculture and protection of biodiversity. It is of particular importance to introduce sustainable development and protect biodiversity in areas of field-crops (*Bošković, et al, 2003, 2005 a, b; 2006; Simić, et al., 2007*).

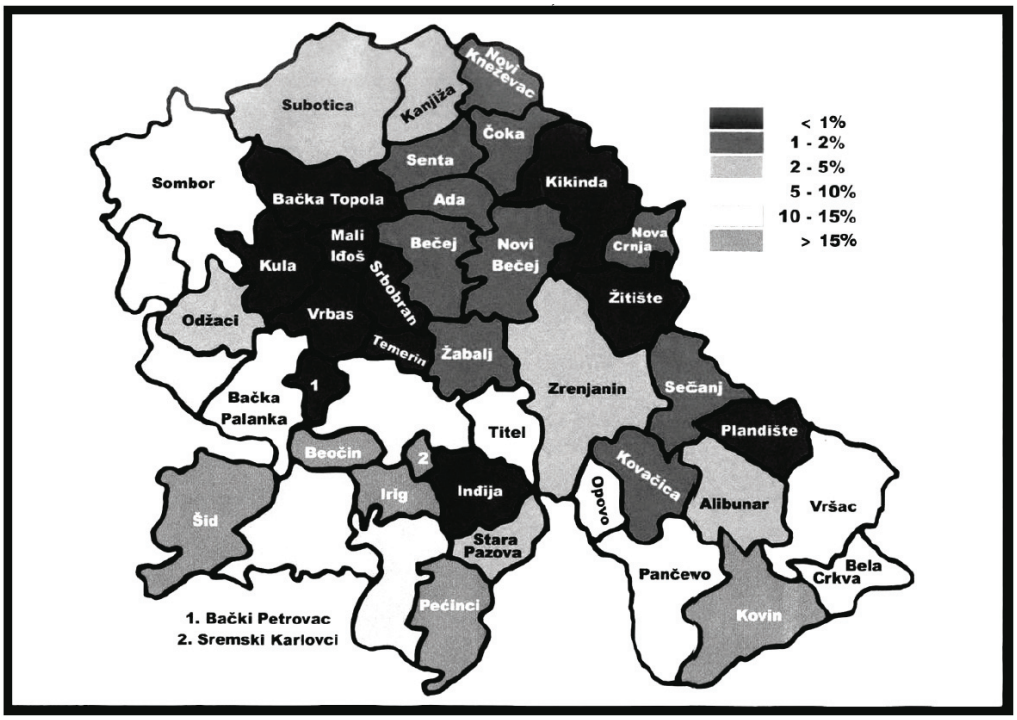

Figure 1: Afforested of Vojvodina municipalities (Rončević et al, 2005)

Impacts of Wind Erosion

Wind erosion is a result of material movement by the wind. It generally occurs in areas with little or no vegetation, as it is the case in whole of Vojvodina (during spring and autumn, when winds are strongest, fields are covered with little or no vegetation). Most of the soils in Vojvodina are high quality soils therefore wind erosion presents a serious problem. Wind erosion is known to be able to losses of 2 t/ha of soil per year. According to *Velašević et al. 1989*, wind eroded sediment contains eight times more humus, 10 times more nitrogen, 5 times more phosphorus and potassium in comparison

with the main land, from which it was carried away. That means that each year, soil loses large amounts of humus and minerals hence reducing its fertility due to wind erosion, polluting the air and water and at the same time. Wind erosion may also have the potential to transport pesticides.

Influence of wind erosion on air pollution

According to some published data (*Tomanović, et al, 2003*) air pollution in Sombor municipality can be influenced (in April and May) by field works. Local farmers have started planting modern varieties in order to increase yields causing fertilizer consumption and pesticide levels to grown rapidly. Nitrogen consumption, for example, increased from 2 to 75 million tons in the last 45 years, and pesticide consumption has increased by 10-30% during the 1980s in many countries (*Pretty, 1995*).

Most of these include some toxic substances that can negatively affect human health and the environment.

Children are more sensitive to toxic effects of applied substances than the adults, since their organisms, nervous and immune system are still developing, cell division is much faster and their weight is lower (*Zahm and Ward, 1998*).

The long-term health problems can occur after a single exposure to high concentrations or after the exposure to low concentrations of pesticides over the long period of time. The long-term health problems include asthma, leukemia, Parkinson's disease, birth defects and various types of cancer (*Dich, et al.,1997*)

Statistics from the Dispensary for lung diseases and tuberculosis in Sombor show that numbers of lung cancer have been tripled in Sombor municipality during the period between 2002 and 2005. According to data obtained from Sombor's Institute for public protection, 75.39% of preschool children, and 46.49% of school children and other youth suffer from respiratory system diseases in Sombor municipality.

Influence of shelterbelts

Shelterbelts have been used for centuries to alter environmental conditions in agricultural areas and recently started to be used in rural/urban interfaces, providing numerous economic, social, and environmental benefits (*Droze, 1977; Cook and Cable, 1995; Schoeneberger et al., 2001*).

Field shelterbelts consist of rows of trees (in Sombor region 4 rows of different kinds of trees) planted on rural/urban land. Shelterbelts consisting of 4-6 rows of trees show best wind-control results (*Xue-bin, 2002*). They protect crops and soil (regardless of cropping system used), keep snow (thick shelterbelts trap snow close to the shelterbelt, reducing snow removal costs from adjacent roadways and improving road safety, *Shaw, 1988*) and distribute snow (porous shelterbelts alter windflow so that

snow is distributed relatively uniformly across a field, *Scholten, 1988*), and improve the micro-climate for the crops growing in their shelter, increasing the soil moisture.

Soil humidity is 9-10% higher in protected areas compared with the unprotected (*Hanjie and Hao, 2003*). Shelterbelts can provide relatively cheap and long-term solution for reducing effects of wind erosion. They can reduce wind speed by 10-15% in front of shelterbelts, and 20-60% at the back (40-60 high of shelterbelts. Crops benefit from the reduced wind speed in the protected zone. The plants are less likely to be twisted by the wind or sandblasted by eroding particles (*Mize,et al.,2008*). Wind speed reduction is used in rural/urban areas to protect buildings, livestock, roads, as well as visual and oddour barriers (*Brandle, et al., 2004*). A shelterbelt must be designed to perform its main function with optimum effectiveness. They are especially important in dry years when low crop yields result in insufficient residue cover. They help increase biodiversity and stop evaporation as well.

According to available data, evaporation is 30-40% lower in areas with forests or shelterbelts. Protected area from evaporation is 50-60 high of shelterbelts. During the summer, air temperature is for 4^0 C lower in shelterbelts area compared with open areas. Soil temperature at the depth of about 15-30 cm is for about 4-5^{0}C lower in shelterbelt areas, compared with open areas, providing better air circulation in the soil, during the summer period. During winter period situation is reverse.

Shelterbelts help increase biodiversity providing habitats for many species. More pollinating insects are found in shelterbelts areas than in open areas. For example, honey bee flight is inhibited at wind speeds of 6.7-8.9 m/s (*Norton, 1988*). A number of insects, such as aphids (*Homoptera: Aphididae*), are carried by wind (*Pasek, 1988*). Shelterbelts reduce wind speed hence reducing the damage associated with aphid transmitted viruses (*Simons, 1957*). Bird species that feed on crop pests, reduce insecticide reqirements and costs (*Dix et al., 1995*). A Kansas study indicated significant economic benefits (US$30 million annually) could be attributed to hunters using shelterbelts for bird hunting (*Cable and Cook, 1990*).

Shelterbelts project in Sombor region has started in late eighties and untill now more than 60% of projected work has been finished. Shelterbelts cover nearly 700 ha (or 700 km of trees). The project has not been finished yet, because of political situation (lack of local government support), and unsolved property law legislation problems concerning shelterbelts. Shelterbelts have been put in danger when the proprietors of land covered by stelterbelts (various agricultural organizations), entered the process of privatisation. As shelterbelts have not been protected by law, new owners can cut it with no consequences (*figure 2*).

Unfortunately, shelterbelts are not properly protected by law. Their cutting does not require consequential forest-planting, and if done in area less than 1m^3 is treated as penalty, not as a crime.

Figure 2: Cutting shelterbelts (Prijić, 2008)

Conclusion

Shelterbelts are linear forests established on the landscape to achieve various (conservation, economic, social and environmental) goals. These designed corridors protect crops and livestock from wind, store carbon and offer habitat to numerous insects, birds, and small mammals. As we understand their function better, we will be able to utilize them more efficiently and create more stable landscapes. Facts, such as those showing that the air in the parks contains 200 times less bacteria then the air above streets and that 1 ha of forests absorb 8 liters of CO_2 per hour (*www.pokretgorana.org.rs*) should encourage shelterbelts plantining project in Vojvodina to be finished.

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