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THE SIGNIFICANCE OF THE FIELD SHRUBS AND HEDGES IN BIODIVERSITY CONSERVATION. THE OLD FIELD SHRUBS AND HEDGES OF SILESIAN BOTANICAL GARDEN

Czyżnie i ich znaczenie w ochronie różnorodności biologicznej. Stare czyżnie w Śląskim Ogrodzie Botanicznym

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STRESZCZENIE

Jednym z celów Śląskiego Ogrodu Botanicznego jest ochrona bioróżnorodności naturalnych zbiorowisk występujących na jego terenie. Jednym z najbardziej charakterystycznych zbiorowisk są zadrzewienia i zakrzewienia śródpolne (czyżnie) (Rhamno-Prunutea Rivas Goday et. Garb. 1961). Odgrywają one istotną rolę w rolnictwie, przyczyniając się do podniesienia jakości oraz zwiększenia ilości plonów, ochrony gleby przed degradacją i erozją, zwiększenia zawartości próchnicy oraz dostępności związków odżywczych. Obecność czyżni wpływa na naturalne zwiększenie odporności agrocenoz poprzez znaczne zwiększenie bioróżnorodności danego obszaru tworząc odpowiednie warunki życia, rozrodu i rozwoju wielu gatunków, co w dużej mierze chroni przed wieloma patogenami oraz inwazjami roślin i zwierząt. Pozwala to na zmniejszenie ilości wykorzystywanych pestycydów oraz innych substancji ochrony chemicznej roślin. Z tego powodu czyżnie są istotnym czynnikiem oddziałującym na szeroko rozumiane środowisko naturalne. Czyżnie są ponadto bezpośrednio związane z gospodarką wodną, zmniejszając parowanie wody z gleby i zwiększając dostępność wody oraz związków odżywczych dla roślin. Czyżnie podnoszą również rekreacyjną i edukacyjną wartość terenu Ogrodu.

SUMMARY

One of the undertakings of Silesian Botanical Garden is the preservation of biodiversity of natural associations occurring on its area. The most characteristic associations are field shrubs and hedges (Rhamno-Prunutea Rivas Goday et. Garb. 1961). They play an important role in agriculture, by increasing the amount of yields, soil prevention against degradation and erosion, improving the humus level and the availability of nutrient components. The presence of field shrubs and hedges improve the natural resistance of agrocenosis by increasing their biodiversity and creating suitable conditions for living, breeding and nestling of many species of animals and it is also a suitable environment for wild plants. This allows for significance reduction of used pesticides and other substances of chemical protection. That is why the field shrubs and trees are important factors influencing on agricultural environment. Besides that, field shrubs and hedges are correlated with the water management, decreasing the evaporation of water from the soil and improving the availability of water and nutrient components for the plants. The filed shrubs and hedges increase also the recreational and educational value of the region.

SIGNIFICANCE OF FIELD SHRUBS AND HEDGES

Agrocenosis are very important not only because of food production, but also for our life's conditions. After many years of using in agriculture unfriendly for environment methods, turning back to ecological methods can be observed in many countries of Europe and North America recently. In nowadays agricultures are becoming more biodiversified systems, including many biological elements, such as fields, boundaries, shrubs, trees, streams, ponds and other water reservoirs. It is known that each part of these systems play important role in the development of agriculture.

Previous years were characterized by projecting agricultural fields introducing to ecosystem monocultural biocenosis, related with the progressive destruction of hedgerows network, as observed in 20th century in numerous countries (*Deckers et al, 2005*). The results were sometimes terrible, both for environments and also for human's health and economy. The decrease of biodiversity of populations caused also decrease of resistance against many factors, common in natural environment. Monocultural biocenosis are characterized by lower resistance against dry, strong wind, frost, daily and annual changes of temperature, but what is even more important also against pests and diseases. This ruining strategy in agriculture touched the field shrubs and hedges as well. Old shrubs were in many cases cut, fields – previously diversified systems – were reduced to big surfaces of homogenous crops. Fields projected in that way demands big quantity of chemical protection substances, such as pesticides, which often reduce the quality of crops, influencing also on human's health. In nowadays many farms are being reprojected and rebuilt, to return them natural state and increase their biodiversity (*Deckers et al., 2005*). In that undertaking important role play the field shrubs and hedges (*Exconde, 2004*).

Introducing and conservation of field shrubs and hedges has some production advantages, which can be direct and indirect. Direct advantage is production of energetical plants. The annual production of wood by field shrubs and trees may be enough to balance the lost caused by reducing the surface of fields. Field shrubs and hedges are also the source of fruits, mushrooms, honey, aromatic and medicinal herbes, including also species typical for forest biocenosis etc (*Baudry et al., 2000*; *Ryszkowski, 2005*; *Snider et al., 2005*; *Thakur et al., 2005*).

The indirect advantage in production is even more important. Field hedges and shrubs reduce the evaporation of water from the soil, increasing in that way the amount of water usable for plants. In other words, field shrubs improve the water management of the crops (*Exconde, 2004*; *Livesley et al., 2004*; *McDonald et al., 2001*; *Ryszkowski, 2005*). The presence of hedges decreases the daily and annual amplitudes of temperatures, and in that way they are also very profitable in the agricultures coping with the fast changing climate (*Thakur et al., 2005*). Also the rate of snow melting is lower (about 5%) in the area with field shrubs and trees (*Ryszkowski, 2005*).

Very important advantage is also the reduction of the strength of the wind, which is very profitable, because strong winds are harmfull for the amount and the state of crops. There also occures the decrease in the erosion of the soil. These effects are significant factors in preventing soil degradation (*Baudry et al., 2000*; *Boutin et el., 2001*; *De Costa et al., 2005*; *Exconde, 2004*; *Ryszkowski, 2005*). In many studies was observed the positive correlation between planting hedges and profits of cropping systems (*Abuyewa et al., 2004*; *McDonald et al., 2001*; *Mollah et al., 2002*), which is closely connected with the decrease of soil loss, improve of green material and nutrive equivalent value returning to the soil, and correlated with the species combination also (*Mollah et al., 2002*; *Pham Quang Ha, Thai Phien, 2002*). The presence of hedges is also correlated with better available of some nutrient components (*Abuyewa et al., 2004*). It is worth to mention that field hedges improve the state of soil indirectly also, through the falling down leaves, turning into humus, or through pruning and adding pruned green material to the soil (*Abuyewa et al., 2004*; *De Costa et al., 2005*; *Exconde, 2004*; *McDonald et al., 2001*).

Fields are characterized with the lowest number of species of animals compared with forests biocenosis (*Ryszkowski, 2005*). Hedges and field shrubs creates the biocenosis, making new space for living for many species charac-

teristic for forests, like forest herbs (*Snider et al., 2005*) and other plants and animals. The role of animals in fields is highly differentiated, they are not only pests, which are harmful for the state of crops, but also they are advantageous for agriculture, by reducing the amount of crops pests. The presence of field shrubs increases the biodiversity of organisms, in that way in agrocenosis are created new communities suitable for natural enemies of many species of crops pests, like the beetles, for example ladybugs (*Hinsley, Bellamy, 2000*; *Ryszkowski, 2005*), and also the soil organisms (*Exconde, 2004*; *Ryszkowski, 2005*). Significant increase in the number of soil organisms includes such taxons like soil bacterias, fungi, nematodes, crustacean and others. It is worth of emphasize that nematodes are parasites of many pests, like larvas of potato beetle.

The presence of bees, other insects and many birds is important factor for the pollination of crops (*Richards, 2001*). Field shrubs create the suitable conditions for animals important in pollination of flowers of such species like buckwheet and fruit shrubs and trees. Field hedges increase also the number of birds (*Hinsley, Bellamy, 2000*). Special role plays such plants like hawthorns, lilacs, blackthorns, roses, hazels, spindle-trees and others. In that shrubs birds can easy find suitable place for nestling, breeding and observation (*Ryszkowski, 2005*), what is very important also for agriculture, as the presence of bird reduce the amount of many pests.

The essential role for preserving and improving existing biodiversity plays therefore keeping existing hedges and field shrubs, and also introducing new hedges to ecosystem. There can be mentioned two components: the direct increase the biodiversity by introducing new species, and indirect by creating suitable environment for many species of plants, animals, microorganisms and others (*Exconde, 2004*; *Snider et al., 2005*), and also creating a possibility to migrating of species and organisms (*Hinsley, Bellamy, 2000*; *Snider et al., 2005*).

It is also worth to mention about recreational and cultural role of field trees and shrubs, as historical elements of landscape. They increase of visual atractivity of region, reduce the level of noice and pollution (*Baudry et al., 2000*; *Ryszkowski, 2005*), produce significant amount of oxygen – 1 ha of field trees produce 10 tones of oxygen (*Ryszkowski, 2005*), they can also be the barriers in weed disseminating (*Exconde, 2004*).

In nowadays the new trend is being observed – the development of agroforestry, introducing the field shrubs and hedges to agriculture landscapes. There are obvious results as improved state of the soil, decrease of soil degradation, as was shown in experiment in northwestern Himalayas (*Thakur et al., 2005*), Ghana (*Abuyeva et al., 2004*), Sri Lanka (*De Costa et al., 2005*), Kenya (*Livesley et al., 2004*), Jamaica (*McDonald et al., 2001*). Of course the influence on amount and the state of the yields is highly differentiated, depending highly of species complement (*Exconde, 2004*; *Thakur et al., 2005*). There was often observed reduction of yields, (*Thakur et al., 2005*), possible caused by reduction of crops surface by introducing hedges, or by competition for the cations or light availability. But what is also observed, introduction of hedges improved and diversified existing biocenosis (*Thakur et al., 2005*).

What is more important old, natural hedges should be kept and protected, as the unique elements of agricultures. The occurrence of weeds is the lowest in natural woody hedgerows, in comparison to herbaceous field margins and planted hedgerows (*Boutin et al., 2001*). Also the suitability of hedges for birds and other animals is correlated with the form, shape and the type of plants. In general it can be said that the more biodiversity of species of plants, the more suitable for birds the hedges are (*Hinsley, Bellamy, 2000*).

OLD FIELD SHRUBS AND HEDGES ON THE AREA OF SILESIAN BOTANICAL GARDEN

On the area of Silesian Botanical Garden occur many natural field shrubs (Rhamno-Prunutea Rivas Goday et. Garb. 1961), often including very old specimens of shrubs or trees (Fig. 1). With the special care should be treated the specimens which attained impressive dimensions, which are: spindle-tree, hawthorn, hazel tree and pear-tree.

The most interesting specimen, which is worth of special distinguish is spindle-tree

Fig. 1. An example of old, natural field shrubs located on the area of Silesian Botanical Garden.
Fot. 1. Przykład starej, naturalnej czyżni, na terenie Śląskiego Ogrodu Botanicznego.

Fig. 2. The specimen of old hazel tree located on the area of Silesian Botanical Garden.
Fot. 2. Przykładowy okaz starej leszczyny na terenie Śląskiego Ogrodu Botanicznego.

(*Euonymus europaea* L.), with circumference in breast hight 108 cm, which is one of the biggests in Poland.

Other interesting specimens are numerous old hazel trees (*Corylus avellana* L.) (Fig. 2). These trees are connected closely with Hazel Tree Route, which is planned to be created in the next few years with cooperation with local cities. The influence of hazel trees on local culture can be seen at the first sight of eye in the names of neighbouring villages and cities, very often dwelt from polish name of hazel trees or nuts, like: Orzesze, Lyski, Leszczyny.

Fig. 3. The old specimens of hawthorn localized on the area of Silesian Botanical Garden with the fruits (photo in the corner). The circumference in the breast height amount is 2 m.
Fot. 3. Okaz starego głogu na terenie Śląskiego Ogrodu Botanicznego, o obwodzie na wysokości pierśnicy 2 m, wraz z owocami (zdjęcie w rogu).

The hawthorns (*Crategus monogyna* Jacq.) are very common in Silesian Botanical Garden. In well-stocked hedges they are the tall trees. The biggest one has the circumference in the breast high over 2 meters (Fig. 3).

Very interesting are also the well-stocked hedges of blackthorns, which form wide hedgerows, protecting safe space for numerous birds, nestling between them. Worth of mention are also localized in field hedges the specimens of common pear (*Pyrus communis* L.) (Fig. 4) and roses (*Rosa canina* L.) (Fig. 5).

The area of old field shrubs and hedges is very safe and convenient place for living of many species of animals, including also amphibians (as example: tree frog, green toad and fire-bellied toad) and reptiles (as example: common northern viper, grass snake, and numerous lizards) which should be taken under special care.

The very important undertaking for education and sciences is sustaining of these old specimens, as well as the significant factors in keeping already existing, and what is even more important, increasing biodiversity in local biocenosis, but also as specimens with very high historical and biological value. One of the undertakings of Silesian Botanical Garden is preservation of already existing field shrubs, with a special care about the oldest specimen,

Fig. 4. The old common pear specimen, characteristic accent of field shrubs and hedges.
Fot. 4. Okaz starej gruszy, stanowiący charakterystyczny akcent czyżni.

Fig. 5. Fruits on the shrub of *Rosa canina*.
Fot. 5. Owoce dzikiej róży.

and introducing new field shrubs and hedges on the area of Silesian Botanical Garden.

Summarising, the role of field shrubs is significant for human's economy, by improving the quality and increasing the quantity of yields, reducing the usage of pesticides and other substances of chemical protection. Extremely high popularization of substances of chemical protection of the crops has significant influence on our health, on the conditions of living and breeding populations of wild animals and plants in that way on the general state of natural environment. Field shrubs also play a role in sustaining a water amount in environment. It is important objective also for Poland. What is even more important, field shrubs and trees increase the biodiversity of biocenosis, create suitable conditions for many animals, improving the recreation and education value of region. One of the undertakings related with protecting the biodiversity of Silesian Botanical Garden is conservation of species complement occurred in community characteristic for Silesian region.

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