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Woody plants at the outskir of town settlement Žiar upon Hron

JÁN SUPUKA, ĽUBICA FERIANCOVÁ, ROBERTA ŠTĚPÁNKOVÁ

Slovak Agricultural University in Nitra, Faculty of Horticulture and Landscape Engineering, Tulipánová street No.7, 949 01 Nitra, Slovakia, tel.: +421376522745,
e-mail: Jan.Supuka@uniag.sk, kzaka@uniag.sk

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Abstract: The rural villages and town settlements has specific urban structure. There are private properties and gardens used differently for recreational and production purposes. Public open spaces creates small squares and streets, reserved green areas located at the healthy, cultural, municipal authority office, church and cemetary, housing estates, schools and universities, shoping and sport centres, pedestrian and central town zones as well. Important urban structure and ecological space type is outskirt settlement zone on the border of its intravilane and outstanding landscape types.

Transition zone has specific urban structure that creates built-up components as are industry, store, shopping and sport-recreation centres, transport line and corridors, energy supply objects and accesories. The small villages there could be found those have been joined to the town in processes of urban plan space enlargement. The second important outskirt zone component is flora and its vegetation formations. Those have elements of natural, synanthropic and anthropogenous cultural flora which are reflection of human activity, changed environment conditions and natural plant diaspor penetration in centrifugal and centripedal course. Paper presents woody plant species diversity at outskirt zone of Žiar upon Hron town. There has been found 85 woody species from those 70 deciduous, 1 every green and 14 coniferous species. The antropisation index calculated reaches 0.38 because 24 alien woody plant species has been identified among them.

Keywords: Town Settlement, Outskirt Zone, Vegetation Structure Woody Plant Species.

Introduction

Each compact rural or town settlement has specific space location and intravilane area borders. Outside border town represents outskirt zone and successive transition to the adjoining landscape. There could be found several basic landscape elements or different landscape types as are forests, agricultural land-use, water basins and streams but coast or deserts also. Outskirt zone has marks of both neighbouring landscape types it means urbanised and non urbanised. Transition zone should be understood as multimedial and multifunction space. From those reason outskirt zones has been judged differently according to various standpoint.

Urbanistic-architectonic approach lays emphasis to development of socioeconomy activities and with connected to objects and buildings of production, store, transport and business character (GÁL 1991, GAŽOVÁ 2000, ŠTĚPÁNKOVÁ 2002). While in the past have been dominated garden alotment colony at town trasition zone, at present time shoping centres, industrial parks and car service centres are there dominantly seen (SMIDA 2002).

Landscape architectonical approach emphasize recreation and sport centres, areas of cultural and natural vegetation with landscaping, recreation and production functions as also line and alley vegetation elements at road and river bank sides (KARA 1995, SALAŠOVÁ 2000, SUPUKA 2001). With regard to wide vegetation structure composition of natural and synanthropic type at autecology and synecology level, in transition settlement zones arise mutual enrichment of space landscape types by different flora and fauna, sometimes spontaneous hybrids are found. Biodiversity is enriched distinctly (GORDON 1989, PAVLÍK 1999, SUKOPP & HEJNÝ 1990, SUKOPP et al. 1993, SUPUKA et al. 2000). Abundant frequency of woody plant composition has been described in outskirt zone of Očová settlement (FERIANCOVÁ & SCHLAMPOVÁ 1998).

Settlement and socioeconomy activity on town territory and at its transition zone are main sources to be arisen specific urban soils with changed physical, chemical, hydrological and biotic characteristics. Climate of settlements has also been changed. Environmental impact with contaminant elements and components is expressive (SUPUKA et al. 2000). Those changed environmental conditions evoked changes in vegetation and floristic structure also. Vegetation structure is being influenced by structure, density, area greatness and age of settlement built-up. With emphasis to those criterias, on the territory of Bratislava capital city has been described floristic composition and syntaxons frequency according to follow function zones (JAROLÍMEK 1994): historical centre, high apartment houses, residential quartes, industrial complexes periphery, big housing estates, suburban agricultural fields and vineyards, suburban forests and forest parks.

From viewpoint of originality, vegetation structure at all function and urbanistic-space zones should be divided to follow structural groups (SUPUKA & FERIANCOVÁ 2002):

- Natural and close to natural plant communities and their species. There are mostly fragments of original forests, forest steppe, river bank side stands etc.
- Synanthropic and successive plant communities as are ruderal and segetal vegetation, successive stadium on dumps, nike and degraded localities, planted and second generation woody plants and their stands, extensive orchards and wilded cultural plants.
- Anthropogenic cultural vegetation with utility, aesthetic, landscaping recreational, sport, healthy and duty functions. All types vegetation are planted and maintenanced by man; parks; forest parks, recreation centres, cemetery orchards, gardens and others.

Paper is aimed to dendroflora evaluation at outskirt of Žiar upon Hron district town with regard to specific biotopes and function space vegetation formations.

Material and methods

Characteristic of study area

Žiar upon Hron is regional town settlement with district importance. There live about 30 thousands inhabitants. Town is located in Žiarska basin on waving surface character of river Hron terrace which is surrounded by orographical units Štiavnické vrchy, Kremnické vrchy and Vtáčnik mountains. Town lays in elevation 265 m above sea level. Geology bedrock creates fluvial clay and gravel sediments, soils are most often as cambizem, partially illimerized (HRAŠKO et al. 1991, MAZÚR & LUKNIŠ 1987). Town territory is under influence of warm and temperate warm climate, annual average temperature reaches 9.1℃, annual sum precipitation 500 – 650 mm. Potential natural vegetation represents lowland and underhill flooded forests, oak-hornbeam and beach forests (MICHALKO et al. 1986, QUITT 1971).

Town has historical part connected to baroque – renesance manor with historical park from 1631 year, neobaroque church with adjoining square and low-floor and rectangular buildings of former ancient village Svätý Kríž upon Hron. New part of town has originated from 60th of twenty century with rectangular street orientation also, housing estates and central square close to municipal office and bussines centre.

Field data sampling and woody plants investigation

The map out was made at northeastern town fringe with connection to Lutila stream and Šibeničný vrch, at western fringe where natural erosion terrain is distributed, sporting centre and cemetary places. At the south fringe river Hron terrace is being located.

The woody plant species frequency occurrence was investigated at following cathegories of vegetation formations or genetic groups:

A. Individual and group woody plant elements.
B. Area woody plant elements with greatness more than 0.1 ha
1) Stands close to water basins, streams and wetlands
2) Stands on erosion relief, ravines and river terraces
3) Stads of greenwoods and extensive orchards
C. Line woody plant elements
1) River bank side stands
2) Accompanying woody vegetation on thoroughfare and roads
3) Line woody plant communities on the boundary of properties and grounds

The frequency of woody plant occurrence was measured according to four step scale published by JAROLÍMEK (1994):

x – very often occurrence of woody plant (more than 30%)
+ – often occurrence (10 - 30%)
○ – rare occurrence (less than 10%)
• – non occurrence of woody plant

The synanthropisation index was calculated as rate of alien and autochtonous woody plant species occurred at all vegetation formations on outskirt zones.

Results

At the outskirt zone of Žiar upon Hron town settlements together 85 woody plant species, where identified from those 70 deciduous woody species was found 16 alien and 56 autochtonous species. Coniferous group represents 6 native woody species, which are naturaly grown in surrounding mountains Kremnické vrchy and Štiavnické vrchy, however in outskirt town zones are not autochtonous (*Abies alba, Juniperus communis, Larix decidua, Picea abies, Pinus sylvestris, Taxus baccata*). They have been there planted by man as also others 8 coniferous species which are alien or exotic origin.

The deciduous woody plants were represented 0.28 index of synanthropisation, coniferous species 1.33 one. If there are valuated all woody plants together, than index of synanthropisation was shown 0.38. Deciduous alien woody plants has been planted at transition zones equally as almost coniferous species besides *Juniperus communis* and *Pinus sylvestris*, those been found on dry slopes and erosion relief.

The alien deciduous woody plants were planted for aesthetic and reclamation reason into changed environmental conditions. They have been identified on the margin of gardens, parks or sport centre at eastern and western town fringe. Many of them have spontaneous distributed as zoochore plants (*Aesculus hippocastanum, Juglans regia, Morus alba, Parthenocissus quinguefolia*) or hydrochore and anemochore (*Ailanthus altissima, Amorpha fruticosa, Buddleia davidii, Negundo aceroides, Robinia pseudoacacia*). Their distribution into natural and synanthropic biotopes was evident namely along with water streams, on non maintened areas as ruderal vegetation.

The typical invasive behavioral of alien woody plants with creation of clean monoculture on great areas was not found. *Robinia pseudoacacia* as potentially invasive specimen has grown on western parts of erosion influenced lokalities in thin stands plant community together with other autochtonous species. Those plant communities have always ratter poorer for plant species biodiversity.

Woody plant species occurrence in outskirt town zone was depended to:
- area greatness of mutual neighbouring vegetation formations in course intravilane – extravilane,
- inside structure of outskirt zone a its landuse,
- ecological conditions of neighbouring areas (changes in soil, water, climate conditions),
- contemporary natural and synanthropic phytodiversity (dendrodiversity),
- ecological group of native and alien woody species mainly, those could be as strong potential for active dissemination to adjoining country.

On the basis of these criterias and after previous look-out investigation of town´s transition zones we decided for creation of three main cathegory of function – space vegetation structure or develop-genetic vegetation formation, where have been mapped woody species composition, as are: individual and group, area and line (as was shown in method).

Individual and group vegetation elements are either native biotope fragments on the grassland and slopes close to town, or woody plants were planted spontaneously and in accordance to plan thereabouts industrial, store, shoping and sport centres. The plantatious are all anthropogenous or mixed with participation of alien and native woody species (*Aesculus hippocastanum, Caragana arborescens, Negundo aceroides, Abies alba, Picea abies, Picea pungens, Pseudotsuga menziesii,* resp. *Acer platanoides, Carpinus betulus, Corylus avellana, Fraxinus excelsior, Quercus daleschampii, Q.petraea, Rosa canina, Sorbus aria, Tilia cordata* and others).

The accompaying of river Hron side vegetation contents woody species of genus *Alnus, Fraxinus, Populus, Salix, Ulmus,* in surrouding Lutila stream also species as are *Acer campestre, Carpinus betulus, Coataegus laevigata, Frangula alnus, Ligustrum vulgare, Rosa canina, Rubus fruticosus, Swida sanguinea* etc.

Stands on river terraces were found in northern part of town outskirt, where are being grown dominantly shrubs *Crataegus* sp., *Ligustrum vulgare, Rosa canina, Rhamnus cathartica,* rarely *Cornus mas.* Tree species cathegory were represented by *Fraxinus excelsior, Quercus petraea, Robina pseudoacacia, Sambucus nigra, Tilia cordata, T.platyphylla.*

The erosion influenced relief on western town fringe is covered by *Acer campestre, Carpinus betulus, Crataegus sp., Ligustrum vulgare, Populus tremula, Robinia pseudoacacia, Rosa canina, R.gallica, Rubus hirtus.*

On the eastern outskirt there is Šibeničný vrch hill with comparatively dry environment conditions, where grow native woody species *Corylus avellana, Crataegus sp. Enonymus europeans, Ligustrum vulgare, Prunus spinosa, Rosa*

canina, Betula verrucosa, Quercus petraea, Q.cerris, Juniperus communis, Pinus sylvestris. Alien group woody species represents *Pinus nigra.*

The localities of abandoned extensive orchards could be found close to Lutila stream and above river Hron terrace close to the new housing estate. There are remainders of older tree fruit sorts as are species of genus *Cerasus, Juglans, Malus, Prunus.* In small grenwoods there were occurred species *Carpinus betulus, Quercus sp. Robina pseudoacacia,* in undergrowth *Sambucus nigra.*

The line form cathegory of woody vegetation represents river bankside stands on both Hron and Lutila streams with dominant frequency of *Alnus* sp. *Fraxinus excelsior, Salix* sp. *Populus* sp. including hybrid *Populus* x *canadensis* planted mostly along with Hron river.

The roads are convey communications between town and outside country from different directions. Along with road are planted many trees as *Acer platanoides, A. pseudoplatanus, Juglans regia, Malus* sp., *Populus x canadensis, Prunus* sp. *Sorbus aucuparia.* At heaps and road cut slopes there are planted or naturaly regenerated woody species *Betula verrucosa, Corylus avellana, Euonymus europaeus, Populus tremula, Prunus spinosa, Rosa canina, Viburnum opulus.*

Line stands of woody plants at the boundary of ground are seen on north and western part of town outskirt, where woody plants were identified as are *Carpinus betulus, Corylus avellana, Fraxinus excelsior, Prunus spinosa, Quercus petraea, Rosa canina, Tilia cordata, T. platyphylla.* The fruit tree of genus *Malus, Prunus* and *Pyrus* were found also there.

Woody plants composition in transition zone of Žiar upon Hron is comparable rich. It is reflection of various ecological conditions and anthropogenic activities. Woody species frequency should be more abundant, when industry areal of aluminium alloy plan (SNP) will be investigated. There are many places, areas dumps, flotation field as also restored areas, new plantations of forest trees and landscape-architectonical arranged enter areal to the industry plan.

Discussion

Outskirt zone creates mutual penetration of natural and synanthropic vegetation both at herb and woody plant species. Frequency of plant communities and species occurrence is very rich. At territory of Bratislava city had been described 8 space areas, 33 habitates and 44 plant associations of herbaceous flora (JAROLÍMEK 1994). Woody plant species composition of this city is very rich also. At northwest fringe of Bratislava housing estate about 200 species were found including park – like arranged spaces (REHÁČKOVÁ 2000). At transition zone of Očová town has been described 47 woody plant species of natural and cultural flora (FERIANCOVÁ & SCHLAMPOVÁ 1998), on aluvium cone of Hron river close to Zvolen town was identified 7 syntaxons and 12 woody plant species natural origin mostly (PAVLÍK 1999). The same specific native woody species was found out (SOMŠÁK et al. 1997) in surrouding

mountains of Žiar upon Hron as we found out too. They are for example *Quercus daleschampii, Rosa gallica, Rubus hirtus, Salix elaeagnos.*

Woody plant composition research at town and village outskirt zones is very useful and important, because woody species and their space genetic formations fulfill landscape-architectonical, ecological, isolation, biotic and biotopes as also climatic functions. They are important for landscape, settlement and for man.

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Tab. 1. Occurrence of woody plant species according to different habitant structures.
A, B,C – cathegory of habitat, 1, 2, 3 – type of habitat (explanation see in Methods).

Cathegory and type of habitant locality	A	B			C		
Woody plant name		1	2	3	1	2	3
Dedicuous woody species							
Acer campestre	o	+	+	●	+	●	x
Acer platanoides	+	o	o	+	o	+	+
Acer pseudoplatanus	+	o	+	o	o	+	+
Acer saccharinum	o	●	●	●	●	o	●
Aesculus hippocastanum	o	●	●	●	●	o	●
Ailanthus altissima	o	●	o	●	●	o	●
Alnus glutinosa	●	x	o	●	x	●	●
Amorpha fruticasa	o	●	●	●	●	o	●
Betula verrucosa	+	●	+	o	●	+	+
Buddleia davidii	o	●	●	●	●	●	●
Caragana arborescens	o	●	o	●	●	o	●
Carpinus betulus	+	o	+	+	+	●	o
Cornus mas	o	●	o	●	●	●	●
Corylus avellana	+	o	+	+	o	o	x
Crataegus laevigata	+	o	x	o	o	o	x
Crataegus monogyna	+	o	x	o	o	o	x
Elaeagnus angustifolia	o	●	●	●	●	●	●
Euonymus europaens	●	o	+	o	o	o	+
Fagus sylvatica	+	o	o	●	o	●	+
Forsythia x intermedia	+	●	●	●	●	o	●
Frangula almus	●	+	o	●	+	●	●
Fraxinus excelsior	+	+	+	+	+	+	+
Hedera helix	o	o	●	o	●	●	●
Juglans regia	o	●	●	o	●	●	o
Ligustrum vulgare	●	o	+	o	o	o	+
Lonicera xylosteum	●	o	+	o	●	●	o
Malus domestica	o	●	●	+	●	o	+
Morus alba	o	●	●	●	●	o	o
Negundo aceroides	o	+	o	o	o	o	o
Parthenocissus guinguefolia	●	o	●	●	o	o	●
Populus alba	o	+	●	●	+	●	o
Populus x canadensis	+	o	●	+	+	+	+
Populus x canescens	o	o	o	●	o	●	o
Populus nigra	o	+	o	●	+	●	●
Populus tremula	o	+	+	o	+	o	o
Prunus avium	o	●	o	+	●	o	+
Prunus cerasifera	o	●	●	o	●	o	o
Prunus insititia	o	●	o	●	●	●	o
Prunus padus	●	+	●	●	+	●	o
Prunus spinosa	+	o	+	o	o	o	+
Pyrus communis	o	●	o	+	●	o	o

Quercus cerris	○	●	○	●	●	●	○
Quercus daleschampii	+	○	○	○	●	○	+
Quercus petraea	+	●	○	○	●	●	○
Quercus robur	●	○	●	○	●	●	○
Rhamnus cathartica	●	○	○	●	●	●	○
Ribes grossalaria	○	○	●	○	●	●	○
Robinia pseudoacacia	+	○	+	+	●	+	x
Rosa canina	+	○	+	+	●	○	+
Rosa gallica	○	●	○	○	●	●	○
Rubus fruticosus	○	○	○	○	●	○	+
Rubus hirtus	●	●	○	○	●	●	○
Rubus idaeus	●	○	●	○	●	●	○
Salix alba	○	x	+	○	x	○	○
Salix caprea	○	+	+	○	+	○	+
Salix cinerea	●	○	○	●	+	●	●
Salix elaeagnos	●	○	●	●	○	●	●
Salix fragilis	○	x	+	○	x	○	○
Salix purpurea	●	○	○	●	○	●	●
Salix triandra	●	○	○	●	○	●	○
Sambucus nigra	+	+	○	○	+	○	+
Sorbus aria	○	○	○	●	●	○	○
Sorbus aucuparia	○	●	○	○	●	+	○
Sorbus torminalis	○	●	○	○	●	●	○
Syringa vulgaris	+	●	○	○	●	○	○
Tilia cordata	+	○	○	+	●	+	+
Tilia platyphylla	+	○	○	+	●	+	+
Ulmus glabra	○	○	●	●	●	○	○
Ulmus laevis	○	○	○	●	○	●	○
Ulmus minor	○	●	○	○	●	●	○
Coniferous woody species							
Abies alba	○	●	●	●	●	○	●
Chamaecyparis lawsoniana	○	●	●	●	●	●	●
Juniperus chinensis	○	●	●	●	●	●	●
Juniperus communis	○	●	○	●	●	○	●
Larix decidua	○	●	○			○	○
Picea abies	○	●	○	●	●	○	○
Picea omorica	○	●	●	●	●	●	●
Picea pungens	○	●	●	●	●	○	●
Pinus nigra	○	●	○	●	●	○	●
Pinus strobus	○	●	●	●	●	●	●
Pinus sylvestris	○	●	○	●	●	○	○
Pseudotsuga menziesii	○	●	●	●	●	●	●
Taxus baccata	○	●	●	●	●	●	●
Thuja occidentalis	○	●	●	●	●	●	●
Thuja orientalis	○	●	●	●	●	●	●