THE IMPORTANCE OF THE RIPARIAN FORESTS ON THE UPPER AND MIDDLE COURSE OF THE ARGEȘ RIVER

STANCU Daniela Ileana

Abstract. Riparian forests ecosystems have complex and extremely important functions such as: protecting the shores against erosion, reducing the effects of floods, chemical purification of water and supply of groundwater, large quantities of good quality timber, exceptional landscape effects, bio-diversity conservation and optimization of the habitat for birds, fish, and other animals. The achievement of these functions is obstructed by a series of factors which caused: fragmentation (through deforestation) of bordering watercourses vegetation, changes in habitat structure and tree stands consistency decrease, wood disappearance and occurrence of invasive plants. In order to optimize the functions of riparian forests, sustainable management and certain ecological treatment and reconstructive measures, adequate for each type of ecosystem and developing and health level of each stand, are compulsory. The stability of river forest galleries is threatened by different factors: abiotic (climate change), anthropic (water quantitative and qualitative change) and biotic (invasive oomicetes, fungi, insects, plants, with high destabilization power of ashes, alders, poplars). In the future, genotypes of river gallery tree species have to be found in order to resist to the new complex challenges, respectively new efficient control and management methods of the risk factors.

Keywords: Argeș River, riparian forests, poplar, willow, alder river galleries, protection.

Rezumat. Importanța zăvoaielor de pe cursul superior și mijlociu al râului Argeş. Ecosistemele zăvoaielor au funcții extrem de complexe și importante, cum ar fi: protecția malurilor împotriva eroziunii, reducerea efectului inundațiilor, purificarea chimică a apei și realimentarea apelor subterane, asigurarea unor cantități mari de cherestea de bună calitate, menținerea peisajelor excepționale, conservarea biodiversității, optimizarea habitatului pentru păsări, pești și alte animale. Îndeplinirea acestor funcții este obstrucționată de o serie de factori care au determinat următoarele: fragmentarea (prin defrișare) a vegetației cursurilor de apă limitrofe, modificări ale structurii habitatului fapt ce duce la scăderea consistenței arboretelor prin dispariția lemnului și apariția plantelor invazive. Pentru optimizarea funcțiilor pădurilor riverane, este necesar un management durabil și anumite măsuri ecologice de tratare și de reconstrucție adecvate fiecărui tip de ecosistem și nivelului de dezvoltare și sănătate al fiecărui arboret. Stabilitatea galeriilor de-a lungul râurilor este amenințată de numeroși factori: abiotici (schimbări climatice), antropici (modificarea calitativă și cantitativă a apei) și biotici (oomicete invazive, ciuperci, insecte, plante, care au putere mare de destabilizare a arinilor, sălciilor, plopilor). În viitor trebuie găsite genotipuri ale speciilor de arbori care populau zăvoaiele în trecut, pentru a rezista noilor provocări, respectiv noi metode eficiente de control și management al factorilor de risc.

Cuvinte cheie: Râul Argeș, zăvoaie, plop, salcie, galerii de arin, protecție.

INTRODUCTION

The riparian forests on the territory of our country are every day scarcer, due to the anthropic intervention on the rivers course. Analysing the degree of degradation of these riparian forests, we were able to realize their importance and also the measures that must be taken to prevent their disappearance.

The Argeş River has 350 km long and a hydrographic basin surface of 12,550 km^2. It springs from the central-western part of the main peak of the Făgăraş Mountains through two tributaries: Buda and Capra. In the end the Arges River flows into the Danube at Oltenița.

The Buda stream (the main source of the Argeş river hydrographic system) springs under the Arpaşu Mic peak, from 2,030 m altitude, from the Buda glacial lake. The Capra stream springs from the Capra glacial lake, located below the Vânătoarea lui Buteanu peak at 2,230 m altitude (STANCU, 2005).

Downstream of the confluence of the Buda and Capra streams, the Vidraru dam was built. From the source, to the area of Piteşti, the Argeş River has a direction of NS flow, first draining the southern slopes of the Făgăraş Mountains, after that crossing the Argeş Hills and after separating the Cotmeana Piedmont from the Cândești Piedmont, it enters the plain, where it wets many subunits of the Romanian Plain.

On the upper course of the river Argeş, a hydropower system was built consisting of numerous micro-hydropower stations (Argeş, Cerbureni, Oeşti, Albeşti, Curtea de Argeş, Zigoneni, Băiculeşti, Budeasa, Merișani, etc.). The upper valley of the Argeş River is part of an interesting and incomparable tourist area crossed by the Transfăgărășan national road.

MATERIAL AND METHODS

The purpose of this action was to highlight the diversity of the ecosystems that represent the spontaneous living coverage, part of it natural, which is still present in our country. The impact of anthropogenic pressure has led to such profound changes in some places that it is often difficult to reconstruct the original aspects of plant groups. These resulted in the mosaic of the vegetal carpet.

Phytosociological surveys were carried out for each forest habitat, and the correspondence with the classification systems used at European level consisted of in indicating the codes and the names of the habitat types from the considered classifications (NATURA 2000, EMERALD, CORINE, PALEARCTIC HABITATS, EUNIS) and the Romanian classification system. The plant nomenclature follows Flora Europaea and Ciocârlan, 2000. The Romanian vegetation synthesis works drawn up by different authors or teams of authors from Romania were used to classify the associations (SANDA et al., 2001).

RESULTS AND DISCUSSIONS

With the disappearance of the forest vegetation, through deforestation or windfalls, the biological balance of the affected territory changes and new ecological aspects appear. In a relatively short period of time, forest vegetation is destroyed, and new stands made up of pioneer species appear, followed by the gradual resettlement of the species that once made up the forest. In this series of successions, the stage of domination of the grass species is interspersed.

Spontaneous vegetation, relatively well preserved on steep slopes, in the immediate vicinity of hydropower facilities and access roads, loses much of its spontaneous character, with irreversible changes caused by human activity occurring on some parts of the land.

The main tributaries of the Argeș River are: Vâlsan, Doamnei, Sabar, Dâmbovița, Neajlov. The vegetation of the streams is usually confined along the rivers and streams from the lower mountain floor to the plain area and is installed on alluvium, wet soils or in puddle depressions during the spring.

The riparian forests are made of softwood trees: willow, alder, poplar. The riparian forests with white alder are found between 1000 - 700 m altitude, those with black alder between 700 - 200 m altitude and those with willow below 200 m altitude. Recent riparian forests are clusters of trees, seemingly chaotic, while old riparian forests are differentiated by biotopes. In the mountain floor these forests mainly include white alder (*Alnus incana*) and, to a lower extent, spruce and fir.

In the hilly units, the dominant species is the black alder (*Alnus glutinosa*) and as secondary species: the white poplar (*Populus alba*), the crackling willow (*Salix fragilis*). The shrub layer is well developed, comprising: shock, hazelnut, howthorn, honeysuckle (sometimes Tartar maple and buckthorn). The grassy layer usually includes hygrophilous species: *Equisetum palustre, Ranunculus repens, Caltha laeta* etc.

The woody vegetation of the riparian forests is usually located along the rivers and streams from the lower mountain floor to the plain area and is installed on alluvium or wet soils, in depressions puddle during the spring. The flora of these phytocenoses is dominated by hygrophilous and mesohygrophilous elements.

The trees strengthen the cohesion of the banks, limit the lateral erosion and favour the stability of the riverbed. So, riparian forests act directly on the hydraulic conditions through the root system of the trees and through the branches of shrubs that touch the surface of the water. The roots of trees and the branches of shrubs, immersed in water, significantly slow down the flow rate, especially in curves, where the speed becomes zero (PALAU & ALCAZAR, 2012). The presence of the root network in the river bank increases the soil resistance, which promotes the formation of micro-habitats between the active riverbed where speeds are higher and the river bank, where speeds are low. The trees canopy adjusts the water temperature and optimizes the fish living environment through their thick shadow (Photo 1).

Photo 1. Buda stream – riparian forest (original).

There are a lot of deregulatory factors of riparian forest ecosystems: forest crossings, extraction of sand and stone from the course bed, frequent crossing of cattle on the bottom of riverbeds, irregular planting of poplars on the drain, dams built by beavers, household waste and pets thrown into the water, large-scale cutting that causes difficulties in regeneration, monospecific plantations or with few other species without preserving dendrological biodiversity.

Poplar or spruce plantations, by their superficial rooting, promote the uprooting of trees. Young, dense coniferous plantations diminish both the diversity and density of herbaceous vegetation and, respectively, the ability to fix fine sediments, as well as the richness of the associated fauna (including fish). In fact, the potential of spruce in mountainous wetlands is mediocre, it is more exposed to fungal diseases and wind gusts (CLINCIU, 2012).

The key body for adapting trees to alluvial resorts is the root system, as the interface between the tree and the substrate. Adult trees cannot withstand water currents unless they have a well-developed root system that ensures good anchorage in the sediment (Photo 2).

There are generally three types of vegetation lane management:

- most of the riparian forests in the plain area and low hills have been cleared and put to agricultural use: pastures, hayfields, orchards;
- in the large rivers meadows where the forest was preserved, poplar and willow monocultures with shorter, very productive cycles, were installed;
- others have been abandoned, there has been fragmentation of vegetation corridors and various structures have been implanted (sewage treatment plants, stone and sand mining quarries, pumping stations.

In floods, erosion and biodiversity maintenance management, the interventions will consider two entities: forested minor and major riverbed, integrated in a supervised and well-managed basin.

On the upper and middle course of the Arges river, respectively the Buda river valley, the Valsanului valley, the Doamnei river valley, due to the presence of the mountain alder (*Alnus viridis*) and the white alder (*Alnus incana*) the areas can be included in the following habitats (DONIŢĂ et al., 2005):

- south-eastern Carpathian grey alder galleries (*Telekio speciosae-Alnetum incanae* (Coldea, 1986; 1990).
- Dacian-Getic black alder (*Alnus glutinosa*) woods with *Stellaria nemorum*

QUERCO – FAGETEA Br.-Bl. et Vlieger 1937em. Borhidi 1996
FAGETALIA SYLVATICAE Pawl.in Pawl. et al. 1928
Alno – Ulmion Br.-Bl. et R. Tüxen 1943
Alnenion glutinosae – incanae Oberdorfer 1953
Telekio speciosae - Alnetum incanae Colfdea (1986) 1990
Stellario nemori –Alnetum glutinosae (Kastner 1938) Lohmeyer 1957

Photo 2. Vâlsan River – riparian forest (original).

Telekio speciosae - Alnetum incanae Coldea (1986) 1990

This endemic association for the Romanian Carpathians is widely spread along the Buda Valley, the Vâlsan Valley, as well as in the middle mountain floor along the streams inside the forests. Along the Buda Valley and the Vâlsan Valley, there are riparian forests with *Alnus incana* that vegetate on alluvial soils and even on rocks with a neutral or even slightly acid reaction. In addition to the two characteristic species *Alnus incana* and *Telekia speciosa* there are other species such as: *Petasites kablikianus, Ranunculus repens, Festuca gigantea, Cirsium oleraceum, Geranium phaeum, Petasites hybridus,Symphytum cordatum, Dentaria glandulosa, Pulmonaria rubra, Leucanthemum waldsteinii, Campanula abietina, Angelica sylvestris, Myosotis sylvatica, Salvia glutinosa, Stellaria nemorum*.

Conservative value: very big.

Stellario nemori –Alnetum glutinosae (Kastner 1938) Lohmeyer 1957

The phytocenoses built by *Alnus glutinosa* are found on the middle course of the Vâlsan river and on the upper course of the Doamnei river. The floristic composition is rich and heterogeneous as a result of the altitude but also of the influence of the hydric factor. There are many characteristic species of the alliance, in terms of order and class, among which we mention: *Stellaria nemorum, Imppatiens noli-tangere, Circaea lutetiana, Sambucus nigra, Euphorbia amygdaloides, Geum urbanum.* Tree layer is dominated by *Alnus glutinosa*, but can be found *Alnus incana, Ulmus minor, Carpinus betulus, Tilia cordata, Acer pseudoplatanus, Salix alba, Cerasus avium.* The shrub layer consists of: *Clematis vitalba, Hedera helix, Corylus avellana, Cornus sanguineus, Crataegus monogyna, Prunus spinosa, Rosa canina, Salix cinerea.*

Conservative value: very big.

CONCLUSIONS

Riparian forest ecosystems have complex and extremely important functions such as: protecting the shores against erosion, mitigating the effects of floods, chemical purification of water and refuelling groundwater, large quantities of good quality timber, exceptional landscape effects, biodiversity conservation, including outstanding trees and optimization of the habitat for birds, fish and game.

The achievement of these functions is obstructed by a series of factors which caused: fragmentation (through deforestation) of the water-shore vegetation, changes in structure and decrease in the consistency of tree stands, wood disappearance and occurrence of invasive plants. In order to optimize the functions of riparian forests, all owners must be trained towards a sustainable management and certain ecological, treatment and management reconstructive measures must be taken, adequate for each type of ecosystem and for the development and health level of each stand.

Firstly, protection areas of minimum 15 m wide (higher in lower zone) need to be established on each side of the watercourse, on which, by helping natural regeneration or by reforestation, by clearance, by thinning and adequate treatment, the following will be supported:

1. native species: *Alnus viridis, A. incana, A. glutinosa, Salix alba, Populus alba, P. nigra, Quercus robur, Fraxinus angustifolia* (with helping tree and shrub species) highly resistant to floods and pollution, with a great capacity of sprouting. These tree species have a very important ecological role: they strengthen the banks and prevent their deterioration, the roots, most of which are in the water, provide shelter for the fish and their crown shades the water, preventing overheating during the summer time (CHIRA & CHIRA, 2001);
2. specimens with straight strains, vigorous and symmetrical cover canopies, withstand flash floods, storms and wind throws and pure spruce stands shall be avoided since their laterally spreading roots do not set the shores and are not suitable for gusts of wind. Also, spruces and pines are not suitable for floods. Indeed, remarkably are the black alders, which set the atmospheric nitrogen and enrich sands and gravels from river beds and the willows, preferred by birds for food and nesting (BOLEA et al., 2014);
3. the river forest galleries' stability is threatened by different factors: abiotic (climate change), anthropic (water quantitative and qualitative change) and biotic (invasive oomicetes, fungi, insects, plants with a high destabilization power of ashes, alders, poplars). In the future, other tree species have to be found in order to resist to the new complex challenges, and new efficient risk factor control and management methods must be taken.

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Stancu Daniela Ileana
The Argeş County Museum, Armand Călinescu, 44, 110047, Piteşti, Argeş, Romania.
E-mail: stancuileana@yahoo.com

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