General considerations on the flora and vegetation of Albania's rivers

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Abstract

The studied region is characterised by its rich flora, vegetation, and diversity of habitats, from constantly submerged areas, moving on to areas subject to tidal movements, and ending in areas that are always above water level. In many cases the relations between these various types of habitat are of great ecological importance. All of these areas are specific to the area's rivers and cannot be found anywhere else. The relatively modest density of the vegetation is due to human pressure exerted on the area: cementing, building embankments, and poplar fields have greatly changed the original landscape. Where human influence has been reduced, thickets of common reed (*Phragmites australis*) can often be found, as well as populations of floating species such as the duckweed (of the *Lemna* species), the giant duckweed (*Salvinia natans*) and the water chestnut (*Trapa natans*). On the edges, in other words in transitional areas between aquatic and terrestrial habitats, there are varieties of sedge (*Carex elata, C. riparia*) water lilies (*Iris pseudoacorus*), purple-loosestrifes (*Lythrum salicaria*), and sometimes summer snowflakes (*Leucojum aestivum*). Mesophyte woods, characterised less by Mediterranean and more by continental features, grow in less protruding areas, where conditions are cooler and more humid. The dominant species of these woods are: *Alnus glutinosa*, *Fraxinus angustifolia*, the bay-oak (*Quercus robur*) and the elm (*Ulmus minor*). In the low areas close to the water table, and in the floodplains not given over to the growing of poplars, there are small hygrophilous woods whose main species are the willow (*Salix alba*) and the white poplar (*Populus alba*).

Introduction

Albania is rich in natural aquatic resources. There is a dense hydrographic network composed of streams and rivers. All the rivers flow from east to west and all debouch in the Adriatic and Ionian seas. The two big-

gest rivers in Albania (the Drin and the Vjosa) flow across national borders. The high density of the hydrographic network is the result of broken relief and intensive rains. This network has an average density about D=1.4 km/km^2. The distribution of Albania's river network is determined by the physical and geographic characteristics of the watersheds and especially by its morphological characteristics, the lithological nature of the territory, the action of the rains, and evaporation. In mountain areas, all the rivers are characterized by gravel or rocky beds, their size determined by flow regimes. The bottom flow is characterized by an eroded layer with low and variable landscape.

Material and methods

The main plant communities of the area were identified; the sites of the surveys varied from 0.25 m^2 (for aquatic vegetation) to 200 m^2 (for forest). More than 150 surveys were carried out in the area, according to the Zurich-Montpellier approach.

The floristic nomenclature and the degree of threat are respectively based on Flora Europaea (Tutin *et al.,* 1968 - 1980), Flora of Albania (Paparisto *et al.,* 1984 - 2000), and The Red Book (Vangjeli *et al.*, 1995). The classification of the vegetation was based on the higher phytosociological units of the Braun-Blanquet (1952) system (order, alliance, association) and the classification of vegetation of SE Europe according to Horvat *et al.* (1972).

Results

The flora and vegetation of Albania's rivers can be easily distinguished into two different fundamental types; those of a strictly aquatic nature that live in or on the river-bed, and riparian vegetation growing along the banks.

Aquatic vegetation

Most of the aquatic flora consist of algae and higher plants, which are suited for humid environments and sometimes even complete immersion, if temporary.

Aquatic plants depend on a fluvial environment, and their existence is influenced by many factors. For example, periods of submersion, the water table, the force of the current, the composition of the riverbed, and the transparency of the water all play a role. Some plants are completely submerged while others root in the riverbed and emerge from the water at various heights, and others still are without roots and float on the water.

In stretches of the river where the water flows with force and speed, the plants are sparse, the riverbed is unstable and moves continuously, and only a small community of algae is able to form colonies. Some of these algae are microscopic, the diatomeae and the chyanophyceae, and form coloured films on the substrate (e.g. the rocks). Where the current reduces its speed and the water is calm, several species of algae, including floating algae and higher plants such as crowfoot proliferate.

The Aquatic Plant associations can be grouped as follows:

- Underwater or aquatic bed plant associations dominated by different kinds of algae, especially by *Chara* sp.
- Submerged plant associations (Rooted Vascular plants) including mainly species of the following genera: Pondweed (*Potamogeton*), Parrot Feather (*Myriophyllum*), Naiad-wort (*Najas*), Tape-grass (*Vallisneria*) etc.
- Halophyte plant associations; these plants have roots and a part of the stem submerged, but most of the plant is above water. These are called persistent emergent plants. The main associations in this category are reeds (*Phragmites australis*) and bulrushes (*Typha*).
- Floating leaved plants, typically dominated by Water Lily (*Nymphaea alba* and *Nuphar luteum*), Water Chestnut (*Trapa natans*) *Lemna minor* or *L. trisulca*. In general these associations are found in optimal conditions in the lower stretches of rivers, especially in sheltered areas.

The most widely diffused marsh vegetation in the area of the rivers is the common reedbed (*Phragmites australis*). This is fairly ubiquitous, in the sense that it can be found in slightly salty waters near river mouths (together with halophile species, i.e., species that prefer salty environments like the *Puccinellia festuciformis*, a variety of saltmarsh-grass), in fresh waters (together with fresh water species such as *Lythrum salicaria*, commonly known as the purple loosestrife), and even in terrestrial environments (on the shores of embankments). Generally speaking, as the salinity increases the reedbed tends to become monospecific, in other words to be completely dominated by the common reed. When the salinity becomes excessive, the reed is replaced by decidedly more halophile species such as sea-lavender (*Limonium spp.*) and saltmarsh-grass (*Puccinellia palustris*).
Associated *species* with equally high abundance values include hygrophytes such as the Lesser Bulrush, Purple Loosestrife, Fen Sedge, Water Plantain, and Branched Bur-Reed.

Riparian vegetation

Riverbanks are characterized by high species richness, which is mainly based on habitat diversity in cross-section and periodic disturbances, such as floods. The total species richness of a given river depends on the habitat diversity along the water course. Riparian vegetation includes shrubs and arboreal species (willows, alders, poplars), which are found in areas between aquatic plants and other plant species farther away from the river. They are hygrophilous species, whose roots are connected with the groundwater. Riparian forests, or alluvial forests, are generally wooded areas suited to moist soils that cover both the river banks and the areas which are periodically submerged by flooding.
In the mountains, riparian vegetation principally consists of humid meadows which are gradually replaced

by riparian woods of alders as the slope of the ground decreases. The various species of willows (white willow, riparian willow) and poplars, which prevail on the valley floor or plain, slowly replace the alders. A rich undergrowth, characterized by grasses, bushes, reedbeds, and sometimes orchids, grows beside the riparian woods. The vegetation of this belt belongs to the classes *Alno-Populetea* and *Salicetea purpurea*. The main species of the riparian vegetation are: *Populus alba, Salix alba, Salix purpurea, Salix amplexicaulis, Salix elaeagnos* subsp. *angustifolia, Alnus glutinosa, Alnus incana, Platanus orientalis* etc.

Another interesting association which thrives in humid and regularly flooded environments in this belt is the White Poplar. The forest physiognomy is determined by the White Poplar, which is found along the river valleys from the coast up to the mountain areas. In low humidity environments the White Poplars are characterised by weak development and very often do not grow above the shrub level. Where water flows are strongest, the substrate is characterised by gravel and these environments are predominated by Oriental Planes (*Platanus orientalis*), associated with hygrophilous shrubs such as the Grey Willow and Small Flower Tamarisk. On dry gravel, this association is characterized by fewer associated shrubs, whereas in humid places the Oriental Plane is associated with many other shrubs such as the Common Alder, White Poplar, White Willow, Hawthorn, as well as herbaceous types such as the Round-Leaved Birthwort, Pennyroyal, Ivy, White Butterbur, Hairy Buttercup, Maidenhair Fern, and Long-Leaved Mint.

Close to the riverbank, the Oriental Plane is associated with Walnut trees, especially in the upper valley of the Vjosa and Shkumbini Rivers, and with Oleanders in the valley of the Qeparo stream.

The most important parts of the river's vegetation, from the mouth up to the high mountain area, are the

associations of White Willow, and herbaceous plants such as the Spiny Rush, Self-Heal, Greater Plantain, and Dove's Foot Cranesbills.

Discussion and conclusions

The results show a relatively rich flora and vegetation. 125 plant species (vascular plants) have been registered so far. Most of them belong to hydrophile or hygrophilous plant species and the cosmopolitan element (Fig. 1, 2). Some hydro- and hygrophytes are included in the Red Book of Albania (Tab. 2). The results based on the phytosociological investigations indicate the presence of 18 associations belonging to six different classes and eight orders, distributed in alternating zones of vegetation. A summary of this classification is shown in Tab. 1.

The role played by this kind of vegetation is fundamental for the balance of the river: the riparian vegetation works

Table 1 - Phytosociological classification

Charetea	Nymphaeetum albae-luteae	Alno-populetea
Charetalia	Trapetum natantis	Alnetalia glutinosae
Charion	Nymphoidetum peltatae	Alnion glutinosae
Communities with Chara sp.		Alnetum glutinosae
	Phragmiti – Magnocaricetea	Alno-Quercion roboris
Lemnetea	Bolboschoenetalia maritimi	Quercetum roboris
Lemnetalia	Bolboschoenion maritimi	Fraxinion angustifoliae
Lemnion	Bolboschoenetum maritimi	Alno - Fraxinetum angustifoliae
Lemnetum trisulcae,	Phragmitetalia australis	Ulmo - Fraxinetum angustifoliae
Lemnetum minoris		Junco (acuti) - Fraxinetum angustifoliae
	Phragmition australis	
Isoeto – Nano juncetea	Phragmitetum	Leucojo – Fraxinetum angustifoliae
Isoeto - Nano juncetalia	Scirpo - Phragmitetum	Alno – Populetalia
Nanocyperion	Bolboschoeno - Phragmitetum australis	Alnion incanae
Juncetum bufonii	Typhetum angustifoliae	Alnetum incanae
Bidention tripartitae	Typhetum latifoliae	Populetalia albae
Eleocharitetum palustris	Cyperetum longi	Populetum albae balcanicum
	Oenanthion aquaticae	Platanion orientalis
Potametea	Butomo-Sagittarietum angustifoliae	Platanetum orientalis
Potametalia	Glycerio-Sparganietum neglecti	Juglando - Platanetum orientalis
Potamion	Sparganietum erecti	
Myriophyllo-Potametum,	Butometum umbellati	Salicetea purpureae
Potameto-Najadetum,	Oenantho-Rorippetum amphibiae	Salicetalia purpurea
Ceratophyllo-Potametum,	Equisetetum fluviatilis	Salicion eleagni
Elodeetum canadensis,	Rorippo-Phalaridetum arundinaceae	Salicetum triandrae balcanicum
Polygonetum amphibii	Ranunculion aquatilis	Salicion albae
Nupharo-Potametalia	Veronico beccabungae-Callitrichetum stagnalis	Tamarici - Salicetum purpureae
Nymphaeion	Hydrocharition	Nerio – Tamaricetum parviflorae
Myriophyllo-Nupharetum,	Hydrocharitetum morsus-ranae	

Figure 1 - Floristical Spectrum

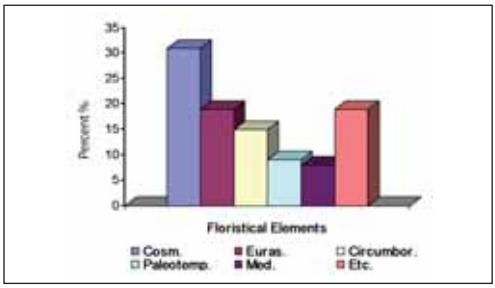
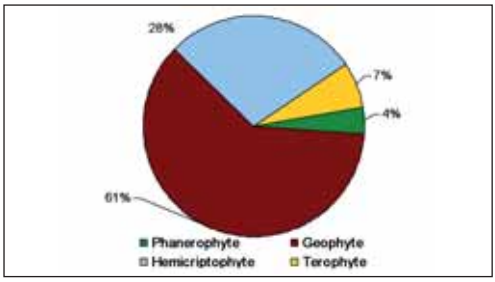


Figure 2 - Biological Spectrum



as a filter and therefore plays a key role in the purification of the water. Through their roots, aquatic plants are able to absorb polluting inorganic materials such as phosphates and nitrates which are found in detergents (soap, washing powder, etc.) and fertilizers used in agriculture. For this reason, a "buffer" zone of natural vegetation between rivers and farmland is extremely important.

Roots from these plants have another important function: they preserve the riverbanks from erosion caused by flowing water. Alders and willows, for example, have large and deep root systems, which consolidate and

Table 2 - List of Endangered and Threatened species in river's area

Hydrocotile vulgaris	Ex?	Nymphaea alba	V
Quecus robur	Ex?	Nuphar lutea	V
Symphytum officinale	Ex?	Nymphoides peltata	V
Fraxinus exelsior	E	Ranunculus lingua	V
Adiantum capillus-veneris	V	Ulmus laevis	V
Butomus umbellatus	V	Baldellia ranunculoides	V
Caltha palustris	V	Conium maculatum	R
Cladium mariscus	V	Typha shuttlewortii	V
Hydrocharis morsus-.ranae	V	Salix fragilis	V
Salix triandra	V	Trapa natans	V
Osmunda regalis	V	Sagittaria sagittifolia	V
Phyllitis scolopendrium	V	Ranunculus fontanus	V

make the banks resistant to the force of the current. Vegetation found along the course of the river, often called a "green corridor", provides necessary shade to keep the water temperature stable. Water temperature influences the amount of available dissolved oxygen in the water on which aquatic life forms depend.

In addition, the variety of vegetation gives refuge and sustenance to many species of animals, insects, birds, reptiles, and amphibians.

Thus, these bordering areas between water and land have a great ecological value. When intact, the riparian zones cross and link the land with the river, which serves as a biological corridor and is vital for vertebrate and invertebrate fauna. Unfortunately, these important areas have been severely reduced and fragmented for reasons of development for housing, roads, bridges, and construction; flood regulation; and the desire for new and better farmland. As a result of using such resources without regulation, many hygrophilous taxa and their associations are currently at risk of extinction or significant reduction. Moreover, human intervention, such as reclamation, dam building, unregulated use of the waters and industrial pollution, has damaged flora and vegetation of very high value not only in ecological but also in economics.

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