Vjosa Wild River National Park (VWRNP)

Integrated Management Plan

Ecological study of the VWRNP

November, 2023

Updated April, 2024

ABBREVIATIONS

AGS	Albanian Geological Service
ASIG	State Authority for Geospatial Information
BBC	British Broadcasting Corporation
BZM	Buffer Zone Management
CAPI	Computer Assisted Photointerpretation
CLC	CORINE Land-Cover
CLCN	CORINE Land-Cover nomenclature
CLCG	CORINE Land-Cover - CLC2018 Technical Guidelines
CEO	Chief Executive Officer
CTF	Conservation Trust Fund
DCM	Decision of Council of Ministers
DEM	Digital Elevation Model
EUNIS	European Nature Information System
FGM	Faculty of Geology and Mining
FHMV	Flood Hazard Maps of Vjosa/Aoos River basin
GCP	Ground Control Points
GDP	Gross Domestic Product
GMV	Geological Map of Vjosa/Aoos River basin
GNSP	General National Spatial Plan
GO	Governmental Organization
HPP	Hydropower plant
HQ	Annual Maximum Discharge
IBA	Important Bird Areas
IGEWE	Institute of Geosciences, Energy, Water and Environment
INSTAT	Institute of Statistics

INTERREG	EU programs to stimulate cooperation
IPA	Important Plant Areas
IUCN	International Union for Conservation of Nature
LGP	Local General Plan
LGM	Last Glacial Maximum
LUMV	Land-Use Maps of Vjosa/Aoos River basin
MIE	Ministry of Infrastructure and Energy
MoTE	Ministry of Tourism and Environment
MoU	Memorandum of Understanding
MP	Management plan
NAPA	National Agency for Protected Areas
NGO	Non-governmental organization
NTPA	National Territorial Planning Agency
NSDI	National Strategy for Development and Integration
ODA	Official development aid
PA	Protected area
PUT	Polytechnic University of Tirana
RAPA	Regional Administration for Protected Areas
SAMV	Seismic Activity Map of Vjosa/Aoos River basin
SD	Strategic directions
SLLC	State Limited Liability Company
SNRM	Sustainable Natural Resource Management
SM	Seismic Microzonation Studies
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
VANT	Vjosa-Aoös Nature Trust
VRB	Vjosa/Aoos River basin
VWRNP	Vjosa Wild River National Park

INTRODUCTION

According to the NAPA guidelines for the preparation of studies required for the preparation of an Integrated Management Plan (IMP) for the protected area, in addition to the Introduction and Summary chapters, the following chapters are required as necessary content for the preparation of an Ecological Study as a basis for the preparation of an IMP: Methodology, Study, Main Threats, Measuring Indicators and Main Parameters for Monitoring the Environmental Situation, References/Bibliography and Annexes, Maps, Tables, Graphics.

The Vjosa Wild River National Park (VWRNP) was established in 2023 according to national law (based on Article 100 of the Constitution and Article 8 point 2 and 10 of Law No. 81/2017 "On Protected Areas" as Category II of protected areas) and international standards (Category II, IUCN Protected Areas Category System). The national park includes the main river Vjosa and three tributaries (Drino with Kardhiq, Bënça and Shushica). It protects one of the last free-flowing wild rivers in Europe and its unique ecosystem (Figure 1).

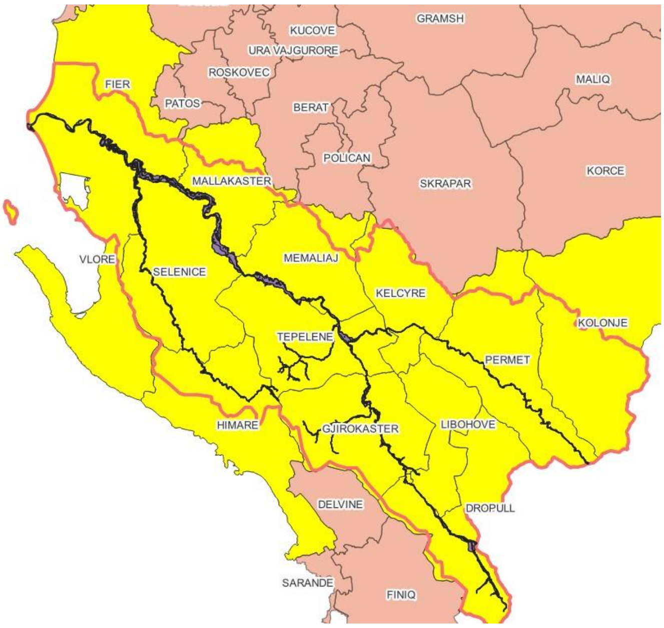


Figure 1: Boundaries of the Vjosa Wild River National Park (Schwarz, Dobbelsteijn, 2023).

The VWRNP has a total area of 12,727 ha, which includes mainly water areas (47.3%), coastal areas and floodplains (36.1%), land areas (9.5%) and river terraces (7.1%). It includes two protection zones: the strict central subzone (first degree of protection), which covers 92.9% of the total national park area, and the traditional use and sustainable development subzone (including forests, agricultural land, and pastures), where traditional activities can be carried out.

CHAPTER 0 METHODOLOGY

The present study is a compilation of all known and available data on ecological and biological data for the Vjosa river valley, together with other data on the physical-geographical characteristics of the area. For the preparation of this study, no additional targeted surveys (except for selected bird species) have been carried out, but data from the scientific research camps organised annually along the river, which are attended by local and foreign scientists, students and others, was also used.

It would be difficult to expect that the habitats or species along the approximately 400 km long stretch of the Vjosa and its tributaries would be sufficiently studied. However, it is possible to see from the data collected and analysed which research is most needed for future work to determine and implement conservation activities within the effective management of the VWRNP, and in particular which sections of the river.

CHAPTER 1 THE STUDY

The Vjosa is one of the last, if not the last, large European rivers that has retained its natural structure, biodiversity and natural processes throughout its course; it is a free-flowing river, unrestricted by dams or barriers. The key to understanding the Vjosa phenomenon is that it and its tributaries function as a self-sustaining, preserved ecosystem, supported by natural processes, notably river flow and sediment transport.

GENERAL DESCRIPTION

Vjosa is the second largest river in Albania and closes the series of six major rivers entering the Adriatic Sea, which form the entire alluvial coastal plain, beginning in the north with the large Drin-Moraca-Bojana-Buna system, and further down, with Mat, Erzen, Shkumbin and Seman Rivers. Together with Seman (Devoll and Osum), Vjosa forms a huge connected delta plain.

The transboundary catchment of Vjosa covers approximately 6,800 km² (4,540 km² in Albania), and the river flows in a SE-NW direction over a length of 272 km (190 of which are located in Albania) from the Pindus Mountain Range in Greece to the Vjosa Delta, and then the Adriatic Sea. Albania's catchment area crosses into the districts of Gjirokastra, Vlora, Fier, Korça, and Berat. Figure 2 provides an overview of the Vjosa catchment, its main tributaries, and major cities.

Vjosa and its tributaries form a functioning natural ecosystem large enough to mitigate the external disturbances of other altered areas found adjacent to and along the river corridor, without significantly affecting natural hydrological processes. However, the ecosystem is extremely fragile and sensitive, so it can be dramatically altered by any changes to the water regime upstream or downstream (Sovinc, 2021).

In the geological, hydro-morphological, hydrological, and ecological context, the Vjosa River valley can be divided into three subareas:

- The upper section of the Vjosa River is characterized by steep gorges among Përmet, Këlcyra, and Dragot, crossed by areas with depositional cones and large gullies. The valley of the Vjosa River expands in the upper reaches of the Dragot area, except for the gorge of Poçem.

- The middle section, spanning the stretch which includes the confluence with the Drino River, where the city of Tepelena is located, is known for the large sand and gravel banks formed by the branching river. Downstream of Selenica, the river's catchment area shrinks, the valley widens, and the river begins to meander. The floodplains of the Vjosa River are known as one of the most magnificent coastal ecosystems of the Balkan Peninsula, characterized by their natural hydro-morphodynamic river processes. The wide branching stream, the large gravel banks and islands, and the pioneer plant species, willows, poplars, and tamarisks give the Vjosa valley an extraordinary character.

- The lower section is characterized by the stretch of the Vjosa River and the formation of wide meanders. Between the cities of Fier and Vlora, the Vjosa River passes through the Myzeqeja lowlands and flows towards the Adriatic Sea. The Vjosa Delta is located north of the Narta Lagoon, where it reaches the sea.

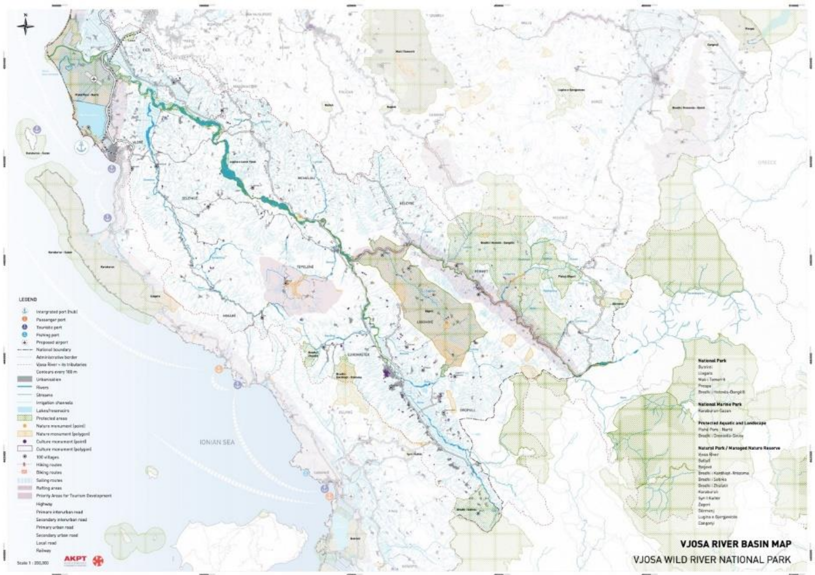


Figure 2: Vjosa River Basin map (map by NTPA)

GEOLOGY

The Vjosa valley represents an area of international interest for geological studies. Situated on the southern part of the Albanides, the Vjosa River crosses several geological structures consisting of successive anticlines and synclines affected by a series of active tectonic and neo-tectonic lines (see Figure 3). As a result of this unique composition, Vjosa offers a spectacular view of outcrops of rocks, as well as characteristics of geodynamic phenomena. The carbonate formations, under the effect of the karst phenomenon, form groundwater flows draining along the Vjosa valley in 47 permanent water springs (Durmishi et al., 2018).

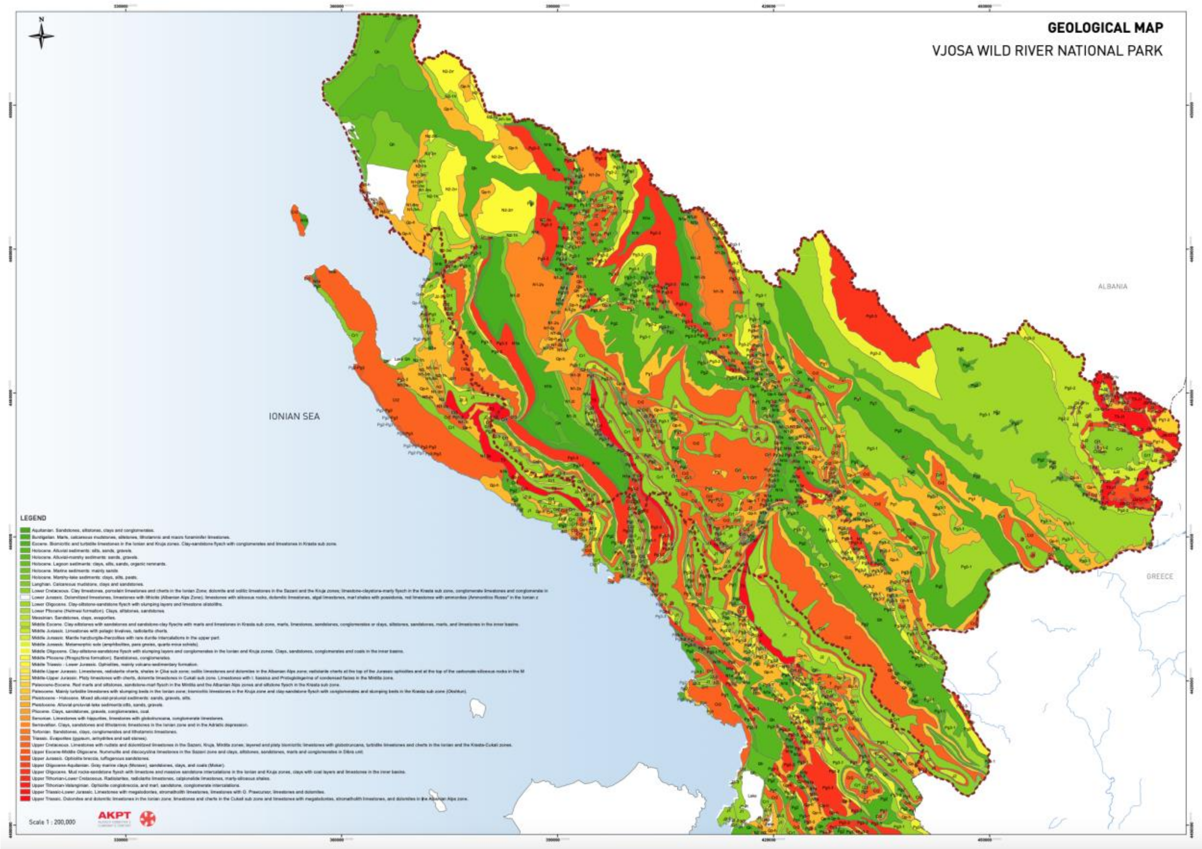


Figure 3: Geological map of the Vjosa River Basin, Albanian Geological Service (AGS)

Geologically, the Vjosa catchment is embedded within five tectonic zones, the largest of which is the Ionian zone. These tectonic zones are part of the Albanides-Hellenides chain, which, together with the Dinarides, make up the dominant mountain range in the Western Balkans. The complex tectonic structure consists of two domains, the eastern or Internal and the western or External Albanides (Aliaj, 2006; Schiemer et al., 2018).

The Vjosa/Aoös River is divided into three geological sections. The upstream section of the river valley, frozen during the Last Glacial Maximum, drains ophiolites, flysch deposits, carbonate, and limestone deposits. In the middle course section, between Dragot and Poçem, the river flows mainly over the flysch deposits of the Ionian tectonic zone. The downstream section extends from Poçem to the Adriatic Sea, with the river flowing over the Ionian tectonic zone and the quaternary deposits of the pre-Adriatic lowland tectonic zone, mainly consisting of gravel, sand, silt, and clay (Skrame, 2020; *EcoAlbania*, 2021). As a result of this geological context, channel types display a remarkable variety of geological forms: the river forms gorges and incises the terraces in the upper and middle catchment forms into braiding channel patterns as the valley widens and transitions to a meandering state towards the mouth (Bizzi et al., 2021).

The Vjosa Delta represents the most important area in the Myzeqeja lowlands, 2/3 of which is a result of delta progradation over a period of 500 years (Fouache et al., 2010). Previous archaeological studies show the displacement of the Vjosa mouth south of its actual location in the Vlora Bay (where the Narta Lagoon was created), and to its north, along the foot of the Frakulla structural ridge, less than 1 km southwest of the ancient city of Apollonia. The Vjosa Delta is wave-dominated, characterized by sand banks, mud flats, salt marshes, reed beds, small lagoons, and temporary marshes. Using historical topographic maps from the

19th century to the present, shoreline dynamic analysis indicates the fluctuation of the coastline position, with the trends of recent years hinting towards future erosion (Durmishi et al., 2018).

The catchment is dominated by mountains averaging some 300-1500 m a.s.l., but reaching peaks of 2600 m (Figure 4). The relief and slopes are steep and only the big rivers accumulate and shape terraced or even flat valleys, such as Drino.

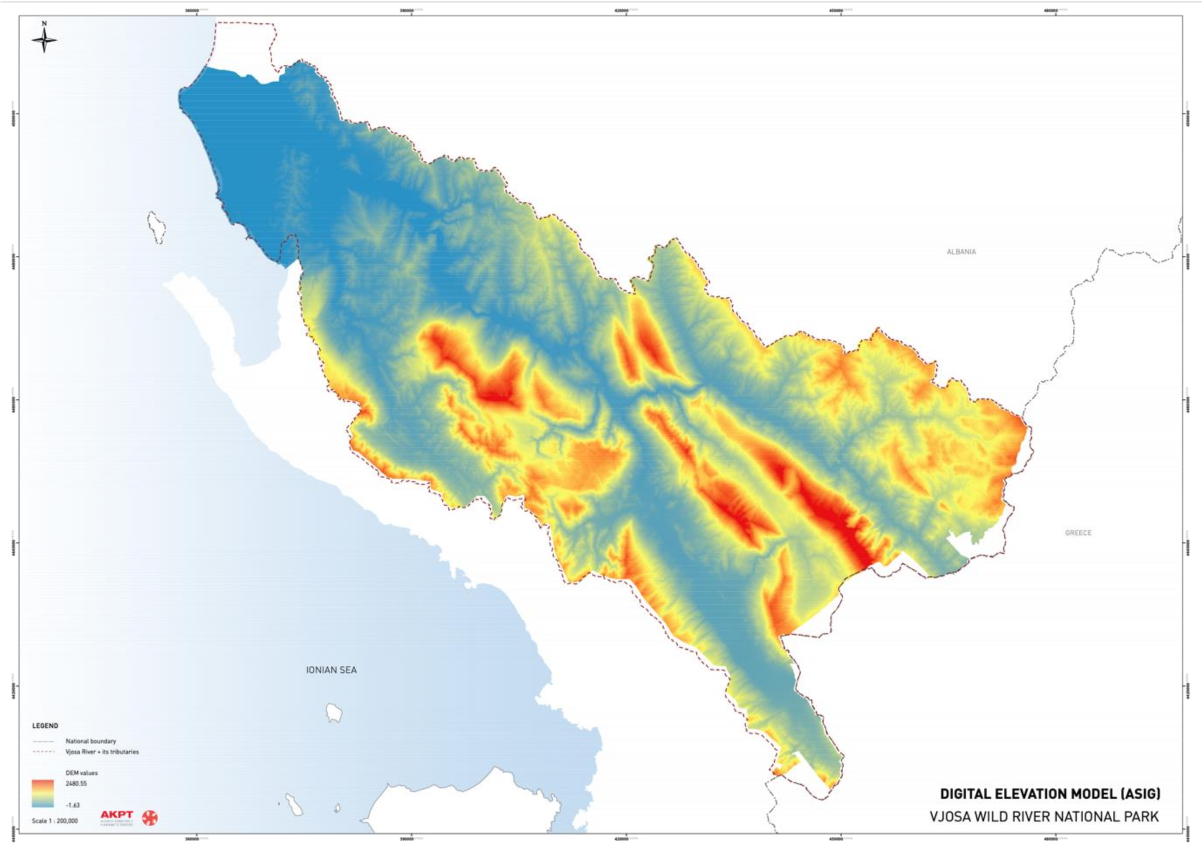


Figure 4: Digital Elevation Map of the Vjosa River Basin, ASIG

The river flows through several neo-tectonic zones (mainly in the Ionian zone), and the river systems can be dated back to the upper Pleistozän (long period of alternating ice ages), some 150,000 years ago, starting erosion and transport of material from the mountains to the sea.

Geological formations and features are diverse and originate beginning with the Triassic Period (before 200-250 million years) up to the Quaternary Period today, generating magmatic rocks, carbonates, and terrigenous sediments (flysch and molasse). They are subject to weathering and the subsequent consolidation of alluvial deposits, karst phenomena in the limestone rocks, the movement and sliding of colluviums (unconsolidated sediments at the base of hill slopes), as well as tectonic activity. The mountain ridges are mainly built of limestone rocks, while lower hills persist of flysch rocks. The Drino valley, the field of Gjirokastra, is built of Quaternary deposits of molasses. Along Vjosa conglomerate deposits can be found in the upper reach, while the delta and the coastal plain are developed by alluvial deposits. Most of the lower hills and foot mountains are built of various materials transported by the rivers in previous times, including all kinds of gravel, sand, silt, and clays. In the high mountains, karst erosion in the limestone produced steep crests and sharp slopes. On the other hand, small karstic depressions, like poljes, can be found (Çajup is the largest one with some 90 ha).

GEOMORPHOLOGY

The geomorphological history of the Vjosa valley can be traced back to the glacial periods, where the limited ice layer that formed over the valley had nevertheless a noticeable influence on the hydro-morphological characteristics of the Vjosa River. This influence is reflected in two different processes: the clear sectioning of the river in fluvial deposits, indicating that the historical sedimentary stock was higher than today, and as seen in other sections of the river, that those sedimentary stocks are currently equal or higher than during the Ice Age or earlier. The section of Poçem and Përmet has a linear longitudinal profile, which indicates the stable transport of sedimentary deposits rather than the downstream connection. Previously, such findings were known only from laboratory experiments (Hauer, 2021; *EcoAlbania*, 2021).

The overall geomorphology of the Vjosa basin is distinguished by an NW-SE orientation of the folded structures and tectonic plates, with the valleys and their tributaries aligned along the tectonic lines of the Alpine thrust system. This configuration results in significant fluctuations in the elevation of the mountain ranges surrounding the Vjosa valley. In Greece, the elevation of Aoös varies between 2,636 to 400 meters above sea level, while in Albania, the elevation ranges from 2,500 m to sea level (CNR Cereg, 2015). The mountains flanking the middle stretch of the valley vary in elevation from 300 meters in the north to nearly 2,000 m in the south. The Gribe Mountain Range, which peaks with Mt. Kudhës (1907 m), separates Vjosa in the north and northeast from the Shushica valley in the southwest. At Poçem, the river is situated between two parallel mountain ranges composed of limestone and flysch (Schiemer et al., 2018).

The Vjosa River itself runs through an assortment of landscapes. The mean catchment slope is 28%, while the riverbed slope is about 4%. Low gradients are characteristic of the lower course of the river, surrounded by a wide, flat floodplain with terraces shaped during the Quaternary Period, roughly 2.59 million years ago. This region includes the Myzeqeja floodplain located near the city of Vlora, the Kota valley, which forms part of the Shushica River tributary basin, and the Drino valley with the areas of Gjirokastra and Dropull. The gradients of the river in these zones are shallow - up to 5° (CNR Cereg, 2015). The river's middle course is characterized by hills of highly fragmented, terrigenous, sedimentary rock, which the Vjosa tributaries have eroded over time. These include areas with very high slopes around the highland of Kurvelesh and the mountains of Nemërçka, Lunxhëria, Bureto, Postnan, and Melesin. Gorges and deep canyons can be found in Bënça, Këlcyra, and Langarica. The river's upper course is surrounded by large mountains, with abrupt crests and very steep slopes resulting from water erosion and limestone terrain (karst). In Greece, the Aoös tributary, Voidomatis, flows through the Vikos Gorge, listed as the deepest canyon in the world (UNDP Albania, 2017).

HIDRO-MORPHOLOGY

The Vjosa River and valley are one of the most magnificent riparian ecosystems in the Balkans, exceptional for their natural hydro-morphodynamic fluvial processes. They represent important points of reference for the hydro-morphological characterization of the Balkan rivers and the resulting processes of landscape formation (Hauer, 2021). The channel pattern shows significant variations over the length of the river in Albania (Daja et al., 2018). In the upper section, Vjosa follows a sequence of steep canyons among Përmet, Këlcyra, and Dragot, entrenched in gorges intersected by areas with large alluvial fans and islands. Past Dragot, the river valley widens, narrowing only for the gorges of Kalivaç and Poçem. Near the city of Tepelena and around the confluence with the Drino River, the fluvial landscape is distinct for its large gravel bars and sandbars formed by the braiding river. The watershed slope of the river decreases after Selenica, the valley becomes wide, and the river starts meandering (Figure 5).

- Valley forms: The afore-mentioned conditions in the catchment lead to a wide range of valley formations, not always in consecutive order (from up to downstream), but also with breakthrough sections and widenings in the headwaters. Most of the valleys are only partially confined and the canyon reaches, like Langarica and upper Bënça (Nivica and Lekdush canyons), are limited in length. Long reaches of upper Vjosa and middle Bënça are incised into terraces of conglomerate, and therefore, also bank confined. Aside from the upper Drino plain, large widenings of the Vjosa valley downstream of Memaliaj and upstream of Poçem, with associated breakthroughs (at Kalivaç and Poçem), lead to broad active river channels.

- Channels: Various channel types from straight canyons and V-shaped valleys of tributaries and breakthroughs over pendular, terrace entrenched river courses, with alternating gravel bars to widenings with braided sections, to anabranching middle and even meandering lower courses (only in the case of Vjosa) cover the full spectrum of river systems. In addition, the karst phenomenon of underground streams, caves, and springs can be found in several places. Channel patterns, width and depth variations, flow velocities, substrate conditions, and the structure and condition of the riparian zones are rather intact in Vjosa and most of the tributaries.

- River banks: A large variety of bank compositions can be found from the steep canyons along the Langarica and Bënça headwaters in rock or conglomerate, over huge monoliths and boulders in the Shushica breakthrough, to broad gravel channels with alternating river branches delimited only by natural banks and terrace edges towards frequently eroding steep banks in the middle courses, and even shallow banks with fine sediment (sand, silt, and clays) in the lower course and delta.

- Floodplains: While floods in the higher sloped upper and middle course are flashy, they take in the lower Vjosa for up to several weeks. As mentioned, the bed-building annular floods regularly cover the entire active channel, and are responsible for the shifting channels and the rejuvenation of young pioneer stands on gravel bars and islands. Regular but less frequent floods (floods all >1-5 years) are of utmost importance for the ecological conditions in low-lying floodplains. They form and shape floodplains adjacent to the active channel and on major islands. Shrubs of willows, and poplars on the upper courses, and plane trees build the initial vegetation, often stabilizing the land at least up to the next major flood. On a higher elevated areas of the active floodplain (floods all >5-30 years), only remnants of floodplain forests, mainly of poplars, are found. Most of those forests were converted to agricultural land over the years. In the remaining morphological floodplain (floods all >30-300 years), many settlements and a lot of infrastructure can be found.

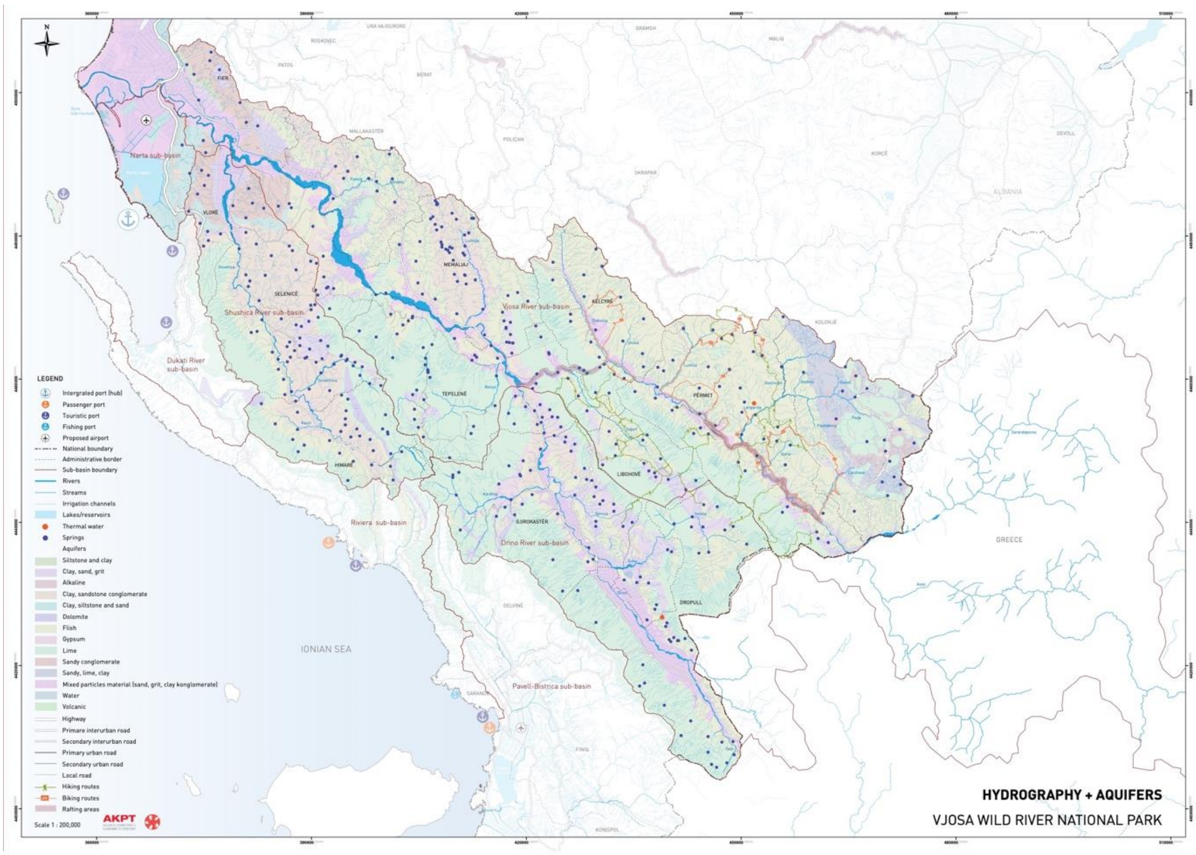


Figure 5: Vjosa River map and its tributaries (map by NTPA)

Overall, the corridor of the Vjosa River valley and its surrounding habitats are characterized by high spatial and temporal heterogeneity, continuous habitat change, and vast biotic heritage. The key to the exceptional biodiversity of Vjosa is in its hydro-morphological dynamics, particularly the longitudinal continuity of the water flow (otherwise known as "the natural flow regime"), which remains undisturbed throughout the length of the river. The flooding and high sediment transport in particular create a continued turnover of the landscape (Tockner & Stanford, 2002; Thorp et al., 2006), facilitating the recycling of matter and the specific routing of nutrients and carbon (McClain et al., 2003; Décamps et al., 2004; Pinay et al., 2007). The mosaic structure of floodplain rivers, characterized by a dynamic equilibrium of different habitats responding to water level fluctuations, provides the habitat conditions for a highly specific and diverse biota (Pickett & White,1985; Décamps, 1996; Townsend et al., 1997; Winemiller et al., 2010; Ward et al., 1999). These unique river dynamics, which have remained intact in the catchment area, contribute to creating well-adapted biota with high levels of alpha, beta, and gamma diversity.

However, this diversity, while significant, is highly vulnerable to changes in the river dynamics. In particular, the terrestrial species of highly dynamic riverine systems are exceptionally sensitive to hydro-morphological changes in discharge, flow regime and sediment budget. Any impacts on these parameters may lead to the decrease or extinction of these highly vulnerable taxa found in Vjosa. This scenario must be averted as the breadth of diversity of species in the Vjosa valley, expressed in the river's natural features, can no longer be found in any other Central European country (Scheimer, 2020; *EcoAlbania*, 2021).

The intact hydro-morphological dynamics make Vjosa a highly attractive case study for international river science. Over the past 150 years, up to 90 per cent of these floodplains in Central and Eastern Europe was lost as a result of the development of HPPs (particularly on the Danube, Rhine, and Po). To reverse this trend, restoration measures have been undertaken over the last 25 years or so (Mosimann, 1992; Schiemer & Reckendorfer, 2000 and 2004; Woolsey et al., 2005). The virtually untouched condition of the Vjosa catchment, characterized by its unobstructed fluvial morphology, continuity of water flow and sediment transport processes, can help us to understand the connection among the hydrological preconditions, river bed morphology and distribution of species. This understanding can in turn yield new knowledge for restoration projects of floodplain areas in the Mediterranean (Schiemer et al., 2018; Rössler et al., 2018).

CLIMATE AND PRECIPITATION

The Vjosa River Basin is part of the southeastern hilly climate zone, and plays an important role in the region's climate, affecting the temperatures and rainfall. The climate of the Vjosa River Basin can be characterized as Mediterranean, with dry and hot summers, and mild and wet winters. The western part of the Vjosa River Basin is warmer than its eastern part due to the lower altitude and proximity to the sea. The mean temperature values vary from 10.7°C to 17.5 °C along the river valley, and from 6°C to 10°C in the mountainous areas. The mean maximum temperatures in the upper, middle, and lower parts of the catchment area range between 26.9°C and 35.8 °C.

The hottest months are June, July, and August, with daily mean temperatures between 20°C and 24 °C. The highest mean maximum values are between 26°C and 36 °C, and the observed absolute maximum values are 41.6°C recorded at Fier (6 July 1988) and 43.5°C at Selenica (18 July 1973). The coldest months are from December to February, with daily mean temperatures of less than 5°C. The average annual rainfall in the river basin ranges from 950 to 1,600 mm, while the long-term annual rainfall reaches 1,076.2 mm, of which about 66% rains in autumn and winter. The minimum precipitation typically occurs in the summer months (June, July, and August), while the maximum rainfall is evident in November and December. The number of rainy days ranges from 85 to 100 days a year. Climate data in the area was obtained from Climate 6 Explorer (Trouet & Oldenborgh, 2013, in Wickel & Galaitsi, 2017).

Precipitation in the Vjosa valley ranges on average from less than 1,000 mm in the coastal region and the most northeastern region up to 1,600 mm predominantly in the mountain ridges of Drino catchment. The highest precipitation, dominated by the Mediterranean climate zone, which is subdivided into orographic zones (from coast to high mountains), occurs at the first high ridges towards the Adriatic Sea, where through convection and raising of wet air masses over the winter most of the rainfall can be expected. The wettest month is February, while August-September is the driest period of the year.

HYDROLOGY

Discharges in the rivers vary strongly, but the relation of average low to flood water discharges is not as pronounced as for other rivers in the Mediterranean. In the upper course, the mean water discharge has some 60 m^3/s in Vjosa, while the lower course has some 175 m^3/s on average (200 m^3/s in the delta). More important for shaping the active channels is the regular and frequent annual flood discharge of some 900 m^3/s, while the 100-year extreme flood can reach 3,000 m^3/s in the upper course and up to 6,000 m^3/s in the lower course. Karst springs are frequent and lead to a good baseflow also during the dry season (e.g., Këlcyra Black Water Spring within the bank of Vjosa). In Drino, even some water is sinking in the karst underground and appears outside of the catchment towards the coast ("Blue Eye" (*Syri i Kaltër*) with some 15 m^3/s spring yield). The Viroi Spring near Gjirokastra is one of the biggest springs in the catchment with some 25-30 m^3/s, and significantly contributes to the discharges of lower Drino, another indicator for the strong groundwater resource in the basin (those aquifers are used for all major settlements in and close to the basin, such as Fier, Vlora, Saranda, and Butrint along the coast and Gjirokastra (Figure 6).

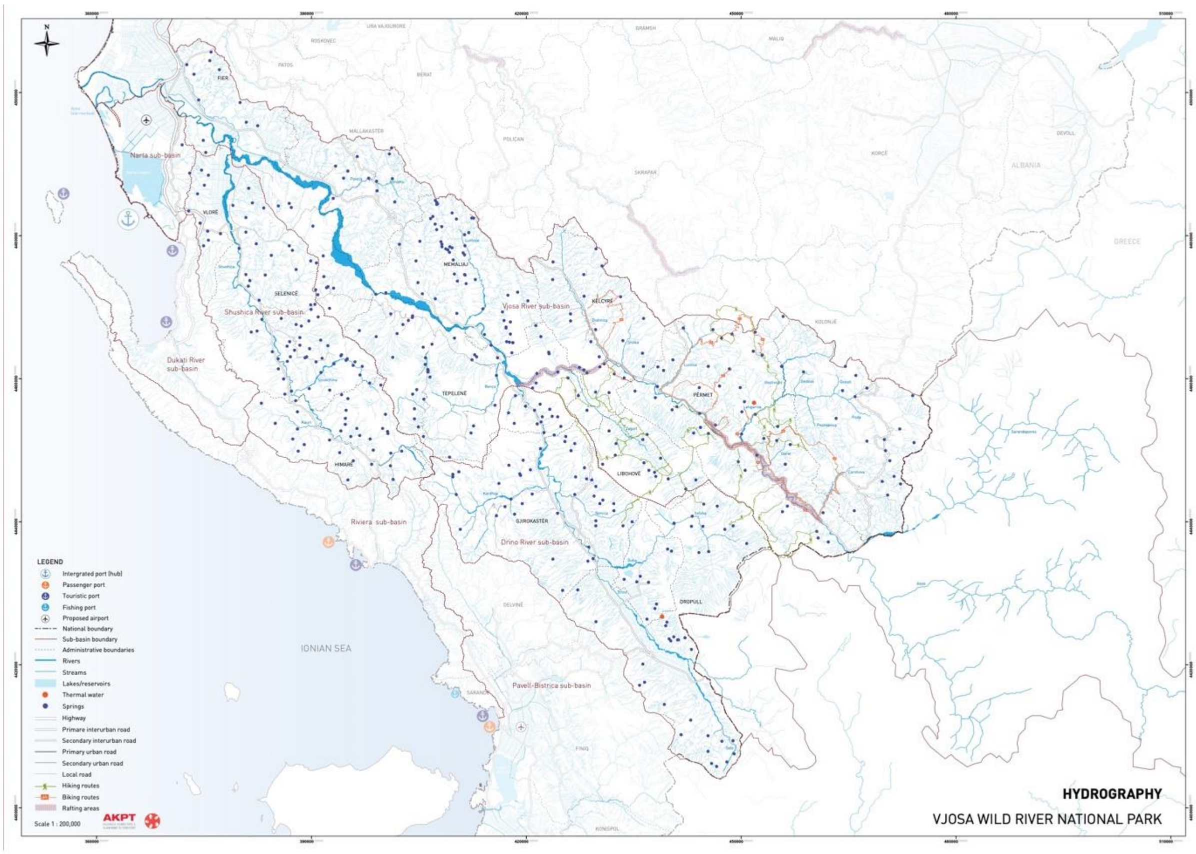


Figure 6: Map of the Vjosa River network (map by NTPA)

Vjosa is not just one of the many similar rivers in Albania. The exceptional biodiversity of the river is very rich and is complemented by the extraordinary value of the unique water regime along the entire river, underlining the importance of the Vjosa River as one of the last free-flowing and intact anabranching river ecosystems in Europe.

BIODIVERSITY CHARACTERISTICS

Research and studies in the area of the Vjosa River and its valley in recent years have revealed a high number and density of species and a variety of endangered habitats at the EU level. The presence of several globally and nationally critically endangered species has been confirmed. The extent of some well conserved EU threatened river habitat types found along the middle section of the Vjosa River and its tributaries is exceptional. A total of 1,725 species are known to date for the Vjosa River and its tributaries in Albania: 653 plants and 1,072 animals.

The existence of a considerable number of endangered species, together with the extraordinary natural ability of the Vjosa ecosystem to contain and grow endangered and rare types of habitats, proves how important the Vjosa River network is and how necessary the protection of its natural integrity is.

MAIN LAND-USE PATTERNS

Land Cover-Use of VRB and their dynamic of changes have been objects of many studies (Habili & Dida, 2000; Pasha, 2000; Troendle, 2002). Referring to these studies the land cover/use maps of Vjosa watershed have been prepared for a series of years: 1960, 1970, 1980, 1986 and 2000 (table 1) (Skrame, 2020)

The main land-use categories in the Vjosa Valley can be divided into 8 types, as shown in the following table 1:

Land-use Categories	% of each category in the catchment				
	1960	1970	1980	1986	2000
Bare/Sand/Rock	3,94	4,17	4,01	10,76	12,51
Broadleaf Forest	10,10	12,39	13,12	9,90	9,28
Conifer Forest	0,58	1,57	2,60	2,06	1,85
Cultivated Land	18,57	21,93	23,32	22,64	21,13
Orchards	0,53	2,01	2,98	1,02	0,93
Pastures	47,89	39,08	36,84	32,97	34,57
Shrubs	16,06	16,2	14,35	17,87	16,95
Urban/Suburban Land	2,33	2,64	2,77	2,77	2,77

Table 1.: Land-use type categories (%) for the Vjosa River catchment (Troendle 2002, Seferlis et al., 2008).

The standard CORINE Land-Cover nomenclature (hereafter CLCN) is a 3-level hierarchical classification system and has 44 classes at the third and most detailed level.

The five main categories of the first level are:

- Artificial surfaces;
- Agricultural areas;
- Forests and semi-natural areas;
- Wetlands;
- Water bodies.

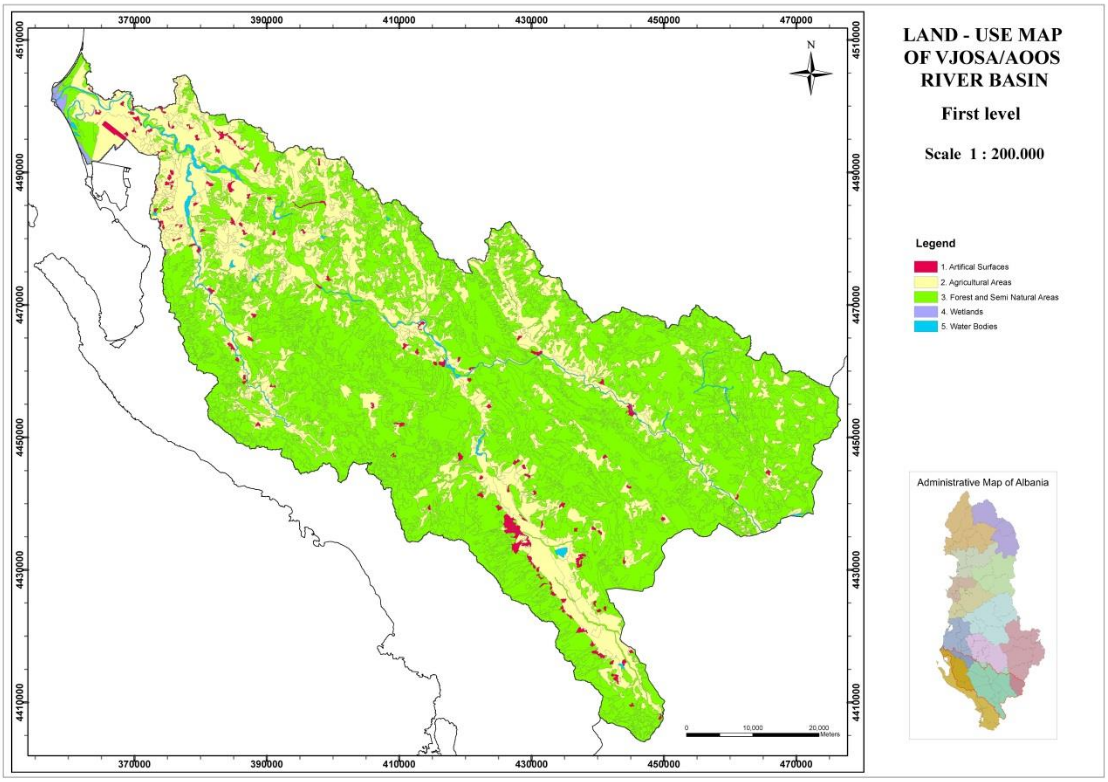


Figure 7: Land-Use Map of Vjosa/Aoos River basin (LUMV) of the first level (in 1 : 200.00 scale). The map shows the distribution of the five CLC categories (Classes: 1, 2, 3, 4 and 5) on the VRB.

The LUMV of the second level (Figure 8) is represented by all the fifteen (15) categories of the second level. The VRB is mainly covered by Scrub and/or herbaceous vegetation associations (41.5%), Forests (22%) and Heterogeneous agricultural areas (14%). 7.3% is covered by Open spaces with little or no vegetation and 6.7% by Arable land. Instead, only the 8.5% is covered by the other CLC classes.

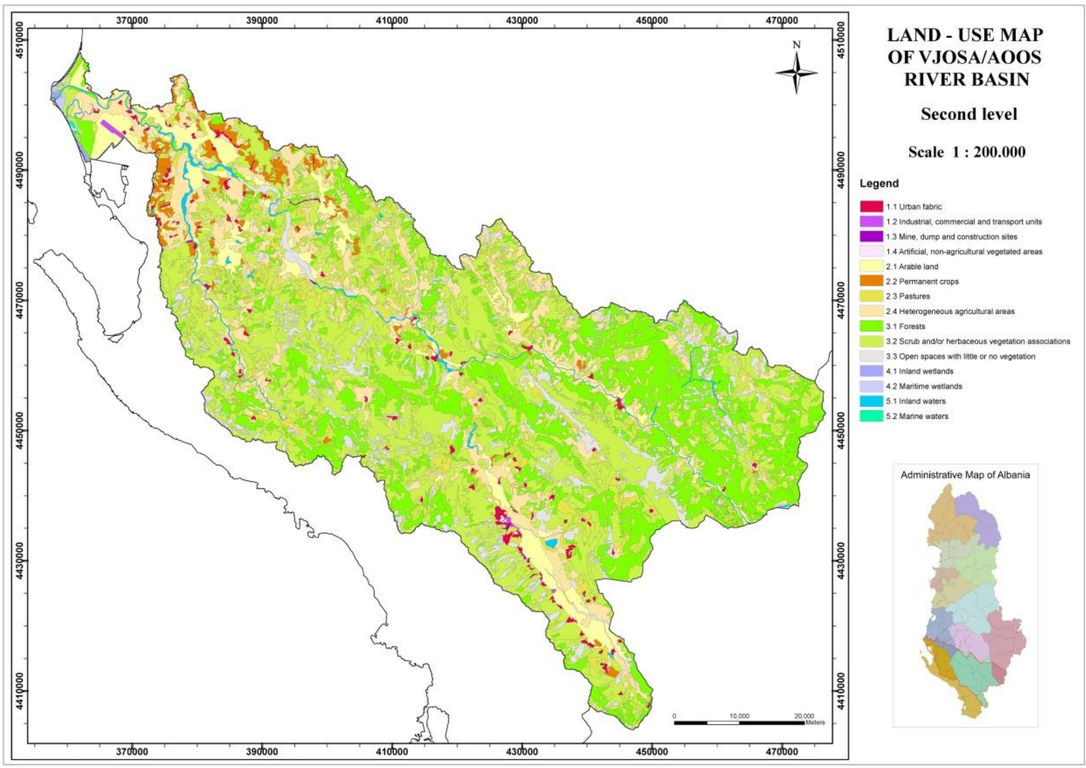


Figure 8: Land-Use Map of Vjosa/Aoos River basin (LUMV) of the second level (in 1 : 200.00 scale). The map shows the distribution of the fifteen (15) CLC categorieson the VRB.

The LUMV of the third level is represented by thirty-five (35) categories of the forty-four (44) categories of the third level as shown on Figure 9. It is mainly covered by 3.1.1 - Broad-leaved forest (18.5%), 3.2.1 - Natural grasslands (16%), 3.2.3 - Sclerophyllous vegetation (14.2%), 3.2.4 - Transitional woodland-shrub (11.1%), 2.4.3 - Land principally occupied by agriculture, with significant areas of natural vegetation (8.4%), 2.1.1 - Non-irrigated arable land (6.4%), 3.3.3 - Sparsely vegetated areas (6%), 2.4.2 - Complex cultivation patterns (5.5%) and 2.3.1 – Pastures (4%). About 10% of the entire VRB is covered by the other CLC classes.

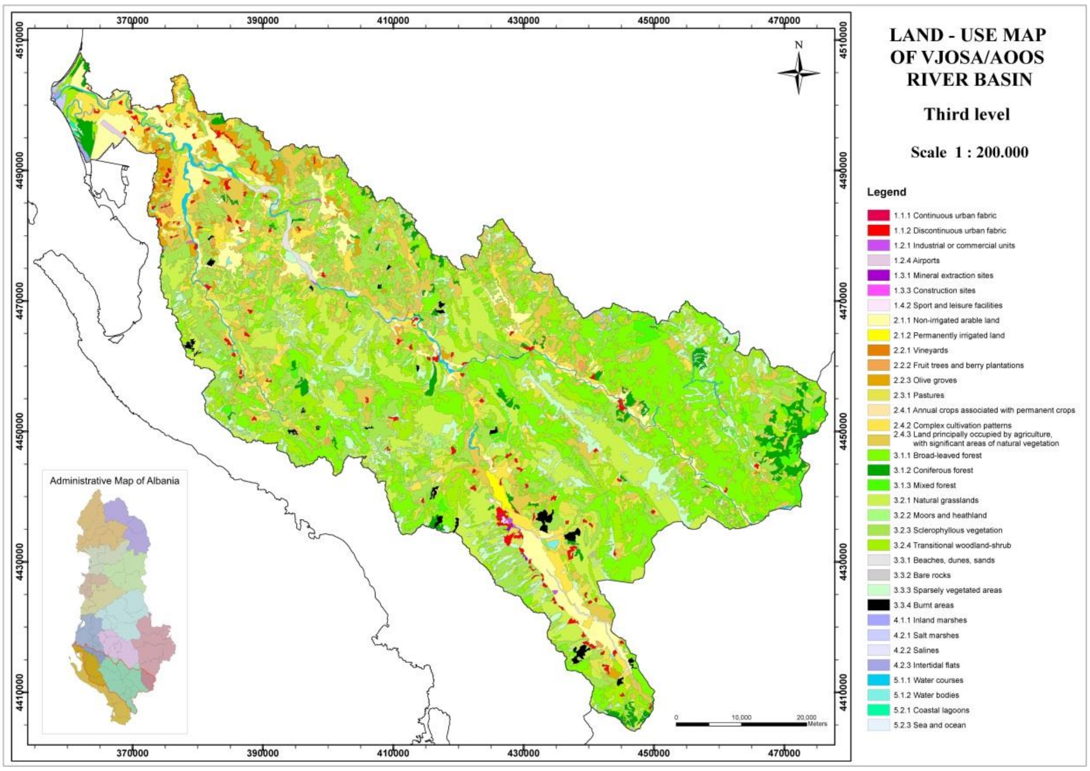


Figure 9: Land-Use Map of Vjosa/Aoos River basin (LUMV) of the third level (in 1 : 200.00 scale). The map shows the distribution of the thirty-five (35) CLC categories

HABITAT TYPES

The Vjosa catchment is an essential area for conservation due to the myriad of habitat types it provides (MoE, 2009; Mullaj et al., 2017; Rössler et al., 2018; see Figure 10).

Schiemer et al. (2020) list 16 habitat types in the river floodplain of the Vjosa river, at low to mean flow, maintained by periodic flood conditions: 7 aquatic habitats (A1-A7); 3 terrestrial habitats within the active channel (AC) on coarse grained sediments (B0-B2); 3 terrestrial habitats within the AC on fine grained sediments (C0-C2); 2 habitats at elevated islands within the AC and on the floodplains (BC3 & BC4); and 1 degradation habitat (D). All are listed in Annex 1 of the European Union Habitats Directive (92/43/EEC, amended document from June 10th, 2013).

The riverine habitats 3220, 3250, 3230, 3240, 92D0, 6210 and 92C0 cover up to 86% of the total area of the Poçemi-Kalivaçi river corridor. Four of them are priority habitats after FFH-Annex I/Natura 2000, EUNIS habitat classification 2004/2012 and EU Red List; respectively: Gravel/sand bars (3220; C3.62; VU); Initial vegetation (3250; C3.553; VU); Mediterranean riparian scrub (92D0; F9.31; LC); and Mediterranean and Macaronesian riparian woodland (92C0; G1.3157; EN); their total areal representation is up to 38%, referred to the morphological floodplain of the Poçemi and Kalivaçi area. (see tables 1-3 in Schiemer et al., 2020) (Abbreviations: EN, endangered; VU, vulnerable; LC, least concern). This underpins the importance of the Vjosa river corridor at a European scale.

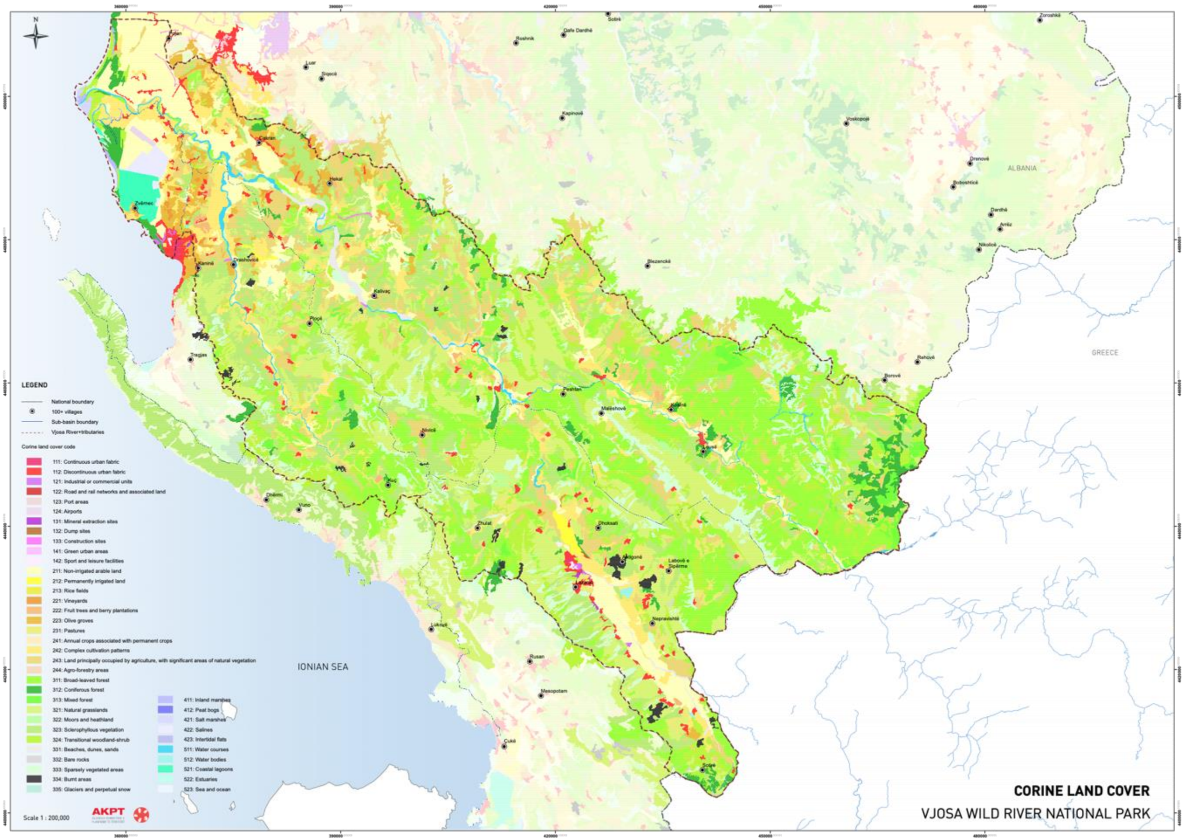


Figure 10: Corine land cover data for the Vjosa River Basin (map by NTPA)

HABITAT TYPES OF THE AREA OAT POÇEM AND KALIVAÇ

The investigated area at Poçem and Kalivaç, covers 2345 ha (1817 ha semiterrestrial and terrestrial habitats + 528 ha wetted areas of the Vjosa) of habitat listed in the Framework of the Habitat Directive (Egger et al. 2019; Meulenbroek et al. 2021). Downstream of Poçem, an additional area of 1386 ha has been identified for some habitat types (3220, 3250, 3230, 3240). This sums up to a minimum value of 3731 ha for the investigated area.

Table 2: Area (ha) of impacted Habitat-Directive types (3220, 3250, 3230, and 3240) for three different sections: Planned Kalivaç reservoir, downstream of Kalivaç Dam to Poçem bridge, and downstream of Poçem bridge; * = Only total area of Habitat-Directive habitats was evaluated

Habitat type	Description	Upstream of Kalivaç Dam (reservoir) (ha)	Downstream of Kalivaç Dam to Poçem bridge (ha)	Downstream of Poçem bridge (ha)
3220, 3250	Vjosa/running water	252	276	*
3220	Alpine rivers and the herbaceous vegetation along their banks	118	98	*
3250	Constantly flowing Mediterranean rivers with *Glaucium flavum*	276	368	*
3230	Alpine rivers and their ligneous vegetation with *Myricaria germanica*	30	14	*
3240	Alpine rivers and their ligneous vegetation with *Salix eleagnos*	28	38	*
	Total	**704**	**795**	**1 386***

Table 3. Area (ha) of impacted Habitat-Directive types (92D0, 6210, 91E0, and 92C0) for three different sections: Planned Kalivaç Reservoir, downstream of Kalivaç Dam to Poçem bridge, and downstream of Poçem bridge (ha)

Habitat type	Description	Upstream of Kalivaç Dam (reservoir) (ha)	Downstream of Kalivaç Dam to Poçem bridge (ha)	Downstream of Poçem bridge (ha)
92D0	Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)	81	197	Not evaluated
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates	63	464	Not evaluated
91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion. Alnion incanae. Salicion albae)	0	8	Not evaluated
92C0	*Platanus orientalis* and *Liquidambar orientalis* woods (*Platanion orientalis*)	29	5	Not evaluated
	Total	**173**	**673**	**-**

Table 4. Selected habitat types in the floodplain zone at Poçem and Kalivaç of the Vjosa investigation area (2019) in relation to the EU-wide inventory of Natura 2000 sites, according to the Habitat Directive. Based on the Natura 2000 Dataset published in 2018 (PublicNatura2000End2017). Datasets with no entries for COVER_HA or with a value of 0 were not included (N = 12 843 for the selected habitat types).

Habitat type Annex I	Sites within EU	Habitat area in sites in EU (ha)	Median (ha)	Max.(ha)	Top quartile	Investigation area, Vjosa 2019 (ha)*	% of EU habitat area in site
3220	434	109 090.5	13.2	52077.5	57.4	216.3	0.2
3230	88	3 669.5	2.9	704.0	19.9	44.7	1.2
3240	540	83 420.5	7.3	52077.5	29.0	66.1	0.1
3250	222	36 506.6	9.6	9559.2	78.3	643.9	1.8
6210	4444	874 815.0	11.0	35827.8	66.6	526.6	0.1
92C0	153	16 678.4	35.7	1592.3	90.7	34.2	0.2
92D0	799	82 312.6	13.4	6995.2	59.3	277.24	0.3

*Wetted area not included

In conclusion:

- Preliminary collaborative research demonstrated the Vjosa´s outstanding status: Both the high abundance of endangered landscape types listed in the EU Habitat Directive and the high biodiversity including threatened and endemic species, underscore its value at EU scale. Indeed, the Vjosa river has been identified as a benchmark for European environmental policy and as a unique natural laboratory for river ecology that could guide restoration efforts in alpine rivers across Europe.

- Fluvial dynamics as the basis for the high and specific biodiversity. The widely undisturbed river dynamics in the Vjosa catchment enables the development of the entire spectrum of floodplain ecosystems from unvegetated gravel bars to floodplain forests. They are of outstanding importance and in an excellent conservation status. All riverine habitats typical for the Vjosa are listed in Annex 1 of the European Union Habitats Directive (92/43/EEC, amended document from June 10th, 2013).

- The riverine habitats 3220, 3250, 3230, 3240, 92D0, 6210 and 92C0 are covering 86% of the total area of the Pocemi-Kalivaci river corridor. This underpins the importance of the Vjosa river corridor at a European scale.

POTENTIAL NATURAL VEGETATION

The section on potential natural vegetation (PNV) is written by Hasenauer et al., 2023. Potential Natural Vegetation, also known as Kuchler potential vegetation, is the vegetation that will develop through natural succession after the last glacier period only driven by environmental conditions (climate, geomorphology, geology) and without any human interventions. It is the result of physiological amplitude of species indicating its theoretical distribution according to the inherited genetic potential and the so-called socio-ecological amplitude indicating the competition among different species for a given place to grow. With other words, the PNV represents the dominating species or species composition of forest succession for a given forest site without any human interferences. Within forest management is considered as a reference ecosystem since the degree of divergence to an existing ecosystem is an indicator of management impacts and degradation effects. The Vjosa river basin has gone under severe and heavy management impacts by overcutting and livestock farming resulting in large devastated forest areas. In addition, little is known about the distribution of the potential natural vegetation coverage. Thus, we obtained European natural vegetation map (scale 1: 250,000) provided by Bundesamt für Naturschutz (2003). The results are shown in Figure 11.

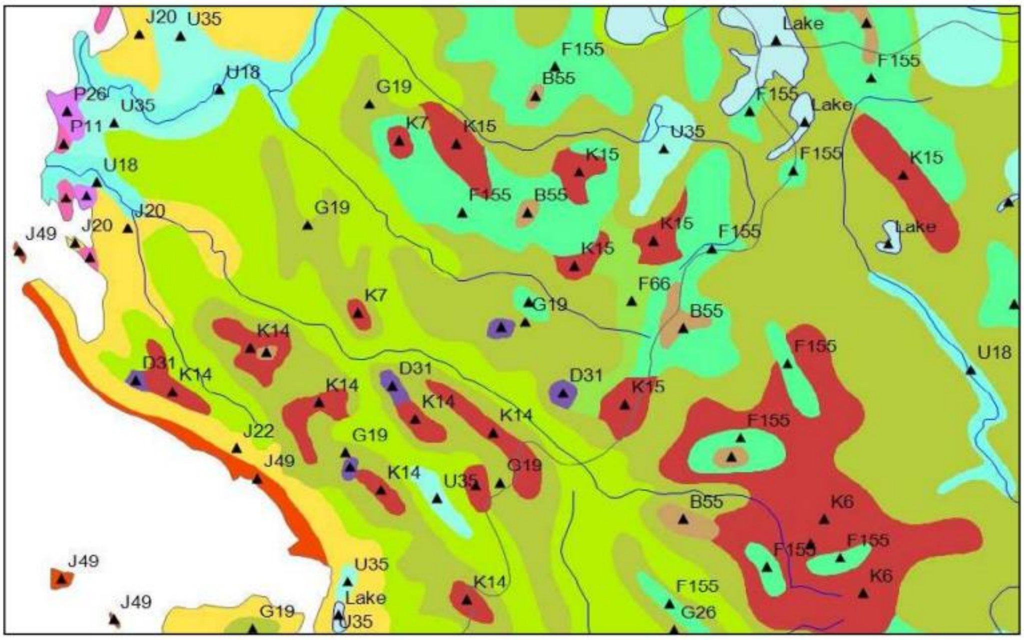


Figure 11: Main Potential Natural Vegetation (PNV) in teh Vjosa River Basin (Bohn iet al., 2003)

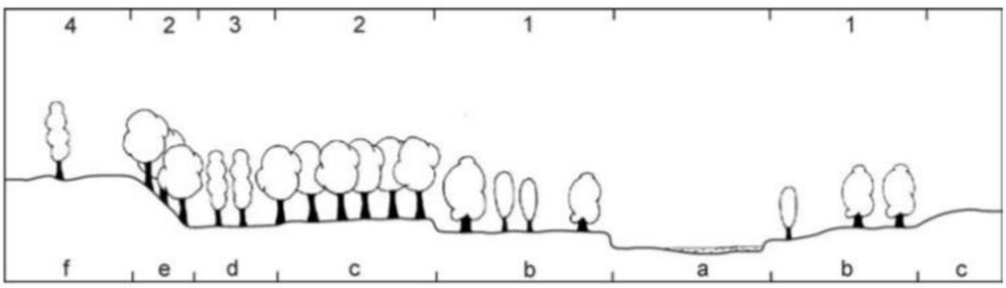
As shown in Figure 11, the PNV of the study area includes zonal and azonal vegetation. Zonal vegetation primarily (climatically conditioned) includes the following formations:

- B55 - B-Arctic tundra and alpine vegetation. This formation lies in coastal lowland and high mountainous locations of Europe. In the case of the Vjosa river basin, it is represented by unit B55 -Iberian, Apennine, Illyrian-Dinaric and Balkan alpine vegetation on carbonate and silicate rock. Their occurrence is restricted to peak areas of the Vjosa river basin and the vegetation on carbonate rock (B55) is characterized above all by grasslands with endemic *Festuca* and *Sesleria* species, but this is outside the border of the Vjosa Wild River National park.

- D31 - D-Mesophytic and hygromesophytic coniferous and mixed broad-leavedconiferous forests, where the main unit from this formation is D31. In southern Albania the spruce forests are formed almost exclusively on limestone between 1200 and 1600 m and consist of *Abies borisii-regis* (an intermediate form between *Abies alba* and *Abies cephalonica*D31). Only in some places do *Fagus sylvatica* (in the north-east), *Pinus nigra* or *Fraxinus ornus* (in the south) exist as admixtures. With *Abies borisii-regis*, the Albanian endemic *Hypericum haplophylloides*, the basiphilous shrub and herb layer (*Sorbus graeca, Daphne mezereum, Sesleria coerulans, Brachypodium pinetum*, and *Galium lucidum agg.*) and xerothermic oak, forests as adjacent communities, this unit is clearly different from the one found in Central Europe.
- F155 - F-Mesophytic deciduous broadleaved and mixed coniferous-broadleaved forests, where the most representative units from this formation are Hellenic beech and fir-beech forests (F155). This formation mainly encompasses deciduous forest communities, but does not include thermophilus deciduous forests dominated by summer-green oak species that occur in the warm temperate climate. This formation covers deciduous forest communities but does not include thermophilus deciduous forests dominated by summer-green oak species that occur in the warm temperate climate. Hellenic beech and fir-beech forests are mainly represented by fir and beech forests, where the entire edaphic spectrum from acidic to calcareous beech forest is represented. This unit stretches from south-eastern Albania and southern Macedonia via north-western Greece (Pindos mountains). It inhabits mesotrophic to eutrophic soils over flysch.
- G19/G26 - G-Thermophilous mixed deciduous broad-leaved forests, also known as xerothermic mixed oak forests, where one of the units is Pannonian-Danubian-Balkan lowland to submontane Balkan oak-bitter oak forests (G19). This unit is represented by *Quercus cerris – Quercus frainetto* forests, with a species-rich flora of woody plants and south and east Balkan colline to montane (mixed) Balkan oak forests (G26). Pannonian-Danubian-Balkan lowland to submontane Balkan oak-bitter oak forests (G19) represented by *Quercus cerris-Quercus frainetto* forests with a species-rich flora of woody plants. The forests are medium- to tallgrowing with two- to three-layers and *Quercus cerris* and *Quercus frainetto* dominating the upper tree layer. Depending on the location, it is mixed with *Carpinus orientalis, Fraxinus ornus, Sorbus torminalis, Acer campestre, Ulmus minor*. The shrub layer mainly consists of *Crataegus monogyna, Cornus mas, Ruscus acuelatus, Euonymus verrucosa* etc. In the herb layer, thermophilus species are predominant, including *Potentilla micrantha, Helleborus odorus, Lithospermum purpurocaeruleum, Polygonatum hirtum, Lathyros laxiflorus, Brachypodium sylvaticum, Stellaria holostea, Festuca heterophylla, Anemone ramunculoides*. The G26 unit includes Balkan oak forests with dominant *Quercus frainetto*. The two-to-three layered forests are mostly medium, rarely tall growing. *Quercus frainetto* is the dominant species in the upper tree layer, with varying admixture of *Quercus cerris* and *Quercus pubescens*. In the lower tree layer, *Carpinus orientalis, Fraxinus ornus, Ostrya carpinifolia* also appear. The shrub layer contains common species such as *Juniperus oxycedrus, Paliurus spina-christi, Phillyrea media* etc. The herb layer contains numerous thermophilus species, including *Lathyrus niger, Potentilla micrantha, Lathyru laxiflorus, Silene coronaria*, and *Helleborus odorus, Galium pseudo-aristatum*. J20 - J-Mediterranean sclerophyllous forests and scrub includes communities of xeromorphic evergreen tree and shrub species, especially the genera *Quercus, Pinus, Juniperus*, and *Pistacia*. In the Vjosa river basin, the J20 unit can be found. Sclerophyllous forests and scrubs occur on all slopes and expositions and most evergreen, broadleaved forest species can grow as trees or shrubs, depending on external influences. The holm oak (*Quercus ilex*) is the most competitive species in dry locations and, in some locations, is mixed with kermes oak (*Quercus coccifera*) and *Quercus cerris, Quercus frainetto, Fraxinus ornus,* and *Carpinus orientalis*. In some cases, grazed oak forests are replaced by a very dense evergreen shrub layer, which can me composed of *Erica arborea, Arbutus unedo*, and *Arbutus andrachne, Myrtus communis, Phillyrea media* etc. In some sites *Pinus halepensis* artificial forest stands were established and in many areas the understory is represented by the common shrub of the thermo-

Mediterranean sclerophyllous shrub formations. Due to tough bark and high regenerative capacity through seed production, *Pinus halepensis* forest stands tolerate fire more than other tree species and for that reason they may dominate or suppress oak as the main tree species. J20 extends further into the colline inland. The south of Albania is climatically much more favorable and the East Mediterranean character in the evergreen sclerophyllous vegetation is more present, since Arbutus andrachne appears in the shrub vegetation.

- K7/K14 - K-Xerophytic coniferous forests and scrub consists of conifer-dominated communities of dry sites on shallow soils, with no groundwater access. Stands are mainly formed by *Pinus.* Their stand structure is shaped by edaphic and climatic factors, but is often altered by human interventions. In some cases, this can result in open stands where the spacing between trees is large.
- Due to a shallow rooting system and steep slopes, many *Pinus halepensis* trees have fallen (for instance in forest stands across the street of the Uji Trebeshina water plant). The main units in the Vjosa river basin are K7 and K14. The K7 unit is mainly located in mountainous regions of the Vjosa river basin, where *Abies borisii-regis* and *Pinus heldreichii* forests are situated. Logging and grazing are widespread forms of disturbance. K14-Meso to Mediterranean pine forests (*Pinus halepensis*) are widespread in the Vjosa river basin and are formed by artificial planting. They were planted due to its resistance to harsh site conditions, as a pioneer species in reforestation of bare lands. They occur on shallow soils of limestone or serpentine sites, forming mostly pure stands U – Azonal vegetation sites. In the Vjosa river basin, azonal vegetation determined by specific soil properties and water regimes, covers vegetation resulting from flood plains, estuaries and freshwater polders as well as other damp or wet (U) sites. This formation of riverine biocenosis and intermittently moist to wet lowlands is represented by deciduous lowland forests and scrubs, often combined with tall reeds, grasslands, herbaceous perennials, and annual vegetation. Shrubs determine the structure of floodplain vegetation with *Salix, Poplar, Platanus, Ulmus*, and *Alnus.* These species are adapted to mechanical loads from water currents, as well as sharp fluctuations in water levels with frequent changes from flooding with floods in winter and in autumn. This vegetation can survive such events without damage and if damaged regenerating occurs quickly. In the Vjosa river basin, there are mainly coniferous alluvial forests (*Salix alba, Populus nigra*, and *Populus alba*) and humid lowland forests of larger river valleys (U18).



1-*Populetum albae*; — a-riverbed at low water

2-*Rubio-Carpinetum betuli*; — b & d- Area affected by floods

3-*Carici remotae-Fraxinetum spp*; — c-Terrace bank

4-Single tree of *Fraxinus angustrifolia*; — f-Terrace

Figure 12: Vjosa River alluvial forests profile

Softwood riparian forests are associated with young riverine sediments and an area extending from the mean waterline to 3/4 to 1 m above it. Due to the frequent flooding, these areas are hardly used for forestry purposes. Sometimes, these species are mixed with hardwood riparian forest species such as elm.

The recent forest area development can be summarized as follows: Between 2000 to 2020 the forest area declined by 9 % from 110.305 ha to 99.834 ha (see Figure 3 and Table 5). Compared to the total land area of the Vjosa catchment, the forest area decreased by 2%, from 24% to 22%. The most affected forest type was the broad-leaved forest, which diminished by 13%. Both mixed and coniferous forest types increased from 2000 to 2020 (2% and 1% of the total forest area, respectively). Mixed forests grew by 40%. At the same time the pasture area increased by 169% from 6039 ha to 17542 ha.

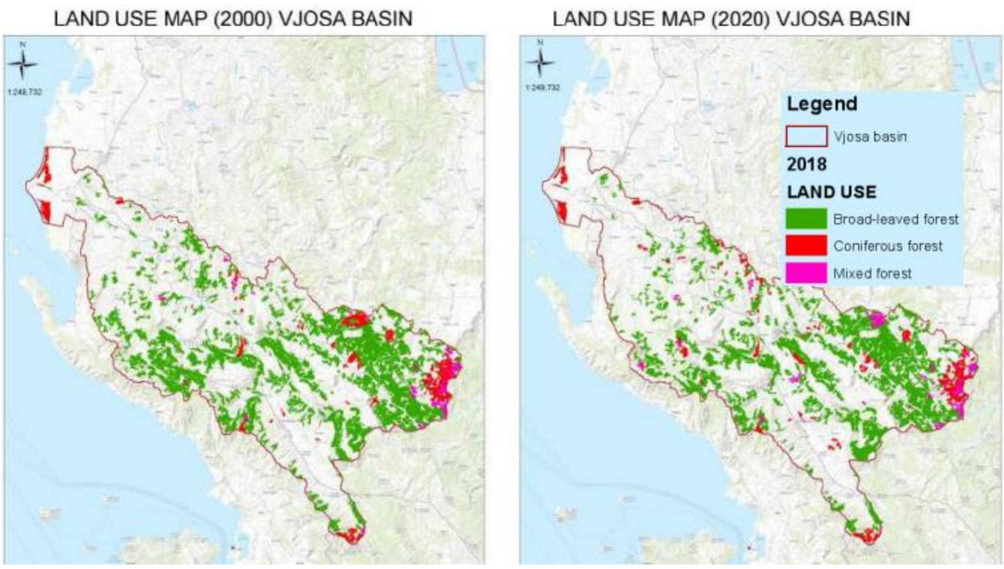


Figure 13: Changes in forest land use (2000 – 2020)

Type	area 2020 (ha)	In % of forest area	area 2000 (ha)	In % of forest area	Delta (ha)	Delta in %
Broad-leaved forest	82990.97	83%	95011.55	86%	-12020.57	-13%
Coniferous forest	11810.67	12%	11702.88	11%	107.79	1%
Mixed forest	5033.15	5%	3590.93	3%	1442.21	40%
Total forest area	**99834.79**		**110305.36**		**-10470.57**	
		In % of total land area		**In % of total land area**		
Total forest area	99834.79	22%	110305.36	24%	-10470.57	-9%
Total land area	**460687.80**		**460687.80**			

Table 5: Changes in forest land use from 2000 to 2020. 'Delta' shows the changes in total numbers and in percentage (2000 – 2020).

FLORA

Due to the lack of extensive studies, it is difficult to pinpoint the precise number of higher plant species found across the Vjosa catchment. Plants include: 354 non-vascular plants (algae) and 299 vascular plants and 68 species of mushrooms are featured in the coastal habitats of the Vjosa-Narta Lagoon. In the Gjirokastra region, according to Malo (2011), no less than 12 taxa are new for Albania, 40 taxa are sub-endemic, and 30 are rare or endangered species (Tan et al., 2011; Shumka et al., 2018).

Moreover, 3 additional threatened species on the IUCN Red List, *Aesculus hippocastanum, Galanthus reginae-olgae*, and *Solenanthus albanicus*, which are categorized as Vulnerable C2a(i), Vulnerable B2ab(iii,v), and Endangered B1ab(v) + 2ab(v), respectively, are found in the river banks and on the rocky faces along the tributaries, as well as the alpine limestone grasslands of the watershed. The dunes or wetlands are also home to several rare or relict species, including *Anacamptis morio ssp. Caucasica, Ephedra distachya, Narcissus tazetta, Nymphaea alba, Nuphar lutea, Nymphoides peltata*, and various species of *Orchis*, *Ophrys*, *Limonium*, and *Scilla*. Other species with a more restricted range can also be found there (Shumka et al., 2018).

In addition, about 380 species of MAPs (Medical and Aromatic Plants) have been recorded within the watershed, 330 of which are wild species (Miho & Shuka, 2017). About 46 of these species are designated as endangered, threatened, or protected, and yet continue to be harvested in the wild, while roughly 70 species grow near water courses. Some of these species belong to the National Red List of species, e.g., *Adiantum capillusveneris* (VU A1b), *Dryopteris filix-mas* (LC), *Alnus glutinosa* (Vu), *Capparis spinosa* (VU A1b), *Galanthus reginae*-olgae (CR B1), *Populus alba* (VU A2b), *Quercus robur* (VU A1b), *Salix fragilis* (VU A1b), *Sambucus nigra* (VU Alb), *Symphytum officinale* (VU A1b), *Ulmus minor* (VU A2b), *Anacamptis morio* (EN A1b), *A. pyramidalis* (EN A1b), *Colchicum autumnale* (EN A1b), etc. (Meulenbroek at al., 2018).

FAUNA

The Vjosa River Basin is home to a vibrant and extensive diversity of fauna and includes many endemic species of great national and international importance in terms of conservation. The diverse populations of fauna in the Vjosa River Basin include:

- More than 150 species of winged insects (*Pterygota*) from different aquatic and terrestrial habitats in the IUCN Category V (protected landscape/ seascape) in the Vjosa-Narta zone (Paparisto, 2001; Shkëmbi et al., 2015; Shkëmbi et al., 2018; Cuvelier et al., 2018).
- The significance of the intact fluvial dynamics is illustrated here with the example of the ground beetle fauna (Carabidae, see Paill et al. 2018). The species richness in the Vjosa river corridor is enormous considering the limited collection time and the small river section which has been studied so far. 112 species have been documented. This exceeds the species richness of carabids in most other near-natural river systems in Europe (e.g. Plachter 1986). In the Tagliamento in Northern Italy, for example, 185 carabid species have been found based on an investigation over the whole river length from headwaters to the estuary over a period of more than 20 years (Kahlen 2009). From the 112 species (2,327 specimens) collected on the Vjosa, 70 (1566 specimens) were exclusively found within the active

channel (AC). The relative abundance of stenotopic riparian species reached values of 93% to 97% (in terms of individual numbers) in the regularly flooded levels of the AC, but only 4% in the higher floodplains.

- The large number of species found and the high percentage of stenotopic floodplain-species which have become very rare throughout Europe (e.g. *Bembidion quadricolle, B. scapulare, B. striatum, Stenolophus discophorus*, and *Poecilus striatopunctatus*) underlines the high conservation value of the Vjosa. It represents a genetic pool of international significance. Other invertebrate species are also well represented. Among orthopterans *Saga pedo* is listed as a strictly protected species in Appendix II of the Bern Convention. *Sphingonotus coerulans, Acrotylus insubricus, Xya pfaendleri* and *Xya variegata*, are listed on the European Red List (see Rabl and Kunz 2018).
- Recent survey, which gives only a snapshot of the existing diversity at the catchment scale, yielded 143 species thus far, of which approx. 50%—according to "Fauna Europaea" (https://fauna-eu.org)—are new to the fauna of Albania. It includes species endemic to the western Balkans (e.g. Ephemeroptera: *Rhithrogena neretvana, Ecdyonurus puma, Ephemerella maculocaudata*, and Trichoptera: *Rhyacophila diakoftensis, Rhyacophila balcanica, Rhyacophila loxias, Micrasema sericeum, Thremma anomalum*, among others), and vital populations of pan-European species like the Plecoptera *Marthamea vitripennis* and *Xanthoperla apicalis*, the Ephemeroptera *Neoephemera maxima* and *Prosopistoma pennigerum* and the aquatic beetle *Potamophilus acuminatus* (Coleoptera: Elmidae). These species were formerly widely distributed in large, dynamic rivers across Central and Eastern Europe and are now on their decline (see Graf et al. 2018, Bauernfeind 2018) and are considered to be endangered at a European scale.
- About 60 mollusk species were reported in the coastal habitats of the Vjosa Delta to the Narta wetlands; among them, 27 gastropods (snails), 29 bivalves (mussels), and 4 cephalopods (octopus, squids, and cuttlefish). Of these, 42 species originate from marine habitats, 12 from freshwater, and 6 from terrestrial sites (Beqiraj, 2001, 2004; Beqiraj et al., 2002; Dhora, 2002).
- At least 31 species of fish inhabit the river system, 27 of which are native, including 8 species endemic to the Balkan and 4 non-native species (Shumka et al., 2018). The Vjosa River, its delta, and the Narta Lagoon make the more general area important for fish diversity, fishing, and aquaculture (Shumka et al., 2010, 2014; Markova et al., 2010; Snoj et al., 2009). The fish fauna is an important indicator for the ecological integrity of large river systems as a broad spectrum of habitat conditions are required to fulfil the habitat needs of different ecological guilds in the course of their life cycle (Schiemer and Waidbacher 1992). The Balkan rivers are characterized by Europe's highest concentration of endemic fish species (Freyhof and Brooks 2011). Shumka et al. (2018a) list 31 fish species inhabiting the Vjosa river system including the critically endangered species *Anguilla anguilla* (European eel) and endangered species *Aphanius ibericus* (Spanish toothcarp) and *Gobio skadarensis* (Skadar gudgeon) according to IUCN criteria. Furthermore, the Vjosa's fish fauna is characterized by several species endemic to the Balkans e.g. *Barbus prespensis* (Prespa barbel), *Luciobarbus albanicus* (Albanian barbel), *Pachychilon pictum* (Albanian roach) and *Oxynoemacheilus pindus* (Pindus stone loach). The Vjosa is a large migration corridor for both anadromous and catadromous species as well as other saltwater species entering the system. Meulenbroek (in litt.) documented *Anguilla anguilla* from 100 mm up to 510 mm length up to the boarder to Greece. These findings indicate that Mediterranean rivers are significant for the conservation of the European eel stock. The river potentially provides habitat and spawning sites for anadromous sturgeons (Acipenseridae) such as the critically endangered *Acipenser sturio* and *Acipenser naccarii*, which are found along the Albanian coast (Freyhof and Brooks 2011). The assessment of the fish fauna (Meulenbroek et al. 2018) showed distinct differences in the distribution of species and their ontogenetic stages within the riverine habitat range (A1–A5) indicating the need for a broad spectrum of habitat conditions in terms of water depth, flow velocities and substrate types, that provides the basis for species and ontogenetic niches of the characteristic assemblages. Many taxonomic groups of aquatic and terrestrial invertebrates are not, or only sparsely treated in the IUCN Red List, the Bern Convention list or the Albanian Red List of endangered species. To evaluate the conservation status of such taxa we have to refer to their decline in geographic occurrence and population size in Central Europe over the past decades. Macroinvertebrates are a main component for the biological quality assessment in the European Water Framework Directive (Hering et al. 2010). The Vjosa River

provides ideal aquatic habitats for a variety of migratory fish species, as well as certain critically endangered species (Jacoby & Gollock, 2014).

- At least 32 of the 37 reptile species have been identified in Albania. Of the amphibians and reptilians recorded, the following are listed either in Appendix II of the EU Habitats Directive-strictly protected fauna species (*Bufotes viridis, Bombina variegata, Testudo hermanni, Emys orbicularis, Mauremys rivulata, Pseudopus apodus, Podarcis muralis, Podarcis tauricus, Lacerta trilineata, Lacerta viridis, Natrix tesselata*) or Appendix III—protected fauna species (*Bufo bufo, Rana graeca, Pelophylax kurtmuelleri, Pelophylax shqipericus, Natrix natrix*) of the Bern Convention (see Frank et al. 2018; Shumka et al. 2018b).
- A total of 257 recorded bird species across the various ecosystems and habitats of the Vjosa River Basin (MoE, 2009; Bego, unpublished data). The surveys conducted in June 2023 in Vjosa River National Park (Bino, T. et al., 2023) provided surprising results for the colonies of Sand Martin (*Riparia riparia*) as well as large numbers of breeding pairs for the Stone Curlew (*Burhinus oedicnemus*) and Little Ringed Plover (*Charadrius dubius*). Comparison with the national data for breeding birds (EBBA2 2018), show that Vjosa river and its tributaries form the most important breeding ground for the above species in Albania. It is a rather convincing argument that the preservation of those populations is crucial for the survival of the three species in Albania. On the other hand, the survey registered several threats to the above birds in the form of gravel and sand extraction, human disturbance, presence of feral animals related with poor management of waste. Such threats were more evident in the main course of Vjosa river in the segment Mifol-Dragot and Shushica. Unfortunately, this coincides with the presence of the major number of breeding pairs for the three species. It is therefore evident that this segments needs conservation and management actions to ensure the preservation and enhancement of these important biodiversity features of the National Park.

SAND MARTIN *RIPARIA RIPARIA*

The Sand Martin was registered in 13 small, medium and large colonies with a total number of 16,175-18,340 nest holes.

Nevertheless, not all the nest holes were actively used by nesting birds. We estimated that in average only 80% of the nest holes were used by breeding birds. This informs that the number of breeding pairs in Vjosa river and its tributaries is estimated at 12,940-14,672 breeding pairs. This figure is more than double the number of breeding pairs estimated at i 5,223-8,625 in Albania in 2018 (EBBA 2 Albania). It demonstrates the importance of Vjosa river for the conservation of the Sand Martin in Albania.

The largest colonies were registered in fiver main locations (Fig. 14).

a. The river bed in between Kashishte-Beshisht seemed to 7,800-8,800 nest holes or 6,240-7,040 active nests.
b. River section close to Selenica with a large colony of 4,670-5,200 nest holes or 3,735-4,160 active nest.
c. The third large colony was located in the section Kute-Corrush with 1,200-1,400 nest holes or 960-1,120 breeding pairs.
d. The Vjosa river section of Pocem hosted a colony of 800-900 nest holes or 640-720 active nests.
e. Shushica river, the river section of Xhyherine hosted a colony is estimated at 720-840 active nest based on the presumption that 80% of the nest holes were active.

The above data show that the most important river body for the Sand Martin *Riparia riparia* is Vjosa river main course with 14,750-16,650 nest holes or 11,800-13,320 breeding pairs.

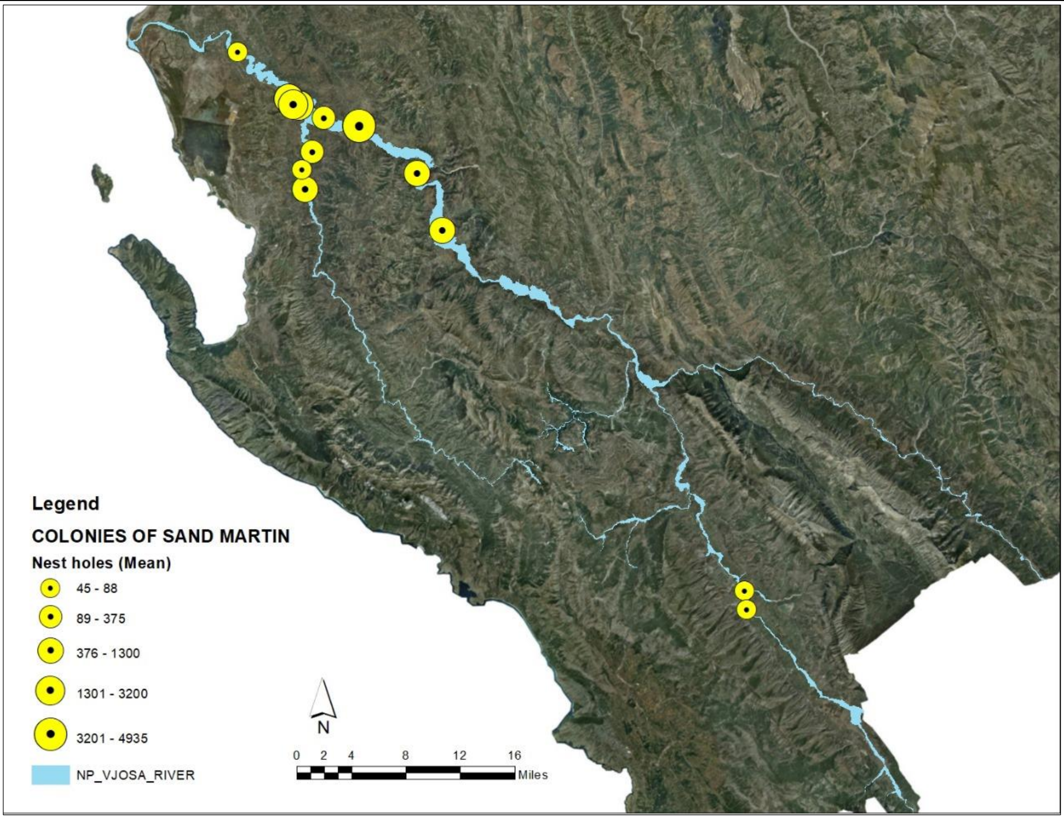


Figure 14: Colonies of the breeding Sand Martin (*Riparia riparia*) in the Vjosa river and its tributaries

Shushica river is the second important river body with 1,320-1,530 nest holes or 1,055-1,225 breeding pairs. Drino river is the other river body with active nests of Sand Martin with a total number of 85-130 breeding pairs out of 105-160 nest holes.

STONE CURLEW *BURHINUS OEDICNEMUS*

The Stone Curlew was registered in 44 different locations in the peak of the breeding season. For some pairs we found evidences of confirmed breeding in the form of eggs and chicks. The rest is either probably or possibly nesting in the gravel beds of Vjosa river. Considering other parts not entirely covered due to difficulties in access, it is estimated that 40-60 breeding pairs use Vjosa river as a nesting area. This figure represents 47-55% of the reported breeding population of 73-128 pairs of Stone Curlews in Albania as reported in 2018 (EBBA2).

The gravel beds in the main course of Vjosa river hosted c 74% of the breeding pairs. The second most important river body in terms of the number of breeding pairs is Shushica with c. 19% and Drino with c. 7% (Fig. 15)

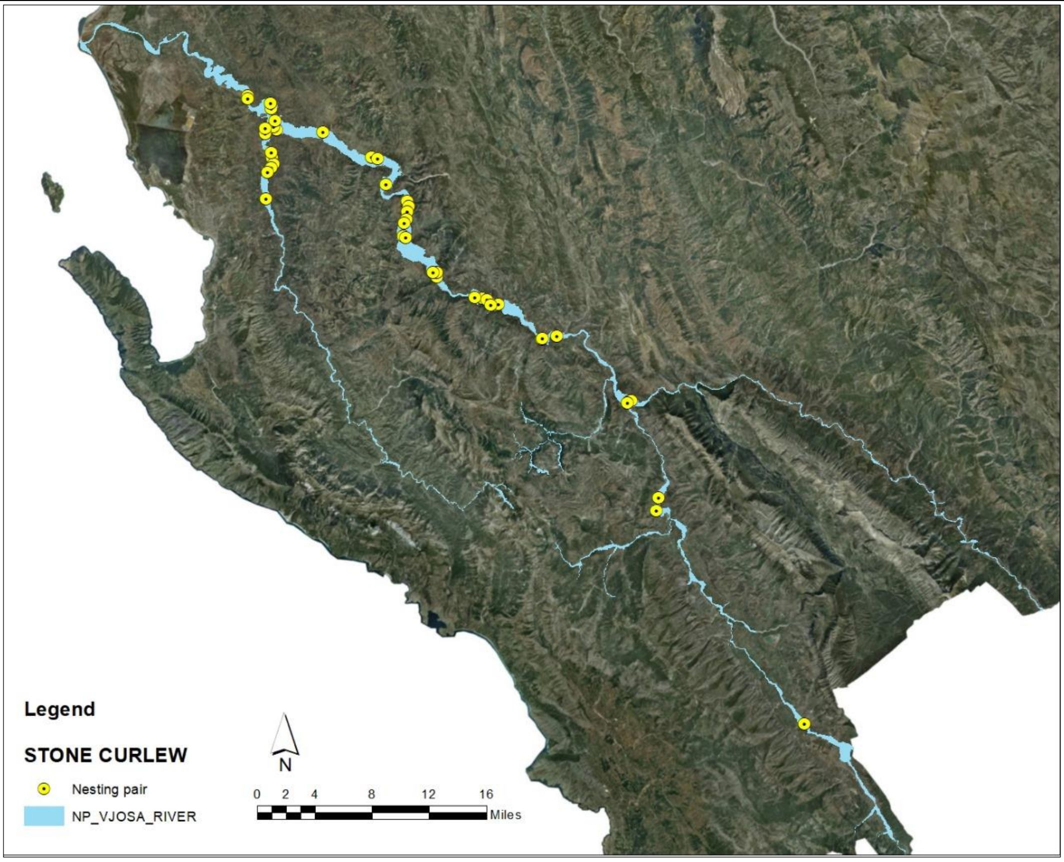


Figure 15: Nesting places of the Stone Curlew (*Burhinus oedicnemus*) in the Vjosa river and its tributaries

The largest gravel beds of Vjosa river, those from Kashishte downstream up to Memaliaj upstream are the most populated by the Stone Curlew. Indeed, those areas offer the best habitat in Vjosa river as they are large gravel beds, dry during summer and with limited vegetation cover where it is easy to run in case of disturbance or predation.

LITTLE RINGED PLOVER *CHARADRIUS DUBIUS*

Surveys registered the presence of 151-209 breeding pairs of Little Ringed Plovers in 152 locations. This figure is rather important for Albania as Vjosa seems to host 26-42% of the total number of breeding pairs in Albania. The shingle banks surrounding the fast flow of Vjosa river present a perfect breeding and feeding habitat for the species. As for the other previous species, the majority of the breeding pairs occurred in the main course of Vjosa river, in the segment in between Mifol to the junction of Vjosa with Drino river. Important numbers were recorded at Shushica river followed by Drino, Kardhiq, Suhe and Sarandopor.

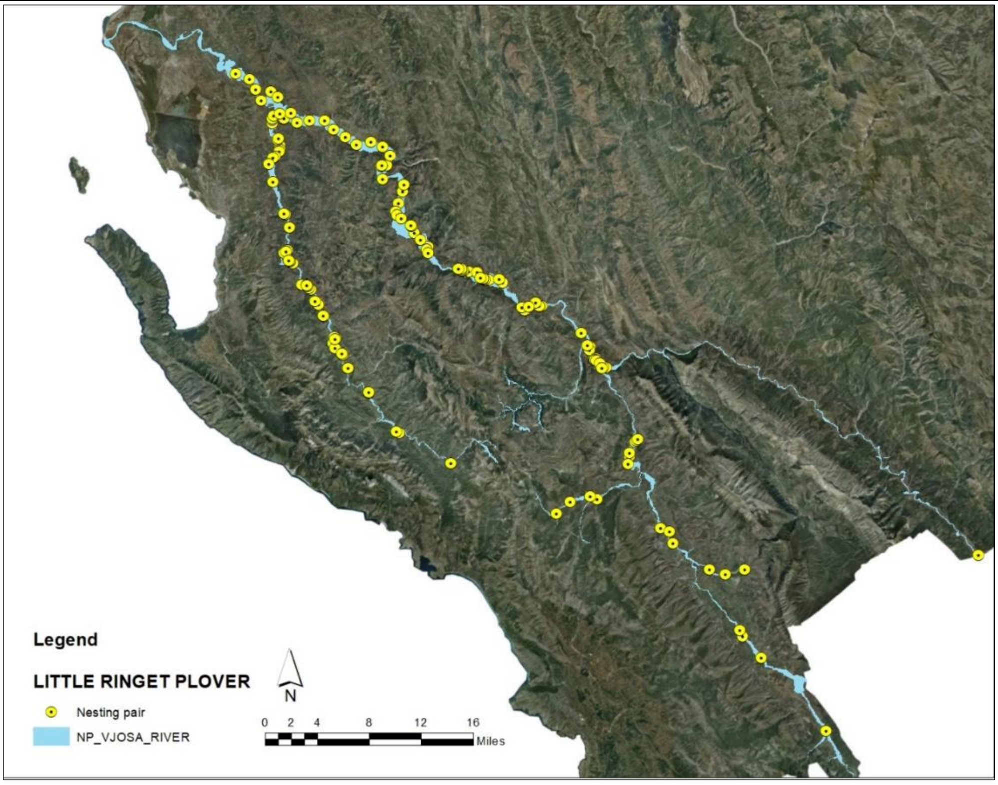


Figure 16. Nesting places of the Little Ringed Plover (*Charadrius dubius*) in the Vjosa river and its tributaries

The surveys provided surprising results for the colonies of the Sand Martin (*Riparia riparia*) as well as large numbers of breeding pairs for the Stone Curlew (*Burhinus oedicnemus*) and Little Ringed Plover (*Charadrius dubius*). Comparison with the national data for breeding birds (EBBA2 2018), show that Vjosa river and its tributaries form the most important breeding ground for the above species in Albania. It is a rather convincing argument that the preservation of those populations is crucial for the survival of the three species in Albania.

Gravel extraction, human disturbance, presence of feral animals related with poor management of waste were the most visible threats for the above species. Such threats were more evident in the main course of Vjosa river in the segment Mifol-Dragot and Shushica. Unfortunately, this coincides with the presence of the major number of breeding pairs for the three species. From the management point of view this seems the segment where major conservation and management actions should take place to ensure the avoidance and mitigation of the threats and consequently the safeguard of colonies and breeding territories.

- The area also harbors around 70 of the 86 registered terrestrial mammal species in Albania (MoE, 2009; Bego, unpublished data), including the European otter, which is significant for the entirety of the Vjosa River system, as well as large carnivores, such as the brown bear and the wolf. Large mammals in the Vjosa watershed also include the Chamois (*Rupicapra rupicapra balcanica*), the roe deer (*Capreolus capreolus*), and the wild boar (*Sus scrofa*). The study area is also a welcoming habitat for both cave-dwelling and forest bats; 29 out of 32 bat species recorded in Albania are present within the Vjosa watershed (Meulenbroek et al., 2018).

Many species that make the Vjosa River Basin their home are listed in *Appendix 1-3 of the Bern Convention*: 41 are found in the *Appendix of the Birds Directive*, and 78 in the *Habitats Directive*. Annex I of the Birds Directive lists 36 bird species, and Annex II of the Habitats Directive lists 1 amphibian, 3 arthropods, 12 fish, 10 mammals, 3 mollusks, and 5 reptiles. 2 species of fish and 2 mammals found in the Vjosa River Basin and listed in Annex II of the Habitats Directive are considered priority species and of very high conservation importance at the EU level. At the national level, the National Red List includes 5 arthropods (VU); 30 birds (6 CR, 6 EN, 18 VU), 6 fish (5 RR, 1 VU), 6 mammals (2 RR, 4 VU), and 3 reptiles (CR).

The Vjosa River Basin holds some of the largest national habitats of particular species or those not found anywhere else in Albania, while studies carried out so far have also discovered the existence of several new species. The fauna of Vjosa comprises typical elements of highly dynamic large rivers, all of which have lost large areas of their former distribution in Europe. These riverine faunal elements are highly sensitive to changes in the natural hydro-morphology. These points attest to the national (and international) importance of the Vjosa River Basin in terms of species conservation, and emphasize the necessity of its protection (*EcoAlbania*, 2021).

EVALUATION OF THE BIODIVERSITY VAUES

The biodiversity values of the Vjosa River valley are assessed based on the range of its habitats and the richness of its species, through various assessment criteria and instruments (national red lists of endangered species, Bern Convention appendices, Appendices of EU Habitats and Birds Directives, IUCN global red lists) (*EcoAlbania*, 2021).

With its largely unobstructed fluvial morphology, longitudinal continuity in water flow, and sediment transport processes from its headwaters to the Adriatic Sea, Vjosa represents a key reference system for dynamic floodplains already lost across Central Europe (Schiemer et al., 2018). Moreover, as one of the last intact river systems in Europe, Vjosa is a sanctuary for numerous species lost or endangered across the rest of the Continent. In addition, Vjosa has also been designated a "No-go" river stretch because it meets the criteria for hydro-morphology, key fish species, protected areas, and significant wetland systems (Chamberlain, 2018).

In conclusion, out of all recorded animal species, 625 are invertebrates: 340 arthropods, 109 mollusks; and 447 vertebrates: 37 fishes, 32 reptiles and 13 amphibians, 295 birds and 70 mammals. Of them, 39 species are endangered according to IUCN, and 119 are on the Albanian Red List (2013). 148 species are listed in Annex 1–3 of the Berne Convention; 41 species in the Bird Directive; 78 species in the Habitats Directive. (Data mainly from Meulenbroek et al., 2020; updated by Miho et al., 2023; 2024; Bino et al., 2023; and Shumka et al., 2018; etc.)

According to the scientific consensus, Vjosa and its surrounding habitats are of remarkably high conservation value for several interconnected reasons. The mosaic of various habitat types forms a highly dynamic natural river ecosystem of a scale unique in Europe. These habitats harbor viable communities of animals that have significantly or entirely disappeared from other European rivers. If Vjosa's habitats are not sufficiently protected, many of these communities will face irreversible endangerment due to their dependence on the highly dynamic river system. Moreover, the declaration of the VWRNP will exert significant positive effects on the biota of the area, not only on the Albanian side of the river, but also on the entire river ecosystem, in particular the environmental parameters of the transboundary areas *(Shallari, S&L, 2022)*. The protection of the Vjosa River system in its present form is therefore not solely an essential matter for Albania *and* Greece, but rather an objective of pan-European importance.

OVERALL BIODIVERSITY AND SPECIES CONSERVATIONS STATUS

Figure x below presents the number of species known to be found in the Vjosa valley (=1.725).

Figure x. The species number after major living groups known to date in the Vjosa river main course and its tributaries. (Data from Meulenbroek *et al.,* 2020; updated by Miho *et al.,* 2023; Bino *et al.*, 2023; and Shumka *et al.*, 2018).

Grupet e gjallesave / Living groups	**Lloje / Species**	**(%)**	**Burimi /Source**
Bimë jo vaskulare / Non vaskular plants: algae	354	21	Miho et al., 2023; Meulenbroek et al., 2020
Bimë vaskulare / Vaskular plants	299	17	Meulenbroek et al., 2020
Invertebrorë / Invertebrates: arthropods	516	30	Meulenbroek et al., 2020
Invertebrorë / Invertebrates: mollusks	109	6	Meulenbroek et al., 2020
Peshq /Fish	37	2	Meulenbroek et al., 2020
Amfibë / Amphibians	13	1	Meulenbroek et al., 2020
Zvarranikë / /Reptiles	32	2	Meulenbroek et al., 2020
Shpendë / Birds	295	17	Meulenbroek et al., 2020; Bino et al., 2023
Gjitarë / Mammals	70	4	Meulenbroek et al., 2027
Gjithsej / Total:	**1725**	**100**	

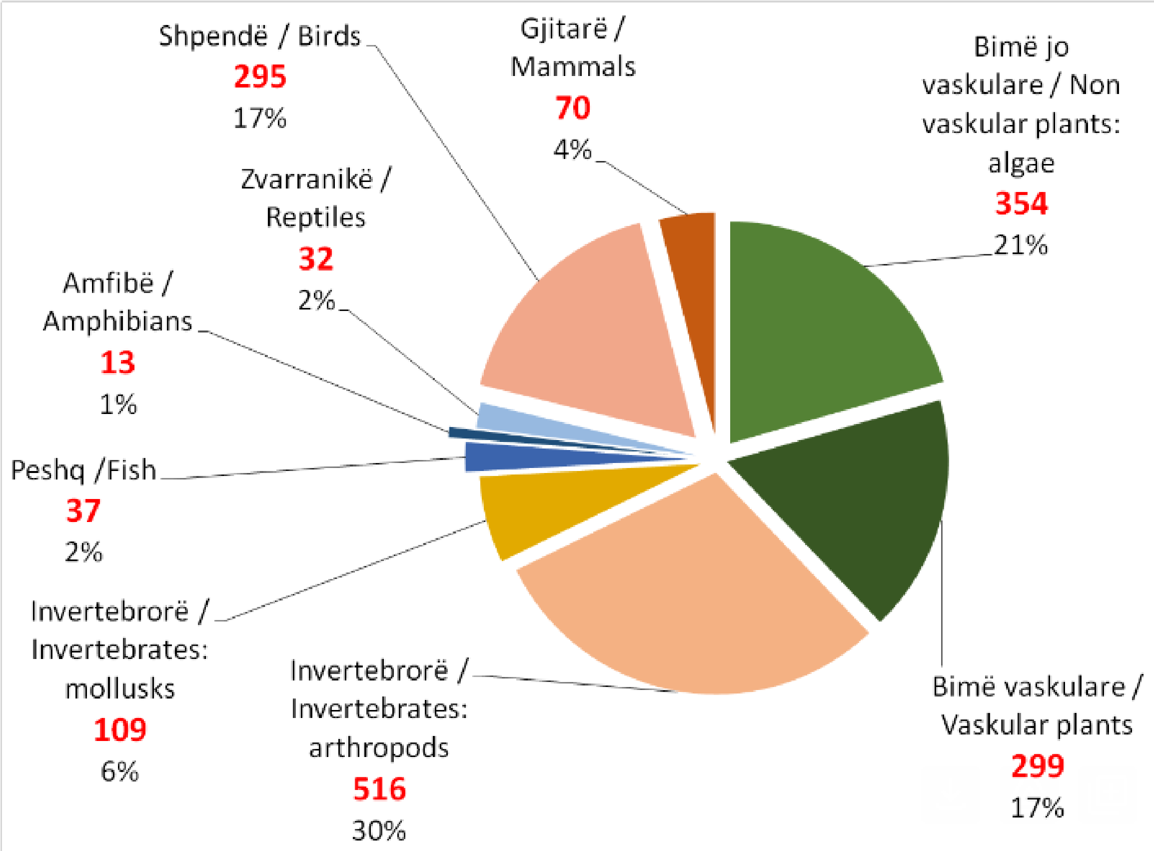


Figure 17: The species number after major living groups known to date in the Vjosa river main course and its tributaries. (Data from Meulenbroek *et al.,* 2020; updated by Miho *et al.,* 2023; Bino *et al.*, 2023; and Shumka *et al.*, 2018).

CONSERVATION STATUS

In conclusion, out of all recorded animal species (=1.725), 39 species are endangered according to IUCN, and 119 are on the Albanian Red List (2013). 148 species are listed in Annex 1–3 of the Berne Convention; 41 species in the Bird Directive; 78 species in the Habitats Directive. (Data mainly from Meulenbroek et al., 2020; updated by Miho et al., 2023; 2024; Bino et al., 2023; and Shumka et al., 2018; etc.)

According to the IUCN Red List, globally threatened species in the Vjosa Valley include:

- one amphibian (*Pelophylax shqiperus* - EN),
- two birds (*Neophron percnopterus* - EN and *Streptopelia turtur* - VU),
- seven fish 4 CR (*Acipenser naccarii, Acipenser stellatus, Acipenser sturio, Aphanius iberus*), 2 EN (*Anguilla anguilla, Gobio scadarensis*) and one VU (*Oxynoemacheilus pindus*),
- one mammal (*Myotis capaccinii* - VU),
- two molluscs (*Unio crassus* - EN, *Vertigo moulinsiana* - VU), and
- two vascular plants (*Aesculus hippocastanum, Galanthus reginae-olgae*, both VU).

In addition, Vjosa is an important ecological corridor as various protected areas are connected by the Vjosa River and its tributaries. More than 15 priority habitat types of European interest have been identified (EU Habitats Directive – NATURA 2000), including seven types (EUNIS, IPA) with a high floristic value. The Vjosa-Narta wetland area is of particular significance as the second most important site for bird diversity in the country, with about 80 species recorded. The area serves the function of being the wintering site for many water bird species, such as the Greater Flamingo, Audouini's Gull, and the Dalmatian Pelican (Shumka et. al., 2018).

CHAPTER 2 MAIN THREATS

Threats to the Vjosa River Valley can be summarized under the headings: Pollution, Land degradation, Hydromorphological change, Land use, and Natural factors. Table A below shows the threats by river section and the overall estimated value for the river as a whole.

Table A: Threats to the Vjosa Valley. Legend: ++ very high threat, + high threat, 0 no threat, ? unknown.

	upper section	middle section	lower section	TOTAL
Pollution				++
Solid waste/waste management	++	+	++	
Groundwater pollution	+	++	+	
Water pollution	0	++	++	
Land degradation				++
Industrialisation	0	++[1]	++	
Urbanisation	0	+	++[2]	
Hydromorphological change				+
Small hydropower plants[3]	++	+	++[4]	
Land use				+/++
Oil dwellings + bitumen excavation and deposits	0	++	0	
Gravel extraction (industrial)	+	++[5]	+	
Stone mining (industrial)	+	0	0	
Water extraction (bottling/industrial)	0	++	++	
Water extraction/ irrigation	0	+	++	
Firewood collection[6]	0	0	0	
Poaching[7]	+	+	++	
Plantations of alien commercial species[8]	0	+	+	
Intensification of agriculture (pastures, regular burning), use of chemicals	0	+	++	
Transformation of former forested areas into croplands and pastures	0	++	++	
Tourism development	0	0	++	
Natural factors				+
Riverbank/coastal erosion	0	+	++	
Floods	0	0	+	
Invasive alien species	0	0	?	
Diseases[9]	+	+	0	

[1]...Selenica area
[2]...Narta Lagoon (airport), seashore (construction of tourism facilities)
[3]... At the time of writing, plans to build the HPPs on the Vjosa River have been abandoned. Otherwise, the construction of the HPPs would be one of the biggest threats to the ecological character of the Vjosa River. There are several small hydropower plants (SHPPs) under operation on the tributaries in the upper part of the Vjosa River Valley.
[4]... Shushica HPP is currently already in the planning process which justifies listing the threat as very high; at present, there are only Kelcyra two minor SHPPs in operation in the headwaters of the Shushica River tributary.
[5]... Vjosa and Shushica Rivers (gravel extraction by the locals for their own purposes is not considered a threat)
[6]...Firewood collection is a traditional activity by the locals and mainly occurs in the upper and middle section. Due to its limited extent, it can not be considered a threat to the ecosystem; however, the collection and use of firewood should be properly prescribed in the future management plan for the protected area.
[7]...Poaching includes hunting of wild animals and illegal fishing. The latter could become a major problem if fishing should be prohibited due to protection of the area related with tourism. The Narta Lagoon fauna is especially sensitive to disturbances from poaching activities.
[8]... i.e. *Paulownia tomentosa*. Data deficient for other species.
[9]... i.e. canker stain plane – tree cancer. Data deficient for other diseases.

CHAPTER 3 MEASURING INDICATORS AND MAIN PARAMETERS FOR MONITORING THE ENVIRONMENTAL SITUATION

Systematic monitoring of biodiversity parameters along the Vjosa is still in the process of being established. Individual surveys are being carried out by experts for individual plant and animal groups, as well as for other environmental parameters such as water quantity and geomorphology, but these are not yet linked. Above all, the results of such analyses are not reflected in concrete conservation actions, as the VWRNP is not yet managed in a comprehensive way. Parameters that need to be collected to ensure the so-called adaptive management process, i.e. the activities of the park manager aimed at ensuring the conditions for the living world, are e.g. species richness and abundance, species composition, habitat quality and size, genetic diversity, population dynamics, ecosystem function and services, indicator species, phenological changes, climate and environmental variables, human impacts, conservation status of species, and invasive species monitoring. These indicators often require a combination of field surveys, remote sensing, genetic analysis, and citizen science initiatives for comprehensive monitoring.

Much of the work is carried out by local and foreign scientists who gather along the river and its tributaries in the so-called Vjosa Science Week camps.

Of particular importance is the commitment of the Esri Group, a world-renowned monitoring, evaluation and data presentation organisation from America, which has offered practical assistance and training to VWRNP staff in carrying out systematic ecological monitoring in the National Park.

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ANNEXES

LAND USE PATTERNS - CLASSES

EVALUATION OF THE BIODIVERSITY VAUES

TYPICAL FOREST ECOSYSTEMS

LAND USE PATTERNS - CLASSES

Earth observation satellite images are the basis of CLC mapping and provide up-to-date information about the Earth's surface at an appropriate resolution. The raw satellite images must first be pre-processed and enhanced to obtain a geometrically correct document in national projection. In the CLC1990 inventory, no orthocorrection was usually applied and the GCPs were mostly selected from 1:100,000 scale maps. In the CLC2000 project, satellite images are ortho-corrected using DTM. The accuracy is characterized by an RMS error of less than 25 meters. For the first CLC inventory, the "traditional" photo interpretation method was used: An overlay was glued to a satellite image printout, on which the photointerpreter drew polygons and provided them with a CLC code. Later, the overlay was digitized, the topology created and the CLC code entered. This procedure often led to various types of errors in the geometry as well as in the thematic content, most of which were later corrected in IMAGE&CLC2000. In CLC2000, the method of drawing on transparencies was discarded and computer-aided image interpretation (CAPI) was used (Buettner at al., 2002). CAPI became the main tool for the creation of all subsequent CLC inventories.

Subsequently, each group of third-level CLC classes is briefly introduced.

Class 1: Artificial areas

- **Class 1.1 Urban fabric**

Class 111 Continuous urban fabric

The continuous urban fabric class is assigned when urban struc-tures and transport networks are dominating the surface area. > 80% of the land surface is covered by impermeable features like buildings, roads and artificially surfaced areas. Non-linear areas of vegetation and bare soil are exceptional.

Class 112 Discontinuous urban fabric

The discontinuous urban fabric class is assigned when urban structures and transport networks associated with vegetated areas and bare surfaces are present and occupy significant surfaces in a discontinuous spatial pattern. The impermeable features like buildings, roads and artificially surfaced areas range from 30 to 80 % land coverage.

- **Class 1.2 Industrial, commercial and transport units**

Class 121 Industrial or commercial units and public facilities

Buildings, other built-up structures and artificial surfaces (with concrete, asphalt, tarmacadam, or stabilised like e.g. beaten earth) occupy most of the area. It can also contain vegetation (most likely grass) or other non-sealed surfaces. This class is assigned for land units that are under industrial or commercial use or serve for public service facilities.

Class 122 Road and rail networks and associated land

Motorways and railways, including associated installations (stations, platforms, embankments, linear greenery narrower than 100 m). Minimum width for inclusion: 100 m.

Class 123 Port areas

Infrastructure of port areas (land and water surface), including quays, dockyards and marinas.

Class 124 Airports

Airports installations: runways, buildings and associated land. This class is assigned for any kind of ground facilities that serve airborne transportation.

- **Class 1.3 Mine, dump and construction sites**

Class 131 Mineral extraction sites

Open-pit extraction sites of construction materials (sandpits, quarries) or other minerals (open-cast mines). Includes flooded mining pits.

Class 132 Dump sites

Public, industrial or mine dump sites.

Class 133 Construction sites

Spaces under construction development, soil or bedrock excavations, earthworks. This class is assigned for areas where landscape is affected by human activities, changed or modified into artificial surfaces, being in a state of anthropogenic transition.

- **Class 1.4 Artificial non-agricultural vegetated areas**

Class 141 Green urban areas

Areas with vegetation within or partly embraced by urban fabric. This class is assigned for urban greenery, which usually has recreational or ornamental character and is usually accessible for the public.

Class 142 Sport and leisure facilities

This class is assigned for areas used for sports, leisure and recreation purposes. Camping grounds, sports grounds, leisure parks, golf courses, racecourses etc. belong to this class, as well as formal parks not surrounded by urban areas.

Class 2: Agricultural areas

- **Class 2.1 Arable land**

Class 211 Non-irrigated arable land

Cultivated land parcels under rainfed agricultural use for annually harvested non-permanent crops, normally under a crop rotation system, including fallow lands within such crop rotation. Fields with sporadic sprinkler-irrigation with non-permanent devices to support dominant rainfed cultivation are included.

Class 212 Permanently irrigated arable land

Cultivated land parcels under agricultural use for arable crops that are permanently or periodically irrigated, using a permanent infrastructure (irrigation channels, drainage network and additional irrigation facilities). Most of these crops cannot be cultivated without artificial water supply. Does not include sporadically irrigated land.

Class 213 Rice fields

Cultivated land parcels prepared for rice production, consisting of periodically flooded flat surfaces with irrigation channels.

- **Class 2.2 Permanent crops**

Class 221 Vineyards

Areas planted with vines, vineyard parcels covering >50% and determining the land use of the area.

Class 222 Fruit tree and berry plantations

Cultivated parcels planted with fruit trees and shrubs, intended for fruit production, including nuts. The planting pattern can be by single or mixed fruit species, both in association with permanently grassy surfaces.

Class 223 Olive groves

Cultivated areas planted with olive trees.

- **Class 2.3 Pastures**

Class 231 Pastures, meadows and other permanent grasslands under agricultural use

Permanent grassland characterized by agricultural use or strong human disturbance. Floral composition dominated by graminacea and influenced by human activity. Typically used for grazing - pastures, or mechanical harvesting of grass – meadows.

- **Class 2.4 Heterogeneous agricultural areas**

Class 241 Annual crops associated with permanent crops

Cultivated land parcels with non-permanent crops (mostly arable land) associated with permanent crops (fruit trees or olive trees or vines) on the same parcel.

Class 242 Complex cultivation patterns

Mosaic of small cultivated land parcels with different cultivation types - annual crops, pasture and/or permanent crops, eventually with scattered houses or gardens.

Class 243 Land principally occupied by agriculture, with significant areas of natural vegetation

Areas principally occupied by agriculture, interspersed with significant natural or semi-natural areas (including forests, shrubs, wetlands, water bodies, mineral outcrops) in a mosaic pattern.

Class 244 Agro-forestry areas

Annual crops or grazing land under the wooded cover of forestry species.

Class 3: Forest and semi-natural areas

- ### Class 3.1 Forests

Class 311 Broad-leaved forest

Vegetation formation composed principally of trees, including shrub and bush understorey, where broad-leaved species predominate.

Class 312 Coniferous forest

Vegetation formation composed principally of trees, including shrub and bush understorey, where coniferous species predominate.

Class 313 Mixed forest

Vegetation formation composed principally of trees, including shrub and bush understorey, where neither broad-leaved nor coniferous species predominate.

- ### Class 3.2 Shrubs and/or herbaceous vegetation associations

Class 321 Natural grassland

Grasslands under no or moderate human influence. Low productivity grasslands. Often situated in areas of rough, uneven ground, steep slopes; frequently including rocky areas or patches of other (semi-)natural vegetation.

Class 322 Moors and heathland

Vegetation with low and closed cover, dominated by bushes, shrubs, dwarf shrubs (heather, briars, broom, gorse, laburnum etc.) and herbaceous plants, forming a climax stage of development.

Class 323 Sclerophyllous vegetation

Bushy sclerophyllous vegetation in a climax stage of development, including maquis, matorral and garrigue.

Class 324 Transitional woodland/shrub

Transitional bushy and herbaceous vegetation with occasional scattered trees. Can represent woodland degradation, forest regeneration / recolonization or natural succession.

- ### Class 3.3 Open spaces with little or no vegetation

Class 331 Beaches, dunes, and sand plains

Natural non-vegetated expanses of sand or pebble/gravel, in coastal or continental locations, like beaches, dunes, gravel pads; including beds of stream channels with torrential regime. Vegetation covers maximum 10%.

Class 332 Bare rock

Scree, cliffs, rock outcrops, including areas of active erosion, rocks and reef flats situated above the high-water mark, inland salt planes.

Class 333 Sparsely vegetated areas

Areas with sparse vegetation, covering 10-50% of surface. Includes steppes, tundra, lichen heath, badlands, karstic areas and scattered high-altitude vegetation.

Class 334 Burnt areas

Natural woody vegetation affected by recent fires.

Class 335 Glaciers and perpetual snow

Land covered by glaciers or permanent snowfields.

Class 4: Wetlands

- ### Class 4.1 Inland wetlands

Class 411 Inland marshes

Low-lying land usually flooded in winter, and with ground more or less saturated by fresh water all year round.

Class 412 Peatbogs

Wetlands with accumulation of considerable amount of decomposed moss (mostly Sphagnum) and vegetation matter. Both natural and exploited peat bogs.

- ### Class 4.2 Coastal wetland

Class 421 Coastal salt marshes

Vegetated low-lying areas in the coastal zone, above the high-tide line, susceptible to flooding by seawater. Often in the process of being filled in by coastal mud and sand sediments, gradually being colonized by halophilic plants.

Class 422 Salines

Salt-pans for extraction of salt from salt water by evaporation, active or in process of abandonment. Sections of salt marsh exploited for the production of salt, clearly distinguishable from the rest of the marsh by their parcellation and embankment systems.

Class 423 Intertidal flats

Coastal zone under tidal influence between open sea and land, which is flooded by sea water regularly twice a day in a ca. 12 hours cycle. Area between the average lowest und highest sea water level at low tide and high tide. Generally non-vegetated expanses of mud, sand or rock lying between high and low water marks.

Class 5: Water bodies

- ### Class 5.1 Inland waters

Class 511 Water courses

Natural or artificial water-courses serving as water drainage channels. Includes canals. Minimum width for inclusion: 100 m.

Class 512 Water bodies

Natural or artificial water bodies with presence of standing water surface during most of the year.

- **Class 5.2 Marine waters**

Class 521 Coastal lagoons

Stretches of salt or brackish water in coastal areas which are separated from the sea by a tongue of land or other similar topography. These water bodies can be connected to the sea at limited points, either permanently or for parts of the year only.

Class 522 Estuaries

The mouth of a river under tidal influence within which the tide ebbs and flows.

Class 523 Sea and ocean

Zone seaward of the lowest tide limit.

The LUMV of the first level is represented by all five categories of the first level (classes: 1, 2, 3, 4 and 5).

The RGB color values of the first CLC classes of the third level were used to represent the CLC classes of the first and second levels. Thus, the RGB color of the third-level CLC class 1.1.1 (RGB color: 230-000-077) was used to represent class 1 on the first-level LUMV and class 1.1 on the second-level LUMV; the RGB color of the third-level CLC class 1.2.1 (RGB color: 204-077-242) was used to represent only class 1.2 on the second level LUMV; the RGB color of class 2.1.1 CLC of the third level (RGB color: 255-255-168) was used to represent class 2 on the first level LUMV and class 2.1 on the second level LUMV; and so on.

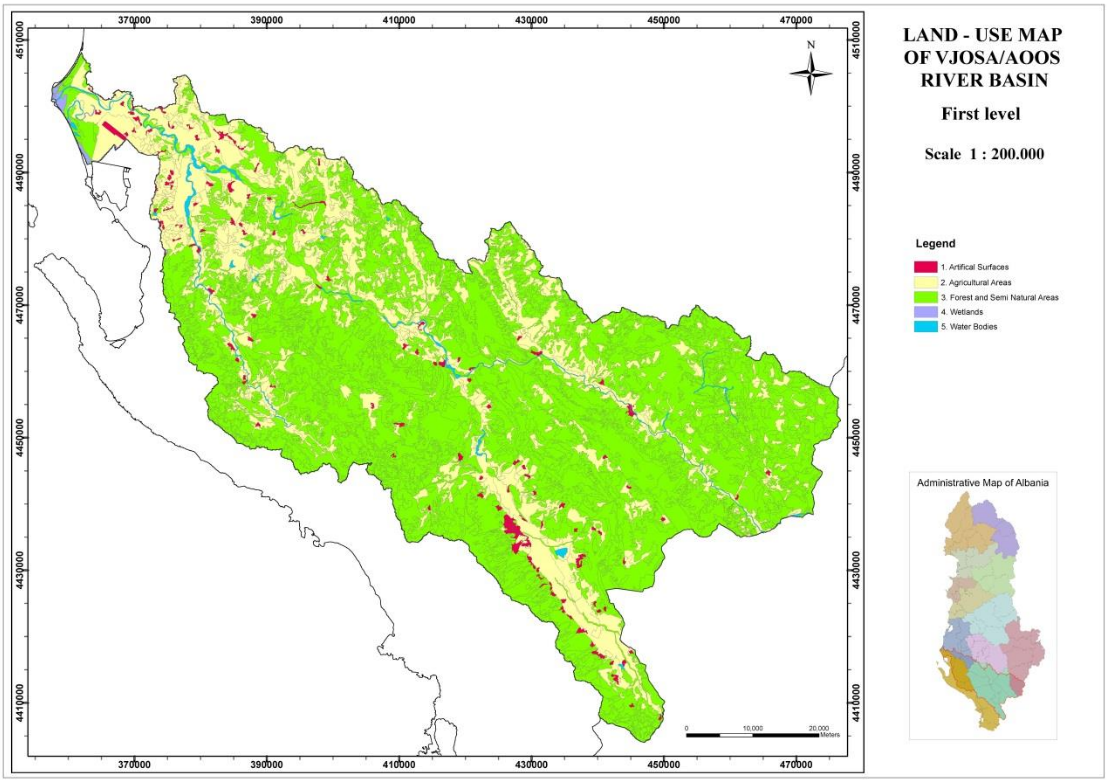
The areas (in m2) and percentages (%) of the Vjosa/Aoos river basin covered by each first-level CLC category are shown in Table 4. The VRB is mainly covered by forest and semi-natural areas (70.9 %) and agricultural areas (26.6 %). Only 2.5 % of the total VRB is covered by artificial surfaces, wetlands and water bodies.

Land-Use Levels			RGB
Level 1	**Level 2**	**Level 3**	
1. ARTIFICIAL SURFACES	1.1 Urban fabric	1.1.1 Continuous urban fabric	230-000-077
		1.1.2 Discontinuous urban fabric	255-000-000
	1.2 Industrial, commercial and transport units	1.2.1 Industrial or commercial units	204-077-242
		1.2.2 Road and rail networks and associated land	204-000-000
		1.2.3 Port areas	230-204-204
		1.2.4 Airports	230-204-230
	1.3 Mine, dump and construction sites	1.3.1 Mineral extraction sites	166-000-204
		1.3.2 Dump sites	166-077-000
		1.3.3 Construction sites	255-077-255
	1.4 Artificial, non-agricultural vegetated areas	1.4.1 Green urban areas	255-166-255
		1.4.2 Sport and leisure facilities	255-230-255
2. AGRICULTURAL AREAS	2.1 Arable land	2.1.1 Non-irrigated arable land	255-255-168
		2.1.2 Permanently irrigated land	255-255-000
		2.1.3 Rice fields	230-230-000
	2.2 Permanent crops	2.2.1 Vineyards	230-128-000
		2.2.2 Fruit trees and berry plantations	242-166-077
		2.2.3 Olive groves	230-166-000
	2.3 Pastures	2.3.1 Pastures	230-230-077
	2.4 Heterogeneous agricultural areas	2.4.1 Annual crops associated with permanent crops	255-230-166
		2.4.2 Complex cultivation patterns	255-230-077

		2.4.3 Land principally occupied by agriculture, with significant areas of natural vegetation	230-204-077
		2.4.4 Agro-forestry areas	242-204-166
3. FOREST AND SEMI NATURAL AREAS	3.1 Forests	3.1.1 Broad-leaved forest	128-255-000
		3.1.2 Coniferous forest	000-166-000
		3.1.3 Mixed forest	077-255-000
	3.2 Scrub and/or herbaceous vegetation associations	3.2.1 Natural grasslands	204-242-077
		3.2.2 Moors and heathland	166-255-128
		3.2.3 Sclerophyllous vegetation	166-230-077
		3.2.4 Transitional woodland-shrub	166-242-000
	3.3 Open spaces with little or no vegetation	3.3.1 Beaches, dunes, sands	230-230-230
		3.3.2 Bare rocks	204-204-204
		3.3.3 Sparsely vegetated areas	204-255-204
		3.3.4 Burnt areas	000-000-000
		3.3.5 Glaciers and perpetual snow	166-230-204

4. WETLANDS	4.1 Inland wetlands	4.1.1 Inland marshes	166-166-255
		4.1.2 Peat bogs	077-077-255
	4.2 Maritime wetlands	4.2.1 Salt marshes	204-204-255
		4.2.2 Salines	230-230-255
		4.2.3 Intertidal flats	166-166-230
5. WATER BODIES	5.1 Inland waters	5.1.1 Water courses	000-204-242
		5.1.2 Water bodies	128-242-230
	5.2 Marine waters	5.2.1 Coastal lagoons	000-255-166
		5.2.2 Estuaries	166-255-230
		5.2.3 Sea and ocean	230-242-255

The hierarchical order of CLC class levels 1, 2, and 3 following the CORINE Land-Cover nomenclature (CLCN) from Büttner & Kosztra, 2019, as well as the color used to represent each CLC class (44 classes) of the third level.



Land-Use Map of Vjosa/Aoos River basin (LUMV) of the first level (in 1: 200.00 scale). The map shows the distribution of the five CLC categories (Classes: 1, 2, 3, 4 and 5) on the VRB.

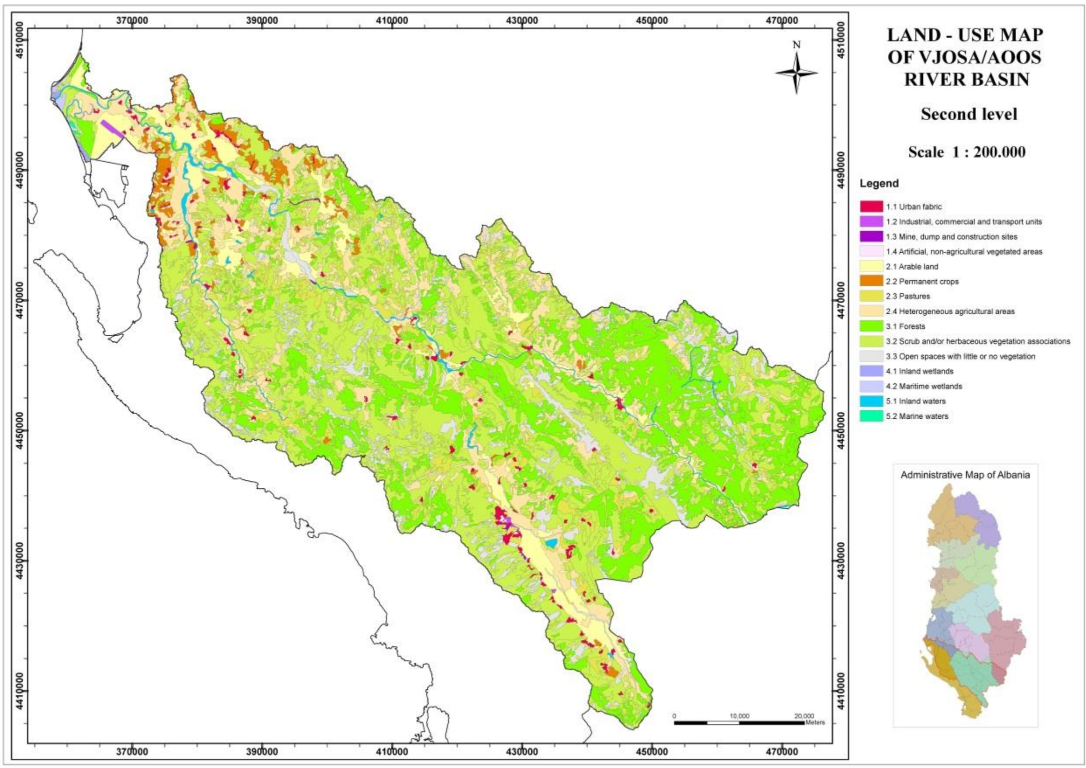
Land-Use Level 1			
Classes	**Codes**	**Areas (m^2)**	**Areas (%)**
ARTIFICIAL SURFACES	1	57486874.74	1.2886%
AGRICULTURAL AREAS	2	1188894691.00	26.6490%
FOREST AND SEMI NATURAL AREAS	3	3161661984.00	70.8685%
WETLANDS	4	8690626.87	0.1948%
WATER BODIES	5	44572730.90	0.9991%

Shows the areas (in m²) of the CLC categories of the first level and the percentages (in %) of the Vjosa/Aoos River catchment covered by each category.

The LUMV of the second level is represented by all the fifteen (15) categories of the second level.

The RGB color values of the first CLC classes of the third level were used to represent the CLC classes of the second levels following the rules mentioned above.

The areas (in m^2) and the percentages (%) of the Vjosa/Aoos River catchment covered by each CLC category of the second level are presented on table 5. The VRB is mainly covered by Scrub and/or herbaceous vegetation associations (41.5%), Forests (22%) and Heterogeneous agricultural areas (14%). 7.3% is covered by Open spaces with little or no vegetation and 6.7% by Arable land. Instead, only the 8.5% is covered by the other CLC classes.



Land-Use Map of Vjosa/Aoos River basin (LUMV) of the second level (in 1 : 200.00 scale). The map shows the distribution of the fifteen (15) CLC categories (Classes: 1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3, 2.4, 3.1, 3.2, 3.3, 4.1, 4.2, 5.1 and 5.2) on the VRB.

Land-Use Level 2			
Classes	**Codes**	**Areas (m^2)**	**Areas (%)**
Urban fabric	1.1	49328053.99	1.1057%
Industrial, commercial and transport units	1.2	4588746.97	0.1029%
Mine, dump and construction sites	1.3	2386454.47	0.0535%
Artificial, non-agricultural vegetated areas	1.4	1183619.31	0.0265%
Arable land	2.1	298401605.10	6.6887%
Permanent crops	2.2	89777521.53	2.0124%
Pastures	2.3	177365320.90	3.9756%
Heterogeneous agricultural areas	2.4	623350243.40	13.9724%
Forests	3.1	984048279.70	22.0574%
Scrub and/or herbaceous vegetation associations	3.2	1849941187.00	41.4664%
Open spaces with little or no vegetation	3.3	327672517.90	7.3448%
Inland wetlands	4.1	3320872.22	0.0744%
Maritime wetlands	4.2	5369754.65	0.1204%
Inland waters	5.1	43477237.93	0.9745%
Marine waters	5.2	1095492.97	0.0246%

Areas (in m^2) of the CLC categories of the second level and the percenteges (in %) of the Vjosa/Aoos River catchment covered by each category.

The LUMV of the third level is represented by thirty-five (35) categories of the forty-four (44) categories of the third level.

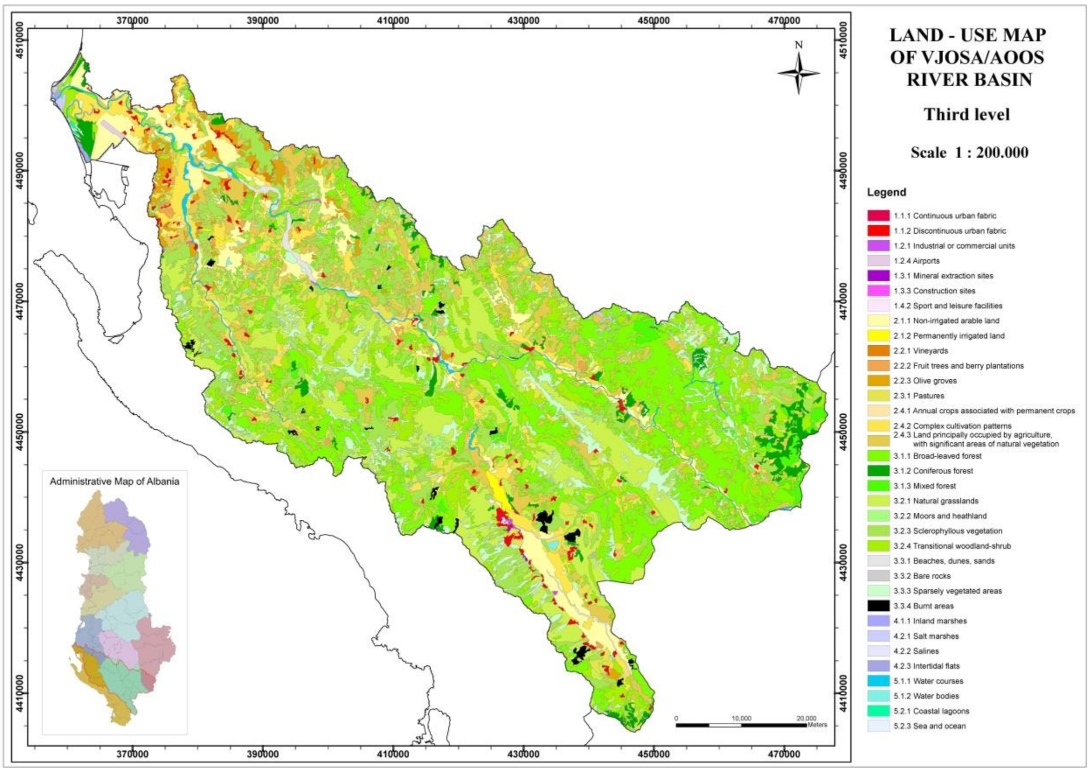
The areas (in m^2) and the percentages (%) of the Vjosa/Aoos River catchment covered by each CLC category of the third level are presented. The RGB color values for the standard ArcMap color set used to represent each CLC class were used.

The VRB total area is covered by the following CLC classes: 1.1.1, 1.1.2, 1.2.1, 1.2.4, 1.3.1, 1.3.3, 1.4.2, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.4.1, 2.4.2, 2.4.3, 3.1.1, 3.1.2, 3.1.3, 3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.3.2, 3.3.3, 3.3.4, 4.1.1, 4.2.1, 4.2.2, 4.2.3, 5.1.1, 5.1.2, 5.2.1 and 5.2.3.

It is mainly covered by 3.1.1 - Broad-leaved forest (18.5%), 3.2.1 - Natural grasslands (16%), 3.2.3 - Sclerophyllous vegetation (14.2%), 3.2.4 - Transitional woodland-shrub (11.1%), 2.4.3 - Land principally occupied by agriculture, with significant areas of natural vegetation (8.4%), 2.1.1 - Non-irrigated arable land (6.4%), 3.3.3 - Sparsely vegetated areas (6%), 2.4.2 - Complex cultivation patterns (5.5%) and 2.3.1 – Pastures (4%). About 10% of the entire VRB is covered by the other CLC classes.

Land-Use Level 3			
Classes	**Codes**	**Areas (m^2)**	**Areas (%)**
Continuous urban fabric	1.1.1	529944.95	0.0119%
Discontinuous urban fabric	1.1.2	48798109.04	1.0938%
Industrial or commercial units	1.2.1	1512741.44	0.0339%
Airports	1.2.4	3076005.53	0.0689%
Mineral extraction sites	1.3.1	883781.63	0.0198%
Construction sites	1.3.3	1502672.84	0.0337%
Sport and leisure facilities	1.4.2	1183619.31	0.0265%
Non-irrigated arable land	2.1.1	287100634.70	6.4353%
Permanently irrigated land	2.1.2	11300970.42	0.2533%
Vineyards	2.2.1	4772140.67	0.1070%
Fruit trees and berry plantations	2.2.2	12977775.65	0.2909%
Olive groves	2.2.3	72027605.21	1.6145%
Pastures	2.3.1	177365320.9	3.9756%
Annual crops associated with permanent crops	2.4.1	1187970.82	0.0266%
Complex cultivation patterns	2.4.2	246771015.10	5.5314%
Land principally occupied by agriculture, with significant areas of natural vegetation	2.4.3	375391257.50	8.4144%
Broad-leaved forest	3.1.1	824690788	18.4854%
Coniferous forest	3.1.2	109108132.10	2.4457%
Mixed forest	3.1.3	50249359.59	1.1263%
Natural grasslands	3.2.1	715497848.30	16.0379%
Moors and heathland	3.2.2	6763243.93	0.1516%
Sclerophyllous vegetation	3.2.3	632978962.50	14.1882%
Transitional woodland-shrub	3.2.4	494701132.20	11.0887%
Beaches, dunes, sands	3.3.1	33671952.39	0.7548%
Bare rocks	3.3.2	4959442.00	0.1112%
Sparsely vegetated areas	3.3.3	265761580.20	5.9570%
Burnt areas	3.3.4	23279543.30	0.5218%
Inland marshes	4.1.1	3320872.22	0.0744%
Salt marshes	4.2.1	4161342.81	0.0933%
Salines	4.2.2	987361.38	0.0221%
Intertidal flats	4.2.3	221050.46	0.0050%
Water courses	5.1.1	39301966.49	0.8810%
Water bodies	5.1.2	4175271.44	0.0936%
Coastal lagoons	5.2.1	947864.51	0.0212%
Sea and ocean	5.2.3	147628.46	0.0033%

Areas (in m^2) of the CLC categories of the third level and the percentages (in %) of the Vjosa/Aoos River catchment covered by each category.



Land-Use Map of Vjosa/Aoos River basin (LUMV) of the third level (in 1 : 200.00 scale). The map shows the distribution of the thirty-five (35) CLC categories (Classes: 1.1.1, 1.1.2, 1.2.1, 1.2.4, 1.3.1, 1.3.3, 1.4.2, 2.1.1, 2.1.2, 2.2.1, 2.2.2, 2.2.3, 2.3.1, 2.4.1, 2.4.2, 2.4.3, 3.1.1, 3.1.2, 3.1.3, 3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.3.2, 3.3.3, 3.3.4, 4.1.1, 4.2.1, 4.2.2, 4.2.3, 5.1.1, 5.1.2, 5.2.1 and 5.2.3.) on the VRB.

TYPICAL FOREST ECOSYSTEMS

Identification of typical forest ecosystems using selected stands as examples (“Reference Stand Concept”)

2.1. Identifying potential vegetation types

Four typical forest vegetation types covering the Vjosa river basin were identified based on the field survey. For each vegetation type, a limited number of stands is selected and as “reference stands” to provide an insight in the ecological, historical, economic challenges and the future management options by forest vegetation type.

The following vegetation types were identified:

1. Floodplain Forests (the typical ecosystem along the river Vjosa)

2. Oak forests the ecosystem relatively close to the Potential Natural Vegetation

3. Mediterranean evergreen shrub forests (Macchia) the ecosystem which resulted in long lasting historic forest management and livestock farming impacts. Macchia is the most important forest ecosystem in the area.

4. Pine forests: Planting started after the second worl war in response to the loss of fuel wood but also to protect soils from eroseion an secure infrastructure.

INFORMATION ON THE LOCATIONS OF THE BREEDING BIRD SPECIES (SAND MARTIN, STONE CURLEW, LITTLE RINGED PLOVER)

1 COLONIES OF SAND MARTIN (*RIPARIA RIPARIA*) IN VJOSA RIVER AND ITS TRIBUTARIES

No.	Colonies	Minimum	Maximum	Latitude	Longitude	River bodies
1	Fitore (Vlore)	60	80	40.635048	19.46546	Vjose
2	Kashishte (Fier)	2,200	2,500	40.579342	19.544483	Vjose
3	Beshisht (Vlore)	3,100	3,300	40.577911	19.551706	Vjose
4	Kashishte (Fier)	2,500	3,000	40.58522	19.538013	Vjose
5	Buzemadh (Mallakaster)	220	270	40.565571	19.587353	Vjose
6	Selenice (Vlore)	4,670	5,200	40.55706	19.637259	Vjose
7	Pocem (Mallakaster)	800	900	40.506634	19.717657	Vjose
8	Kute-Corrush (Mallakaster)	1,200	1,400	40.445705	19.753399	Vjose
9	Dervician (Gjirokaster)	30	60	40.040684	20.176224	Drino
10	Lazarat (Gjirokaster)	75	100	40.061085	20.173256	Drino
11	Picar-Armen (Vlore)	350	400	40.528847	19.571203	Shushice
12	Risili (Vlore)	70	80	40.509968	19.556810	Shushice
13	Xhyherine (Vlore)	900	1,050	40.488922	19.561844	Shushice
	Total Vjosa and tributaries	**16,175**	**18,340**			

2 BREEDING PAIRS OF STONE CURLEW (*BURHINUS OEDICNEMUS*) IN VJOSA RIVER AND ITS TRIBUTARIES

No.	Location	No. of individuals	Latitude	Longitude	River body
1	Kashishte (Fier)	1	40.593477	19.537361	Vjosa
2	Kashishte (Fier)	1	40.590492	19.536498	Vjosa
3	Hambar (Mallakaster)	1	40.559402	19.575766	Vjosa
4	Hambar (Mallakaster)	1	40.562343	19.571472	Vjosa
5	Hambar (Mallakaster)	1	40.568247	19.573330	Vjosa
6	Hambar (Mallakaster)	1	40.580619	19.568348	Vjosa
7	Hambar (Mallakaster)	1	40.585811	19.566831	Vjosa
8	Gjonc (Mallakaster)	1	40.55706	19.637259	Vjosa
9	Pocem (Mallakaster)	1	40.531821	19.701936	Vjosa
10	Pocem (Mallakaster)	1	40.530373	19.710353	Vjosa
11	Pocem (Mallakaster)	1	40.503805	19.720788	Vjosa
12	Kute-Corrush (Mallakaster)	1	40.487259	19.749487	Vjosa
13	Kute-Corrush (Mallakaster)	1	40.481580	19.751597	Vjosa
14	Kute-Corrush (Mallakaster)	1	40.476671	19.749092	Vjosa
15	Kute-Corrush (Mallakaster)	1	40.469016	19.748153	Vjosa
16	Kute-Corrush (Mallakaster)	1	40.464958	19.745302	Vjosa
17	Kute-Corrush (Mallakaster)	1	40.451614	19.744022	Vjosa

18	Kute-Corrush (Mallakaster)	1	40.450157	19.74765	Vjosa
19	Kalivac (Mallakaster)	1	40.410337	19.789261	Vjosa
20	Kalivac (Mallakaster)	1	40.415321	19.788822	Vjosa
21	Kalivac (Mallakaster)	1	40.415069	19.783883	Vjosa
22	Ane Vjose (Tepelene)	1	40.388882	19.849728	Vjosa
23	Ane Vjose (Tepelene)	1	40.389851	19.838997	Vjosa
24	Ane Vjose (Tepelene)	1	40.387524	19.855636	Vjosa
25	Ane Vjose (Tepelene)	1	40.382706	19.870735	Vjosa
26	Ane Vjose (Tepelene)	1	40.381962	19.860939	Vjosa
27	Vasjar (Tepelene)	1	40.347404	19.927809	Vjosa
28	Vasjar (Tepelene)	1	40.350845	19.948288	Vjosa
29	Vasjar (Tepelene)	1	40.348595	19.928524	Vjosa
30	Tepelene-Dragot (Tepelene)	1	40.284676	20.043633	Vjosa
31	Tepelene-Dragot (Tepelene)	1	40.284992	20.046331	Vjosa
32	Tepelene-Dragot (Tepelene)	1	40.282505	20.041166	Vjosa
33	Gline (Dropull)	1	39.956539	20.274099	Drino
34	Humelice (Gjirokaster)	1	40.173454	20.079966	Drino
35	Hundekuq (Gjirokaster)	1	40.186516	20.082432	Drino
36	Armen (Vlore)	1	40.531013	19.569414	Shushice
37	Armen (Vlore)	1	40.524273	19.571629	Shushice
38	Armen (Vlore)	1	40.520973	19.568615	Shushice
39	Armen (Vlore)	1	40.516323	19.563995	Shushice
40	Armen (Vlore)	1	40.555141	19.560007	Shushice
41	Armen (Vlore)	1	40.56097	19.560785	Shushice
42	Xhyherine (Vlore)	1	40.488892	19.561764	Shushice
43	Armen (Vlore)	1	40.536255	19.568998	Shushice
44	Bulo (Gjirokaster)	1	40.058560	20.254676	Suhe (Drino)
	TOTAL	44			

3 BREEDING PAIRS OF LITTLE RINGED PLOVER (*CHARADRIUS DUBIUS*) IN VJOSA RIVER AND ITS TRIBUTARIES

No.	Site	Min	Max	Latitude	Longitude	River
1	Mifol (Vlore)	1	2	40.609051	19.506823	Vjose
2	Beshisht (Vlore)	1	3	40.579357	19.544489	Vjose
3	Kashishte (Fier)	1	3	40.579342	19.544483	Vjose
4	Kashishte (Fier)	1	3	40.591671	19.536367	Vjose
5	Kashishte (Fier)	1	1	40.602579	19.527217	Kashishte
6	Varibop (Mallakaster)	1	1	40.589298	19.557968	Vjose
7	Mesarak (Mallakaster)	1	2	40.554749	19.596903	Vjose
8	Hambar (Mallakaster)	1	1	40.559818	19.575687	Vjose
9	Hambar (Mallakaster)	1	1	40.559334	19.5767	Vjose
10	Hambar (Mallakaster)	1	1	40.559471	19.577919	Vjose
11	Hambar (Mallakaster)	1	2	40.565571	19.587353	Vjose
12	Hambar (Mallakaster)	1	3	40.564416	19.571735	Vjose
13	Hambar (Mallakaster)	1	3	40.582948	19.567795	Vjose
14	Gjonc (Mallakaster)	1	1	40.546759	19.650655	Vjose

15	Gjonc (Mallakaster)	1	1	40.556975	19.615056	Vjose
16	Romes (Mallakaster)	1	2	40.539043	19.667419	Vjose
17	Romes (Mallakaster)	1	2	40.530506	19.68388	Vjose
18	Mollaj (Mallakaster)	1	2	40.533592	19.704975	Vjose
19	Pocem (Mallakaster)	1	2	40.507587	19.727928	Vjose
20	Pocem (Mallakaster)	1	1	40.50618	19.720272	Vjose
21	Pocem (Mallakaster)	1	2	40.507149	19.721546	Vjose
22	Pocem (Mallakaster)	1	2	40.491657	19.721895	Vjose
23	Pocem (Mallakaster)	1	2	40.518183	19.732803	Vjose
24	Pocem (Mallakaster)	1	2	40.528110	19.722444	Vjose
25	Kute (Mallakaster)	1	1	40.464916	19.745291	Vjose
26	Kute (Mallakaster)	1	1	40.455498	19.74127	Vjose
27	Kute (Mallakaster)	1	1	40.451801	19.743418	Vjose
28	Kute (Mallakaster)	1	1	40.478240	19.751589	Vjose
29	Kute (Mallakaster)	1	1	40.485739	19.753860	Vjose
30	Agaraj (Mallakaster)	1	1	40.440461	19.763725	Vjose
31	Agaraj (Mallakaster)	1	1	40.448006	19.750000	Vjose
32	Caushaj (Mallakaster)	1	3	40.424335	19.777883	Vjose
33	Corrush (Mallakaster)	1	2	40.432281	19.769007	Vjose
34	Corrush (Mallakaster)	1	2	40.439470,	19.764624	Vjose
35	Kalivac (Mallakaster)	1	2	40.416336	19.788671	Vjose
36	Kalivac (Mallakaster)	1	2	40.413733	19.786690	Vjose
37	Kalivac (Mallakaster)	1	2	40.409698	19.789412	Vjose
38	Ane Vjose (Tepelene)	1	2	40.389206	19.848444	Vjose
39	Ane Vjose (Tepelene)	1	1	40.389889	19.840263	Vjose
40	Ane Vjose (Tepelene)	1	1	40.389751	19.837883	Vjose
41	Ane Vjose (Tepelene)	1	1	40.390125	19.83753	Vjose
42	Ane Vjose (Tepelene)	1	1	40.391724	19.832319	Vjose
43	Ane Vjose (Tepelene)	1	1	40.388084	19.860068	Vjose
44	Ane Vjose (Tepelene)	1	1	40.3922	19.836843	Vjose
45	Ane Vjose (Tepelene)	1	1	40.392231	19.833332	Vjose
46	Qesarat (Tepelene)	1	1	40.380085	19.877916	Vjose
47	Qesarat (Tepelene)	1	1	40.379414	19.871294	Vjose
48	Qesarat (Tepelene)	1	1	40.380604	19.869764	Vjose
49	Qesarat (Tepelene)	1	2	40.381271	19.869284	Vjose
50	Iliras (Tepelene)	1	2	40.380554	19.89291	Vjose
51	Iliras (Tepelene)	1	3	40.376587	19.89809	Vjose
52	Iliras Tepelene	1	3	40.381866	19.865775	Vjose
53	Vasjar (Tepelene)	1	1	40.348862	19.925945	Vjose
54	Vasjar (Tepelene)	1	2	40.349583	19.935654	Vjose
55	Luftinje (Tepelene)	1	1	40.35062	19.95509	Vjose
56	Luftinje (Tepelene)	1	1	40.347237	19.928402	Vjose
57	Luftinje (Tepelene)	1	1	40.345917	19.930393	Vjose
58	Luftinje (Tepelene)	1	1	40.349747	19.951889	Vjose
59	Luftinje (Tepelene)	1	1	40.35017	19.951077	Vjose
60	Luftinje (Tepelene)	1	3	40.354191	19.945663	Vjose

61	Mamaj (Tepelene)	1	3	40.320591	20.012867	Vjose
62	Bence (Tepelene)	1	2	40.307034	20.021326	Vjose
63	Tepelene	1	1	40.304764	20.025282	Vjose
64	Tepelene	1	1	40.301067	20.024643	Vjose
65	Tepelene-Dragot (Tepelene)	1	1	40.282291	20.048164	Vjose
66	Tepelene-Dragot (Tepelene)	1	1	40.282677	20.044611	Vjose
67	Tepelene-Dragot (Tepelene)	1	2	40.283566	20.040554	Vjose
68	Tepelene Dragot (Tepelene)	1	1	40.292431	20.033173	Vjose
69	Tepelene Dragot (Tepelene)	1	1	40.290253	20.032499	Vjose
70	Tepelene Dragot (Tepelene)	1	1	40.28968	20.034286	Vjose
71	Tepelene Dragot (Tepelene)	1	1	40.287041	20.039698	Vjose
72	Tepelene Dragot (Tepelene)	1	1	40.281471	20.04229	Vjose
73	Picar (Vlore)	1	2	40.528828	19.571163	Shushice
74	Picar (Vlore)	1	1	40.524685	19.571693	Shushice
75	Picar (Vlore)	1	2	40.522423	19.570784	Shushice
76	Lubonje (Vlore)	1	1	40.516338	19.563948	Shushice
77	Lubonje (Vlore)	1	1	40.516884	19.564304	Shushice
78	Lubonje (Vlore)	1	2	40.514927	19.561844	Shushice
79	Lubonje (Vlore)	1	2	40.507938	19.555874	Shushice
80	Shushica (Vlore)	1	1	40.554054	19.559967	Shushice
81	Shushica (Vlore)	1	1	40.557304	19.560135	Shushice
82	Shushica (Vlore)	1	1	40.558899	19.560543	Shushice
83	Shushica (Vlore)	1	1	40.561882	19.562532	Shushice
84	Xhyherine (Vlore)	1	2	40.488129	19.561924	Shushice
85	Drashovice (Vlore)	1	1	40.452259	19.580416	Shushice
86	Drashovice (Vlore)	1	1	40.453068	19.57815	Shushice
87	Drashovice (Vlore)	1	1	40.437275	19.585878	Shushice
88	Vodice (Vlore)	1	1	40.412071	19.583216	Shushice
89	Vodice (Vlore)	1	1	40.410816	19.581528	Shushice
90	Vodice (Vlore)	1	1	40.410126	19.579178	Shushice
91	Vodice (Vlore)	1	1	40.409397	19.578121	Shushice
92	Vodice (Vlore)	1	1	40.410833	19.581667	Shushice
93	Kote (Vlore)	1	2	40.397598	19.591747	Shushice
94	Kote (Vlore)	1	1	40.399612	19.587759	Shushice
95	Kote (Vlore)	1	1	40.400032	19.586327	Shushice
96	Kote (Vlore)	1	1	40.40023	19.585365	Shushice
97	Grabian (Vlore)	1	2	40.535004	19.568382	Shushice
98	Armen (Vlore)	1	1	40.536533	19.569263	Shushice
99	Gumenice (Vlore)	1	1	40.373562	19.603872	Shushice
100	Gumenice (Vlore)	1	1	40.370117	19.614969	Shushice
101	Gumenice (Vlore)	1	1	40.368153	19.618332	Shushice
102	Gumenice (Vlore)	1	2	40.36964	19.61511	Shushice
103	Gumenice (Vlore)	1	1	40.353611	19.628588	Shushice
104	Gumenice (Vlore)	1	1	40.351601	19.628654	Shushice
105	Gumenice (Vlore)	1	1	40.355217	19.624552	Shushice
106	Gjorm (Vlore)	1	1	40.311989	19.652437	Shushice

107	Gjorm (Vlore)	1	2	40.312252	19.652096	Shushice
108	Gjorm (Vlore)	1	1	40.308201	19.650473	Shushice
109	Lepenice (Vlore)	1	1	40.303383	19.653147	Shushice
110	Lepenice (Vlore)	1	1	40.295731	19.665014	Shushice
111	Lepenice (Vlore)	1	1	40.29723	19.663961	Shushice
112	Brataj (Vlore)	1	1	40.280613	19.671618	Shushice
113	Brataj (Vlore)	1	1	40.280537	19.672714	Shushice
114	Mesaplik (Vlore)	1	1	40.253517	19.702835	Shushice
115	Mesaplik (Vlore)	1	1	40.253799	19.702499	Shushice
116	Kallarat (Vlore)	1	1	40.209023	19.74761	Shushice
117	Kuc (Himare)	1	1	40.175236	19.822336	Shushice
118	Kallarat (Vlore)	1	1	40.209866	19.742895	Shushice
119	Gumenice (Vlore)	1	1	40.373829	19.604586	Shushice
120	Gumenice (Vlore)	1	1	40.372494	19.612932	Shushice
121	Gumenice (Vlore)	1	1	40.373409	19.611843	Shushice
122	Gumenice (Vlore)	1	1	40.373142	19.612284	Shushice
123	Gjorm (Vlore)	1	1	40.338585	19.637457	Shushice
124	Gjorm (Vlore)	1	1	40.339535	19.636681	Shushice
125	Gjorm (Vlore)	1	1	40.314651	19.654381	Shushice
126	Gjorm (Vlore)	1	1	40.315052	19.65288	Shushice
127	Gjorm (Vlore)	1	1	40.312859	19.653261	Shushice
128	Gline (Dropull)	1	1	39.957928	20.273071	Drino
129	Gline (Dropull)	1	2	39.981228	20.246088	Drino
130	Gline (Dropull)	1	1	39.988239	20.242603	Drino
131	Asim Zenel (Gjirokaster)	1	1	40.08569	20.145826	Drino
132	Hundekuq (Gjirokaster)	1	2	40.102623	20.127523	Drino
133	Hundekuq (Gjirokaster)	1	1	40.183949	20.082977	Drino
134	Hundekuq (Gjirokaster)	1	1	40.182476	20.082781	Drino
135	Llovine (Dropull)	1	2	39.875599	20.367163	Drino
136	Virua (Gjirokaster)	1	1	40.098549	20.140648	Drino
137	Humelice (Gjirokaster)	1	1	40.173912	20.080868	Drino
138	Hundekuq (Gjirokaster)	1	1	40.186668	20.082478	Drino
139	Hundekuq (Gjirokaster)	1	1	40.199226	20.09053	Drino
140	Hundekuq (Gjirokaster)	1	2	40.200043	20.092611	Drino
141	Hundekuq (Gjirokaster)	1	1	40.201614	20.094278	Drino
142	Kardhiq-Zhulat (Gjirokaster)	1	1	40.135207	20.035551	Kardhiq
143	Kardhiq-Zhulat (Gjirokaster)	1	1	40.137946	20.025098	Kardhiq
144	Kardhiq-Zhulat (Gjirokaster)	1	1	40.131949	19.996432	Kardhiq
145	Kardhiq-Zhulat (Gjirokaster)	1	1	40.118999	19.975849	Kardhiq
146	Suhe (Libohove)	1	1	40.056000	20.250086	Suhe
147	Suhe (Libohove)	1	1	40.050605	20.222189	Suhe
148	Suhe (Libohove)	1	1	40.056446	20.198440	Suhe
149	Carshove-Sarandopor (Permet)	1	1	40.071356	20.589968	Sarandopor
150	Carshove-Sarandopor (Permet)	1	1	40.091061	20.631872	Sarandopor
151	Carshove-Sarandopor (Permet)	1	1	40.093570	20.657167	Sarandopor
	TOTAL	**151**	**209**			

CULTURAL

Cultural and heritage values

The Vjosa valley has numerous archaeological and cultural assets, the most famous of which is Gjirokastra, which is part of the UNESCO World Heritage. In addition, Antigonea, Amantia, and Bylis are considered to be archaeological centers, while a series of monuments created in different periods can be found in Korça, Gjirokastra, Fier, and Vlora.

Historical, cultural and heritage significance of the Vjosa River Basin

The river valleys of Vjosa, Drino, Shushica, Langarica, and Bënça and all the other tributaries of Vjosa have played a vital role in the movement of people and goods since ancient times. A myriad of prehistoric sites, ancient settlements, medieval fortresses, churches, monasteries, mosques and tekkes, aqueducts and water springs, as well as countless bridges, give a good indication of the wider region's historical identity and importance, a place of vibrant life, which continues today. The welcoming atmosphere, traditional food, and uniquely adorned dresses; the co-existence of three major religions (Christian Orthodox, Muslim, and Bektashi), as well as the plethora of tangible cultural heritage resources and pristine nature make the Vjosa/Aoös basin a vibrant nexus of cultural and historical identity (Lafe, 2019).

Monument stock

The number of monuments recorded in the Vjosa surrounding areas is also significant, with a total of 110 natural monuments and 300 cultural monuments. These are distributed as follows:

- in the Gjirokastra District, there are 81 natural monuments and 223 cultural monuments;
- in the Vlora District, there are 19 natural monuments and 67 cultural monuments;
- in the Fier District, there are 10 natural monuments and 10 cultural monuments.

In addition to these monuments, we have 3 historic centers (Gjirokastra, Përmet, and Bënja) and 3 archaeological parks: Antigonea, Amantia, and Bylis (Lafe, 2019).

Heritage and customs in the Vjosa valley

Vjosa, the largest river basin in Southern Albania, is home to one of the most famous folk music genres in the world, known as Albanian Folk Iso-polyphony, which, in 2005, was declared and officially registered on the UNESCO Representative List of the Intangible Cultural Heritage of Humanity (*EcoAlbania*, 2021).

The legacy of Iso-polyphony is strongly tied to the traditional garment of Albania, the fustanella, widely used by men up to the end of the 19^{th} and early 20^{th} centuries. Fustanella, also referred to as a kilt, was widespread throughout the Balkan Peninsula. Archaeological evidence in Albania points to fustanella as a rather ancient form of clothing, with some samples found in ancient sites in Durrës and the village of Smokthina near Vlora, at the heart of the Vjosa River Basin.

Historical areas

Vjosa is near many important cultural landmarks and historical locations. Among these, the historic center of Gjirokastra holds the distinction of being the first UNESCO World Heritage Site in Albania, in 2005, followed thereafter by the Historic Center of Berat, in 2008 (UNESCO, 2008a). These historic centers, located in Central and Southern Albania, were cited to be highly representational of the legacy of the Ottoman-style architecture and "the integrity of their vernacular urban landscape" (Dipasquale et. al, 2021).

Home to over 500 monuments, the historic center of Gjirokastra is the cultural crown jewel of the South of Albania (Lafe, 2019). Founded on the slopes of the Drino valley, Gjirokastra occupies a strategic position satisfying the historical need for defense, while also presenting significant difficulties in construction, which then shaped the morphology and the city's development (Mezini, Pojani, 2015). The city's structure consists of two ridges projecting from the massif, with the southern ridge being dominated by the Castle. The bazaar district is located at the junction of the two ridges, characteristic of the old town of Gjirokastra with its signature crossroads.

Figure 2: 19th-century aqueduct over the Bënça River, a tributary of Vjosa

Also, characteristic are the cobblestone streets and the prevalence of stairways to account for the slope of the settlement. The city, on top of being a World Heritage Site, is rich in its monument stock owing to its long history and importance - some 300 natural and cultural monuments in total.

Berat was inscribed as a World Heritage Site as a result of being "a rare example of a well-preserved Ottoman town" (UNESCO, 2008a). Located in Central Albania, about 120 km from Tirana, Berat is a testament to the coexistence of various religious and cultural communities over its 2400-year long history, having been under the Roman, Byzantine, Bulgarian, and Ottoman influence over the centuries (UNESCO, 2008a; Dipasquale et al., 2021). Berat features a castle, locally known as the *Kala*, most of which was built in the 13th century, although its origins date back to the 4th century BC. Various Byzantine churches (St. Mary Vllaherna, Holy Trinity, and St. Michael) from the 13th century can be found in the castle area, several of which have valuable wall paintings and icons (UNESCO, 2008b). Berat also has several mosques built during the Ottoman era (UNESCO, 2008a). During this era, the city also saw the development of its present-day quarters: *Kala* (the castle), Mangalem, and Gorica on the opposite bank. The housing stock also includes residences from the 18th and 19th centuries, "which embody important innovations to traditional Balkan housing stock...adapted to accommodate life in the town" (UNESCO, 2008b).

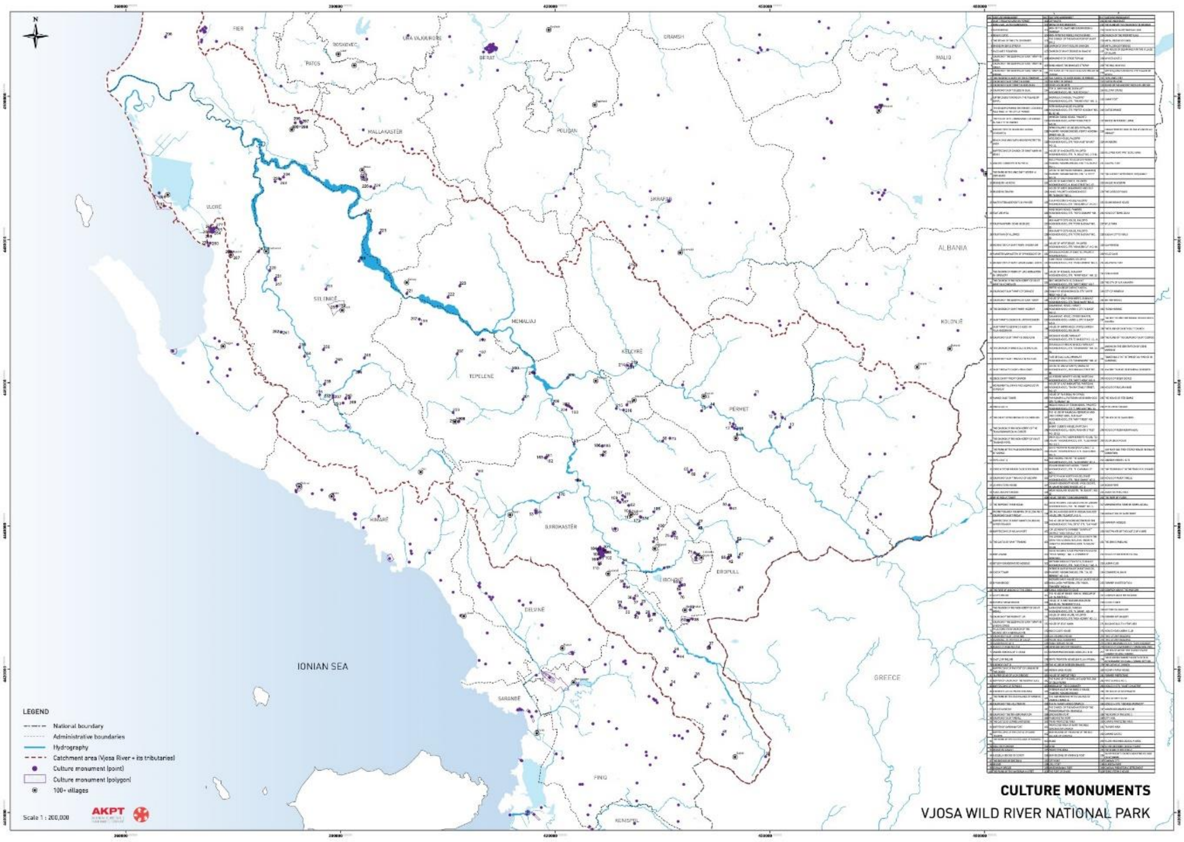


Figure 3: Map of listed cultural monuments (map by NTPA)

The city of Përmet, located nearby, also has a Historic Center characterized by a unique architectural heritage. The Center includes different types of construction, such as folk housing, cult objects, and social amenities. The Historic Center overlaps mainly with the neighborhoods of Shënkoll (Varosh) and Teqë, which, in terms of the composition of buildings and cobbled streets, are where the oldest traces of the city can be seen. Two cult objects are included within the Historic Center: the Church of Saint Friday (1776), a cultural monument of the first category, and Saint Koll Church (built during the 19th century). The built ensemble presents a fascinating typology that includes many dwellings next to one another, with small courtyards, a network of narrow cobbled alleys, and external wooden gates with a stone wall perimeter. The buildings are generally two-storied and built with stone walls. The architecture is characteristic of the area's traditional villages, and most of the buildings are from after the Second World War (DCM No 32/2017).

The Historic Center of the village of Bënja is another local area with significant cultural, historical, urbanistic, architectural, and landscape heritage values, which are physical evidence of the historical development of the village. The overwhelming part of the village consists of the distinct road network and old buildings, which have unique architectural and heritage value. In the Historic Center, one finds a variety of physical and cultural assets, including cultural monuments of the first category, such as the Church of Saint Mary, second-category objects, and objects without status (DCM No 832/2021).

Culinary heritage

As a result of its proximity to several settlements, each renowned for its unique history and cultural identity, the Vjosa valley has the potential to integrate a diverse array of culinary offerings into its tourism offer. Moreover, given the ease of access to fresh food products and ingredients available in the area, Vjosa's culinary tourism can embrace the Slow Food Movement, ensuring the sustainability of this particular mode of tourism. The Slow Food Movement can be defined as "agriculture and food production with strong consideration for environmental sustainability, biodiversity conservation, and social aspects" (Shumka et al., 2022). As previously mentioned, Vjosa is distinct for its high levels of biodiversity. Several studies show that biodiversity is positively linked to the resilience of agricultural systems, helping to protect against environmental shocks and providing key ecosystem services for agricultural production (Rahawarin, 2017, *in* Shumka et al., 2022). Given that the potential benefits of linking the Slow Food Movement to Albania's national parks have already been made evident, it is critical to valorize and facilitate this modality of culinary tourism in the new Vjosa Wild River National Park as well.

In the Vjosa valley, Gjirokastra and Përmet are particularly renowned for their culinary culture, being one of the unique selling points of Përmet in particular. The area's culinary culture has distinct Ottoman roots with its reliance on local oils, spices, herbs, and especially sauces. Thanks to the ample presence of organic, locally sourced ingredients, this region has very few barriers to a "farm-to-fork" approach, which could prove a critical asset in promoting the culinary tourism of the area (NTPA, 2017).

Some typical dishes for Gjirokastra include *pashaqofte*, a soup with small meatballs; *qifqi*, rice balls cooked in a hollow frying pan and mixed with herbs; *shapkat*; *sarma* or *japrak*, stuffed grape leaves with rice and mint; and *qahi*, tiny spinach pies. A must-try local dessert in Gjirokastra is *oshaf*, with sheep milk and cinnamon, as well as Turkish baklava, prepared according to local methods. Another important local product in Gjirokastra is the local cheese, which is renowned throughout Albania. This cheese is made from the milk of goats, sheep, or cows. The most common cheeses are called *djathë i bardhë*, a soft white cheese that is similar to, but a bit harder than, feta, and *kaçkavall*, a hard yellow variety (Visit Gjirokastra, 2022).

Përmet, on the other hand, is renowned for the preparation of *gliko* (a type of traditional jam), as well as the production of *rakia* and wine (NTPA, 2019). To better capitalize on its culinary reputation and boost economic growth, some Përmet businesses have joined a Slow Food Movement, which has about 80 members throughout the country, and a Slow Food Alliance, which counts among its members 27 influential Albanian chefs (Slow Food Foundation ND). The Slow Food Movement is a broader initiative in which everybody is directly or indirectly connected to food production (restaurants, agribusinesses); the Slow Food Alliance is more selective, including only the best restaurant chefs (International Labor Organization, 2020).