DRIN CORDA

Enabling Transboundary Cooperation & Integrated Water Resources Management in the extended DRIN RIVER BASIN

Valuation of Ecosystem Services of the Lake Ohrid Watershed

- Valuing the Natural and Cultural Capital of Lake Ohrid –

[LOWMP Supplement II]

08 May 2017

In the framework of:

Memorandum of Understanding
for the Management of the Extended Transboundary Drin Basin

GEF Project "Enabling Transboundary Cooperation and Integrated Water Resources Management in the Extended Drin River Basin"

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Abbreviations

AMIS – Agricultural Market Information System (North Macedonia)
CICES – Common International Classification of Ecosystem Services
CVM – Contingent valuation method
DEM – Digital elevation model
EC – European Commission
ES – Ecosystem services
EU – European Union
FAO – Food and Agriculture Organization
GDP – Gross domestic product
GEF – Global Environment Facility
GWP-Med – Global Water Partnership – Mediterranean
HPP – Hydro power plant
IPCC – Intergovernmental Panel on Climate Change
IUCN – International Union for Conservation of Nature
LO – Lake Ohrid
LOW – Lake Ohrid watershed
LOWMP – Lake Ohrid Watershed Management Plan
MEA – Millennium Ecosystem Assessment
MAES – Mapping and Assessment of Ecosystems and their Services
MoU – Memorandum of Understanding
NC – Non-consumptive
NGO – Non-governmental organization
NP – National park
NUV – Non-use value
OECD – Organization for Economic Co-operation and Development
SHPP – Small hydro power plant
SSO – State Statistical Office (North Macedonia)
TEEB – Economics of Ecosystems and Biodiversity
TEV – Total Economic Value
ToR – Terms of reference
UN – United Nations
UNECE – United Nations Economic Commission for Europe
UNEP – United Nations Environment Programme
UNESCO – United Nations Educational, Scientific and Cultural Organization
UV – Use value
WB – World Bank
WFD – EU Water Framework Directive
WTP – Willingness-to-pay

1. Introduction

Situated in the south-west of the Balkan Peninsula, Lake Ohrid is one of Europe's largest lakes and, at somewhere between one and three million years, one of the world's oldest. It is a true diamond set in a majestic landscape dominated by high ranges and stroked by winds of the Adriatic and the Aegean, linked through underground channels to its companion over the mountains, Lake Prespa. The lake district is protected by UNESCO and shared by two countries: Albania and North Macedonia.

The Lake Ohrid watershed (LOW) is part of the extended transboundary Drin River Basin, located in the south-western part of the Balkan Peninsula and shared between Albania, Kosovo[1], Montenegro and North Macedonia. Being EU membership candidates, in 2011 the four countries have signed a Memorandum of Understanding (MoU), creating a Shared Vision for the sustainable management of the Drin Basin. The MoU is an outcome of a Drin Dialogue coordinated by the Global Water Partnership – Mediterranean (GWP-Med) and UNECE. Implementation of the MoU is supported through a process called Drin Coordinated Action (Drin CORDA). An Action Plan has been developed for operationalization of the Drin CORDA, whose implementation is supported by the GEF-funded "Enabling Transboundary Cooperation and Integrated Water Resources Management in the Extended Drin River Basin" Project.

In late 2017 the GWP-Med has initiated activities for development of Lake Ohrid Watershed Management Plan (LOWMP). The initiative is a pilot activity under the GEF Project; its key objectives are to: (1) develop the LOWMP in accordance with the pertaining EU regulations – especially the EU Water Framework Directive (WFD) – and national laws; and (2) test and establish an approach, in the form of ToR for the Extended Drin Basin, for preparation of transboundary management plans for the rivers and lakes of the Drin basin. Further on, the Plan needs to be prepared in a highly participatory manner that will bring together a wide array of decisions makers and other stakeholders from both countries sharing the lake. Therefore, besides putting forward a policy document (Plan) for water resource protection based on a comprehensive planning framework such as the EU WFD, a supplementary goal of the initiative is to showcase a contemporary approach for environmental protection and management of transboundary natural resources and ecosystems in an economically and socially sustainable way.

On the other hand, as widely recognized ecosystems provide people with a flow of benefits, also termed ecosystem goods and services, which directly or indirectly contribute to human well-being. Such goods and services stemming from ecosystems' processes and specifics may come in the form of various material or energy outputs of living systems (e.g. fresh water, food products, timber), but also as merits that result from the pathways in which living systems moderate the environment (e.g. climate regulation, water and air quality, pollination), or even as non-material outputs that people obtain from contacts with ecosystems (e.g. recreational, aesthetic or spiritual experiences). However, given that ecosystem services are not equally distributed in space and do not flow at identical rates, the value of these ecosystem services, as well as of the natural assets that provide them, is often overlooked in a decision-making process. Further, current commodity markets only expose information about the value of ecosystem processes and services that are priced and incorporated in transactions, which thus poses limitations on the ability of the markets to provide a broad picture of the ecological values involved in decision processes. Accordingly, it is largely for these reasons that in the past decades a number of initiatives have been undertaken at the EU and worldwide level that result in creating frameworks aimed at mapping, increasing knowledge base and assessment of ecosystem services. Or, put in other words, the logic behind ecosystem service valuation is to resolve the complexities of socio-ecological relationships, make explicit how human decisions can affect ecosystem service values, and to express these values in monetary units that allow for their incorporation in public decision-making processes.

Hence, the primary objective for conducting an assessment (valuation) of the ecosystem services of the Lake Ohrid watershed and this report is to support the development of the LOWMP. Nevertheless, it is also believed that the findings will provide useful insights suitable for fostering a broader informed debate regarding the definition of regional resource protection policies, as well as for promotion and coordination of more detailed further ecosystem service valuations, which are regarded as basic component of an adaptive multi-level and

[1] * References to Kosovo shall be understood to be in the context of Security Council Resolution 1244 (1999).

long-term environmental governance, in both countries. In this respect, it is also believed that the valuation of the LOW ecosystem services as presented herein will serve as a baseline for future valuations of the natural capital of Lake Ohrid and the benefits it contributes to well-being of the societies.

The report provides: (1) a brief overview of LOW natural and socio-economic conditions and its natural and cultural resources; (2) an indication of the perception of Lake Ohrid's values by the key environmental resource users (local residents and tourists); and (3) valuation of watershed's ecosystem services along with summary results and conclusions.

The data used in this analysis include background information and questionnaire data. The background information refer mainly to statistical and other data used for development of the LOWMP. The questionnaire data derive from a survey that was conducted in the LOW region in the summer/autumn of 2018, with an objective to gather an insight into the end-users' perception of the values and benefits arising from the natural characteristics of the LOW, the awareness of the pressures impacting the status and quality of basin's water resources, as well as to determine their willingness-to-pay for improved protection and overall conditions in the LOW.

The findings of the analysis are presented in Chapters 2 to 5 of this report. Supporting information is provided in the Annexes. Graphical presentation of key socio-economic data and ratios are presented in Thematic GIS-based Maps. Technical information is presented in metric units and the costs are in US$ or Euro.

2. The Lake Ohrid Watershed

2.1. Natural Conditions

Topography

With a maximum depth of 290 meters and average depth of 155 meters, straddled in the mountainous region between the southwestern part of North Macedonia and the eastern part of Albania, Lake Ohrid is one of the oldest and deepest lakes in Europe. The lake is located at an altitude of 693 masl and has an area of 358 km^2. The hydrological regime of the lake is dominated by inflow of water from the nearby Lake Prespa via karstic aquifers, while the outflow occurs through the Black Drin river in the town of Struga.

The Lake Ohrid watershed is part of the extended transboundary Drin River Basin, located in the south-western part of the Balkan Peninsula and shared between Albania, Kosovo, Montenegro and North Macedonia.

Fig. 2.1 Lake Ohrid Watershed, key characteristics

Indicator	
Watershed area (km^2)	1,404.9
Lake total area (km^2)	357.9
Watershed/Lake area ratio	2.9
Maximum elevation (masl)	2,271
Average watershed elevation (masl)	1,139
Minimum elevation (Lake Ohrid, masl)	693.1
Lake water level control (Yes/No)	Yes
Average water level change (m)	0.8
Average lake depth (m)	155
Maximum lake depth (m)	293
Lake volume (km^3)	58.6
Dynamic ratio (km/m)	0.6
Retention time (Years)	70- 80
Shoreline length (km)	87.5
Trophic classification	Oligotrophic

Climate, hydrology and hydrography

In general, the local climate conditions in the LOW are categorized as Mediterranean with continental influences. The local climate is influenced by the proximity to the Adriatic Sea, by the surrounding mountains, and by the thermal capacity of Lake Ohrid.

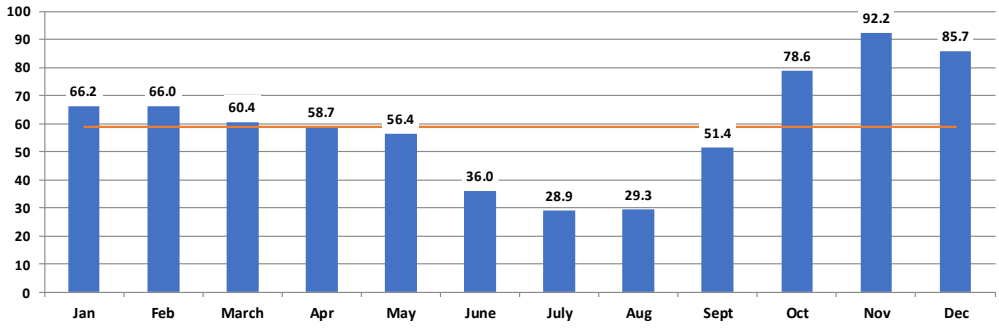
The mean annual temperature recorded in the Ohrid region averages at 11.5 °C; average temperatures range from 21°C during summer to 1.8°C during winter. The temperature of Lake Ohrid's pelagic water (below 150 m depth, year-round) ranges from 6°C to 24–27°C at the surface during summer.

The morphology of the basin also affects the wind regime, with northerly winds prevailing during winter and southerly and southeasterly winds during spring and summer. Average speed of the wind in the Lake Ohrid region is relatively low at 1.8 m/sec.

Precipitation averages around 750 mm annually and is at a minimum during summer. On annual basis, precipitation and lake water-level oscillation reach their peak values (maximum and minimum) in different seasons. Maximum precipitation occurs in the form of snowfall in November/ December, when the lake's water levels are at their lowest. The snow remains throughout the winter at high altitudes (above 1,000 masl.), but begins melting and entering the lake in March/April which then reaches its maximum water level in May/June.

Fig. 2.2: Average monthly precipitation

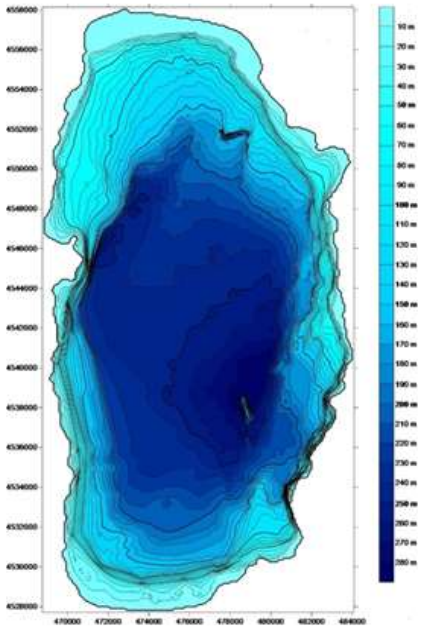
MS Ohrid, 1961 - 2016



The hypothesis that the water from the nearby Prespa Lake is seeping into the karst massif of the Galichica and Suva Gora mountains and draining into Ohrid Lake was first published by Cvijić (1906). The validity of the hypothesis was proven with isotope-based tests (Anovski et al. 1997, 2001; Eftimi and Zoto 1997). Much of the karstic type of aquifers are found in the triennial limestones of Galichica and Jablanica, which drain through numerous springs into Lake Ohrid. Estimates imply that 49% of the inflow from springs into the lake comes from sublacustrine (under water) springs and 51% from surface springs. The most important are: St. Naum (5-10 m^3/sec), Tushemisht (2.5 m^3/sec), Biljanini Springs (1-2 m^3/sec), Bej Bunar (40-100 l/s), and other unknown number of sublacustrine springs.

Besides the springs, important volume of water drains in Lake Ohrid through a number of tributaries, most of which are small creeks that flow only temporarily during snowmelt and heavy rain periods. The main rivers in the LOW, tributaries to Lake Ohrid (Fig. 2.3), include: Sateska, Koselska, Shushica and Grashnica river in North Macedonia, as well as Çeravë and Verdovë rivers in Albania. Two-thirds of the LOW (Lake Ohrid) water outflow passes into the Black Drin River at the town of Struga, flowing northwards on the way to the estuary in the Adriatic Sea. The remaining one-third of the lake's water is lost through evaporation (Watzin et al. 2002).[2] Since 1962 the river's outflow has been controlled with a weir, which regulates the water level in the lake.

Fig. 2.3: Tributaries and bathymetric map of Lake Ohrid



Land cover

The land cover/land use analysis of the LOW is based on data from the European Environment Agency's CORINE

[2] Source: "Shorezone Functionality, Ohrid Lake"; Implementing the EU Water Framework Directive in South-Eastern Europe. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (2017).

Programme[3] (Fig. 2.4). The surface area of the LOW is dominated by Forests, Scrub and open spaces, and the surface area of Lake Ohrid, which collectively account for 79% of the total basin area. Other dominating land cover classes are Arable land and Heterogeneous agricultural areas, which make up 15.6% of the area. Of the remaining 5.3% of land, dominant classes are Urban fabric (2%) and Pastures (1.9%).

Fig. 2.4: LOW Land cover (CORINE Level 2 LUC)

CORINE Land Classes	Area (km2)	% of total
Arable land	43.0	3.06%
Artificial, non-agri. vegetated areas	1.4	0.10%
Forests	457.5	32.58%
Heterogeneous agricultural areas	176.1	12.54%
Industrial, comm. and transport units	2.0	0.14%
Inland waters	2.0	0.14%
Inland wetlands	0.7	0.05%
Mine, dump and construction sites	0.6	0.04%
Open spaces with little or no vegetation	0.4	0.03%
Pastures	26.0	1.85%
Permanent crops	15.1	1.07%
Scrub and/or herbaceous vegetation	294.8	20.99%
Urban fabric	27.6	1.96%
Lake area	357.0	25.43%
Total LOW	**1,404.0**	

Protected areas

A total of 9 protected and sensitive areas located in the LOW are identified, that fall into four of the six IUCN[4] categories (Table 2.1). The total area of all protected areas equals 661.6 km^2 (47% of the total basin area), of which 268.4 km^2 in Albania and 393.2 km^2 in North Macedonia.

Table 2.1: LOW: Protected Areas[5]

ISO3	Site Name	Year	Designation	IUCN CAT	Area (km^2)
MKD	Galichica	1958	National Park	II	145.9
MKD	Ohridsko Ezero	1977	Designated area not yet reviewed	III	247.4
MKD	Duvalo (Kosel)	1979	Designated area not yet reviewed	III	0.0
MKD	Makedonski dab, s.Trpejca, Ohrid	1967	Designated area not yet reviewed	III	0.0
MKD	Platan s.Kalishte, Struga	1961	Designated area not yet reviewed	III	0.0
MKD	Platan-chinar, Ohrid	1967	Designated area not yet reviewed	III	0.0
ALB	Shebenik-Jabllanice	2008	National Park (category II)	II	0.6
MKD	Platanovi Stebla, Ohrid	1967	Designated area not yet reviewed	III	0.0
ALB	Liqeni I Ulzes	2013	Managed Nature Reserve (category IV IUCN)	IV	267.8
				Total	**661.6**

2.2. Socio-economic Conditions

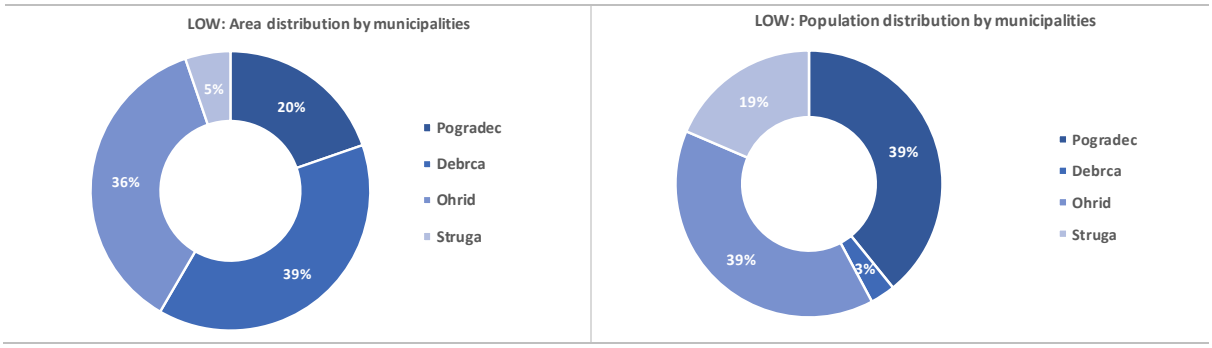
Administrative division

The transboundary LOW is shared between Albania (313 km^2 or 22% of the total basin territory) and North

[3] European Environment Agency (EEA), CORINE (Coordination of information on the environment).
[4] IUCN – International Union for Conservation of Nature.
[5] Source: European Environment Agency's (EEA), The European inventory of nationally designated areas holds information about protected areas and the national legislative instruments, which directly or indirectly create protected areas.

Macedonia (1,091 km^2; 78% of the territory). Administratively, the watershed area falls under four municipalities (local government units), of which Pogradec municipality is in Albania, while Ohrid, Struga and Debrca municipalities are in North Macedonia. The distribution of the LOW territory by the four municipalities is shown on Fig. 2.5. In reference to the administrative division of the basin territory by municipalities, it should be pointed out that only 34% of Pogradec, 98% and 95% of Ohrid and Debrca respectively, and merely 11% of the total area of Struga municipality falls within the LOW. Following the territorial division of Albania from 2014/15, the Albanian territory of the LOW falls under five Administrative Units: Buçimas, Çeravë, Dardhas, Pogradec and Hudenisht.

Fig. 2.5 LOW: Area and population distribution by municipalities



Demography and housing

The total population of the LOW equals 132,059 divided nearly equally between female and male population. Of the total, 39% live in Pogradec municipality, 3% in Debrca, 39% in Ohrid and 19% in Struga (Table 2.2). The overall density of the population for the LOW as a whole is 126 persons per square kilometer.

Table 2.2: LOW: Population statistics

Municipality	Female	Male	Total Municipality	Year	% of LOW population	Area (km^2)	Population density (cap/km^2)	% Urban	% Rural
Pogradec	25,341	26,375	51,716	2011	**39%**	206.2	251	14%	86%
Debrca	2,005	1,989	3,994	2015	**3%**	405.0	10	0%	100%
Ohrid	26,183	25,668	51,850	2015	**39%**	381.0	136	75%	25%
Struga	12,285	12,214	24,498	2015	**19%**	54.8	447	71%	29%
TOTAL in LOW	**65,813**	**66,245**	**132,059**		**100%**	**1,047.0**	**126**	**48%**	**52%**

The total number of settlements in the basin is 94, of which 25 (26.6%) in Albania (Pogradec municipality) and 69 (73.4%) in North Macedonia. 53 of the 94 settlements (or 56%) have population of less than 500, and only 5 have population bigger than 2,000. 58% of the total population in the LOW lives in the three largest cities (municipal administrative centers): Pogradec, Ohrid and Struga.

GDP and employment

According to national statistics, the GDP per capita in 2018 was $5,239 in Albania and $6,100 in North Macedonia. Statistical data for both countries show relatively steady upward growth in these figures over the last several years.

As regards employment, statistics are kept differently in each country but it is clear that unemployment and/or underemployment is high in both countries. In Albania, according to data compiled by the Albanian Institute of Statistics, in 2016 the unemployment rate equaled 15.2%; in North Macedonia, according to the State Statistical Office (SSO), the same rate equaled 23.7%. The situation is considered even more difficult if market indicators are segregated by gender. Thus, the inactivity rate (proportion of the population that is not in the labor force) in 2015 in Albania equaled 52.7% for female population and 35.7% for male population, whereas in North Macedonia the same rate for the female population equaled 55% and 30.8% for male population.

2.3. Natural Resources

Lake Ohrid itself is formed over one graben structure with meridian orientation and horizontal pulling along the main tectonic separator bend: Bilisht – Korçe – Diber. The general extent of the lake is limited by the horst of Suva Mountain (in the east) and Mokra Mountain (in the west). The form of the lake and its shoreline (simple and straight) have been shaped by neotectonic movements along faults that remain active today. Movement along these faults is experienced as earthquakes. The LOW belongs to the Western Macedonian geotectonic zone, which represents a segment of the interior Dinaric Alps. The bedrock structure of the watershed area includes rock masses of various types, composition and age, going all the way back to the Paleozoic, Mesozoic and Cenozoic Eras.

With an estimated age of 2–5 million years, Lake Ohrid is the oldest lake in Europe. Although more work is needed to determine the hypothesis of the lake's origin and age, it remains undisputed that the lake has persisted in its present form since at least the Pleistocene [20]. Four hypotheses exist regarding the limnological origin of the lake, but two of them seem most accurate: the first one supports the theory of "de novo" formation of Lake Ohrid in a dry polje with a spring or river hydrography; and the second hypothesis presumes a paleogeographic connection of Lake Ohrid with the brackish waters on the Balkan Peninsula [21].

The oligotrophic Lake Ohrid is phosphorus limited [2], with an average total phosphorus concentration of 4.5 mg/m^3 and total nitrogen concentration of 171–512 mg/m^3 [22]. The lake's silica concentration is < 200 mg/m^3 in the trophogenic zone during summer, while the average water pH and conductivity are 8.48 and 208 µS/cm respectively. The average Secchi depth is roughly 14 m. Although the concentrations of phosphorus and the water transparency measured in the last few years still suggest an oligotrophic condition in Lake Ohrid, the living organisms show a different pattern. Both the phytoplankton and zooplankton communities are shifting to species composition more characteristic of a mesotrophic lake [23].

Compared with other ancient lakes, Lake Ohrid is relatively small with a total surface area of 358 km^2 and a maximum depth of 293m. Despite its size, the lake contains considerable aquatic species diversity and endemism. Of the 1,200 animal species reported, 212 are considered endemic [21]. Ten of the seventeen identified fish species of the Lake Ohrid are endemic, as are many of the lake's snails, worms, and sponges. According to published data based on almost a decade of detailed taxonomic work on the lake, in total 789 diatom taxa have been recorded, including 117 endemic species [24]. Harboring more than 300 endemic species, Lake Ohrid has the highest index of endemism of all ancient lakes.

The reed belt along the coastline of the lake serves as a spawning site for many fish species and an important wintering site for birds. Tens of thousands of birds of more than twenty species populate the area. However, development has also changed the natural habitats along the shoreline, especially in the areas around Ohrid, Struga, Peshtani, St. Naum, Tushemisht, and Pogradec. In these areas the native reed zone has been drastically reduced, and nutrient enrichment has stimulated the growth of new aquatic plants. The changes in shoreline vegetation have also interrupted the connections between the lake and the shoreline channels and wetlands.

Additionally, the commercially important fish species in Lake Ohrid, including its famous Lake Ohrid trout, have been harvested at unsustainable levels in recent years and the populations of trout are in immediate danger of collapse. Human activities along the shoreline also threaten the spawning and wintering grounds of the Ohrid trout and other fishes [25, 26].

Apart from the lake, as indicated before 47% (662 km^2) of the total watershed territory (1,404 km^2) falls under protected areas that represent additional precious natural asset of the region. Further, 32.6% of the territory is under Forests, 21% under the CORINE LUC of Scrub and open spaces and 15.6% under the categories of Arable land and Heterogenous agricultural areas.

2.4. Cultural Heritage and Resources

The World Heritage Committee of UNESCO inscribed the North Macedonia part of Lake Ohrid on the World Heritage List under natural criteria in 1979. In 1980 the property has been extended to include the cultural and historic area, and three additional criteria had been added. In July 2019 the site has been extended to include the north-western part of Lake Ohrid in Albania, the Lin Peninsula and a strip of land along lake's shoreline

connecting the peninsula with the North Macedonia border[6]. The entire territory of the protected site represents a category of cultural landscape in which history, cultural tradition and societal values are inseparable.

Region's cultural and ambient characteristics hold multilayered values of Lake Ohrid and the surrounding mountain ranges. The universal values of the region are nested in the centuries long synthesis of an iconic nature and human-made structures. Using the lake as a primary source of life, numerous generations have left links between nature, rural and urban living. Thus, the Lake Ohrid region has homed humanity for thousands of years, dating back to the Tertiary period. Remains of Neolithic settlements are found around the lake, with further inhabitance by Illyrian and Hellenic tribes confirmed by ancient scripts, the still standing Ancient theatre of Ohrid and the Monumental Tombs of Lower Selca.

As the history of the region developed, so did the appearance and life in the settlements around the lake. The remains of Via Egnatia, the ancient Roman road connecting Rome and Byzantium (present day Istanbul) in near vicinity of the lake are proof of the civilization continuum throughout the era before Christ. Various early roman Basilicas and mosaics, such as the ones in Lin, St. Erasmo and Plaoshnik, account for the early adoption of Christianity in the region. The 6th century paleochristian church of Lin's floor mosaics spreading over 120m^2 are remarkably conserved and have an outstanding artistic value [11].

As the Slavic tribes began to settle in the region and adopted Christianity, the region became a cradle of Christian theology. Various saints practiced and spread Christianity around the lake, amongst which St. Clement of Ohrid is the most important. Nowadays a newly reconstructed Church sits where St. Clement himself reconstructed an old Church with the purpose of spreading Christianity amongst Slavs. He founded the Ohrid Literacy School, where the Bible was taught in Old Church Slavonic with the use of the Cyrillic script, which he helped develop. His tomb rests in the church to this day.

In the middle ages the region became part of Tsar Samuil's empire, with the city of Ohrid serving as the capital. The fortress built for his needs, with findings of ancient Greek scripts suggesting that it was originally built in the 4th century B.C., was later used by the Ottoman empire and it proudly sits on the highest point of the city to this day.

On top of a hill in Pogradec there are remains of an Illyrian-Albanian castle in a site that has been populated since the 6th century B.C. The churches of St. Sophia and Kaneo in the city of Ohrid from the 11th and 13th century respectively are prime examples of Byzantine architecture that attract plenty of tourists, host cultural events, etc. The St. Jovan Kaneo church, resting on a cliff right above the lake in the city of Ohrid, blends marvelously with the natural setting of the region. The St. Naum monastery from the 16th century on the other side also sits on a plateau right above the lake and has historically welcomed both Christians and Muslims from the region.

Apart from the Byzantine, today's architecture of the area is mostly from the times of the Ottoman Empire. The narrow cobblestoned streets, numerous mosques and churches, tightly built two to three story buildings throughout the lakeside cities of Ohrid and Pogradec are what gives them a particular charm.

A list of 40 major cultural heritage sites of the North Macedonia part of the LOW are shown in Appendix 4.

Lake Ohrid, besides being a natural phenomenon, for centuries has also been an important source of food for the local population. As a consequence, there are a number of fishermen settlements along the shoreline. The fertile valleys located among region's mountain ranges have created conditions thoroughout the centuries for development of numerous rural settlement with distinct architecture and appeal, all of which also represent a piece of the overall cultural heritage and value of the entire watershed, thus attracting particular attention of visitors.

[6] Source: https://whc.unesco.org/en/list/99/.

3. Perception of the Natural and Cultural Values of the Lake Ohrid Region

The wider Lake Ohrid territory, with all its grandiose appearance and biodiversity values has an undeniable natural and cultural significance, as confirmed by the number of visitors to the region and by its UNESCO World Heritage Site status. However, it cannot be taken for granted that the residents and tourists in direct contact with the area itself are fully aware of its importance, and even more so of its innate vulnerability and required level of protection.

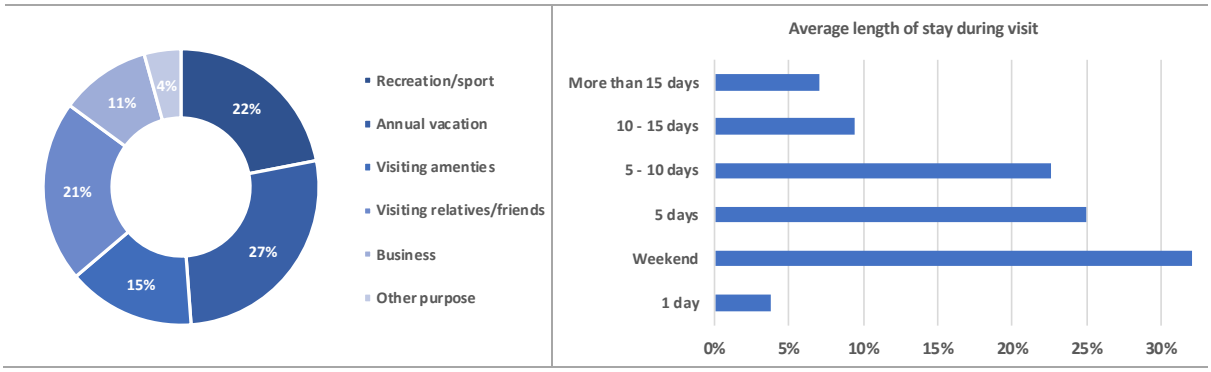
Therefore, in order to elicit the opinion and awareness of the general public and the local community regarding these aspects, as part of the survey conducted for the ecosystem valuation effort a set of questions were included in the survey questionnaires that are focused primarily on the perception of the region's values, as well as on the observations relating to the existence of potential impacts that might hamper the values. Overview of the answers gathered with that part of the survey are provided further.

The survey was conducted in August/September 2018 and covered 220 residents of the LOW and 212 tourists, both domestic and foreign. Two questionnaires were developed for the purpose (Appendix 3). The survey covered all administrative units within the Pogradec municipality and the three municipalities of North Macedonia. It was carried out as 'direct interview with respondents' type of survey by a group of selected local residents (surveyors) from Pogradec, Ohrid and Struga. The surveyors were consulted on various aspects of the task and coordinated during the survey implementation. The choice of respondents was random, however special attention was given to equal participation of female and male respondents.

Reasons for visiting the region and length of stay

The main reason tourists visit the Ohrid Lake is annual vacation, closely followed by recreation/sport and to visit relatives/friends (Fig. 3.1). Majority stay for 2-3 days (32.1%), suggesting that the Lake Ohrid region is predominantly a weekend destination. Nevertheless, there is also a significant percentage of the respondents (visitors) that stay for 5 days (25%) or more (22.6% stay 5-10 days) (Fig. 3.1).

Fig. 3.1: Main reasons for visiting Lake Ohrid and average length of stay



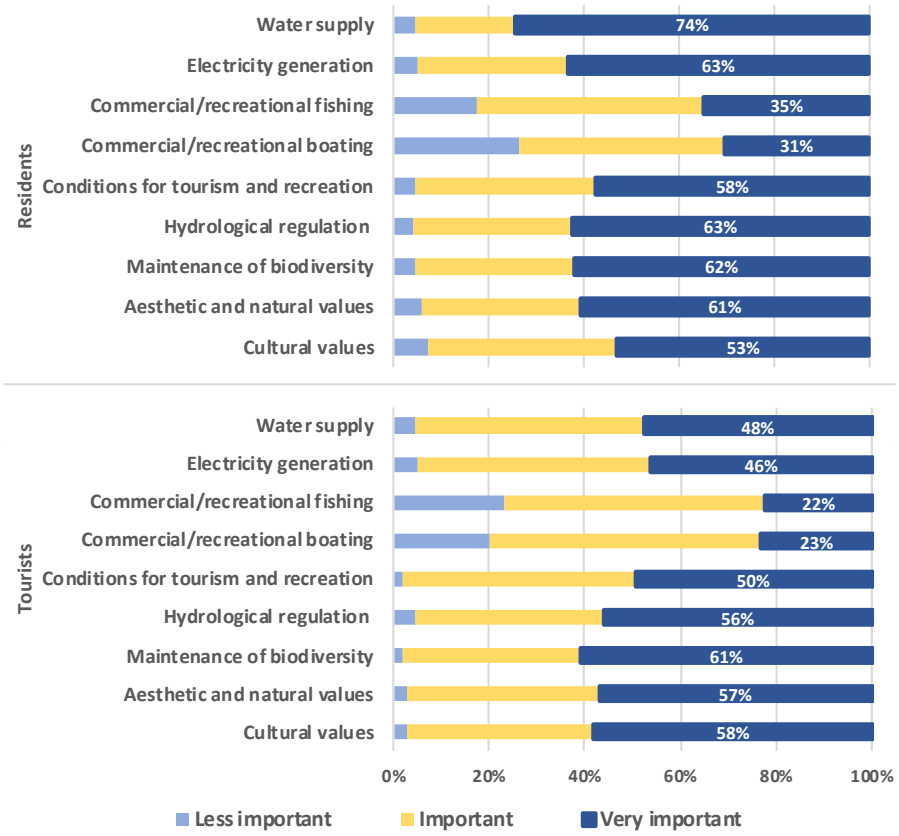
Perception of the benefits (ecosystem services) of the LOW

When asked to rank the importance of the benefits that people have from the Lake Ohrid watershed, tourists and residents had similar opinion (Fig. 3.2). Water supply and maintenance of biodiversity are the two highest ranked benefits in the eyes of residents and tourists respectively. While biodiversity maintenance is equally important for both residents and tourists, the water supplied by the Lake Ohrid is perceived as more important by residents compared to tourists. 74% of questioned residents view water supply as very important, while 48% of tourists have the same opinion.

The benefits of cultural and natural values also have a high importance in the tourists' opinion, along with hydrological regulation. On the other hand, fishing and boating are not perceived as very important benefits provided by Lake Ohrid. Electricity generation, like water supply is a service that is much more valued by the

residents than the tourists, as residents are more likely to be aware of the importance of the Ohrid Lake in the downstream electricity production compared to tourists.

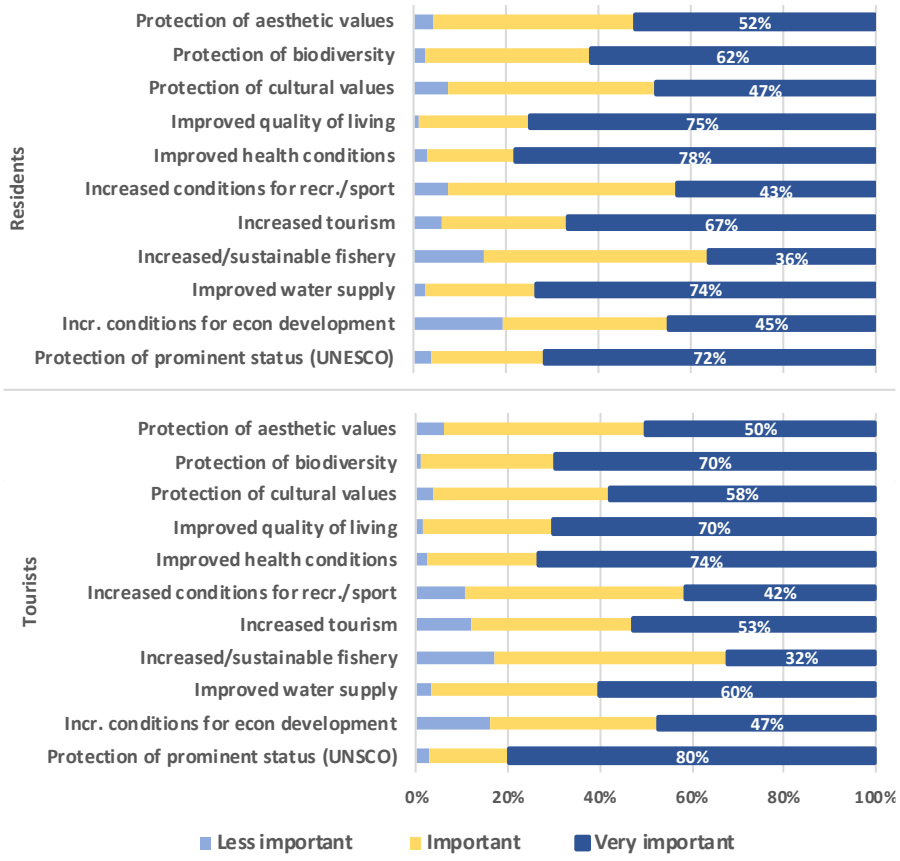
Fig. 3.2: Benefits provided by the Lake Ohrid watershed



<u>Perception of the benefits linked with good water quality</u>

When asked about benefits closely linked with the water resource quality in the basin, the protection of the UNESCO World Heritage Site status has a very high importance amongst both tourists and residents (Fig. 3.3). As already stated, it can be concluded from the chart that tourists give higher importance on cultural values and biodiversity protection, compared to residents who place high importance on water supply. Nevertheless, improved quality of living and health conditions are benefits from good water quality that both tourists and residents value highly. Increased conditions for economic development and increased/sustainable fishery are benefits that are seen as least important by both groups of respondents.

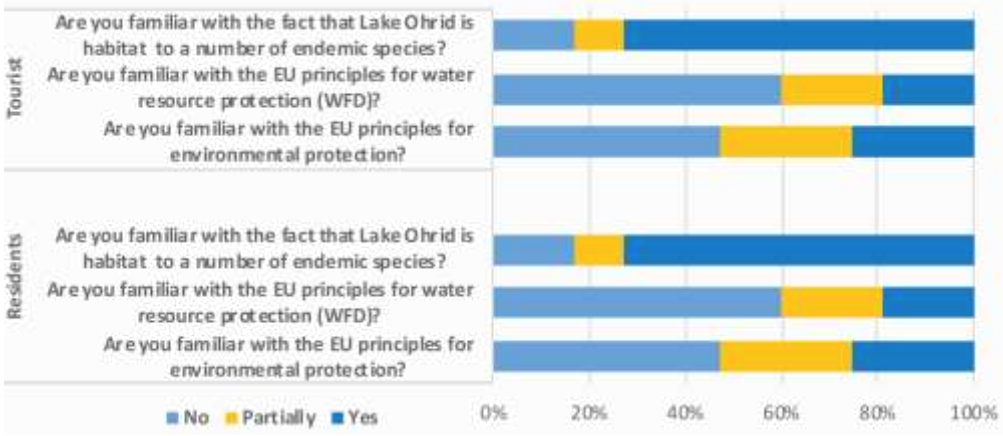
Fig. 3.3: Benefits linked with good water quality



Awareness of Lake's endemism and EU environmental protection principles

Even though the public is generally aware of the benefits provided by the Lake Ohrid and its watershed, it has a low awareness of existing environmental (especially water resource) protection standards and principles (Fig. 3.4).

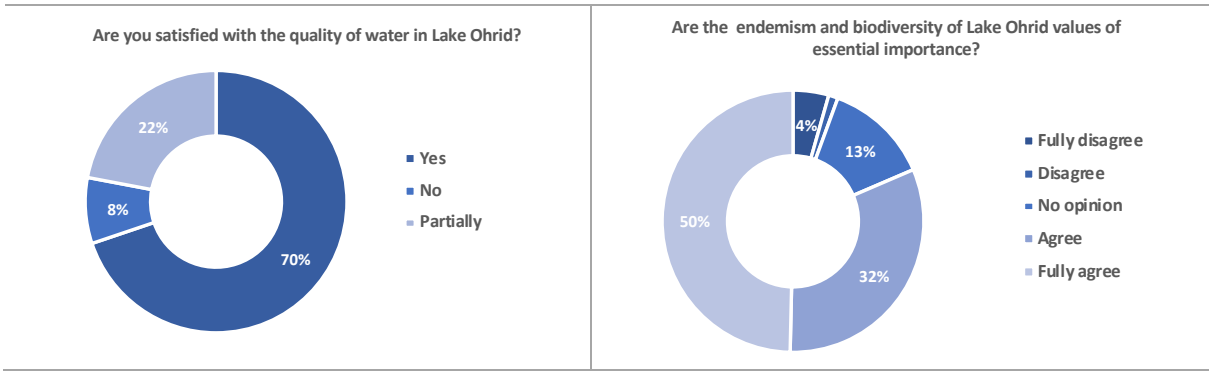
Fig. 3.4: Awareness of Ohrid Lake endemism and knowledge of EU environmental protection principles



Satisfaction with Lake's water quality

The high awareness regarding biodiversity and endemism of Lake Ohrid (Fig. 3.5), coupled with the UNESCO status and limited knowledge of environmental standards (Fig. 3.4) may lead towards an opinion that human impact on the watershed is negligible. In fact, only 8% of the questioned are dissatisfied with the Lake Ohrid water quality (Fig. 3.5).

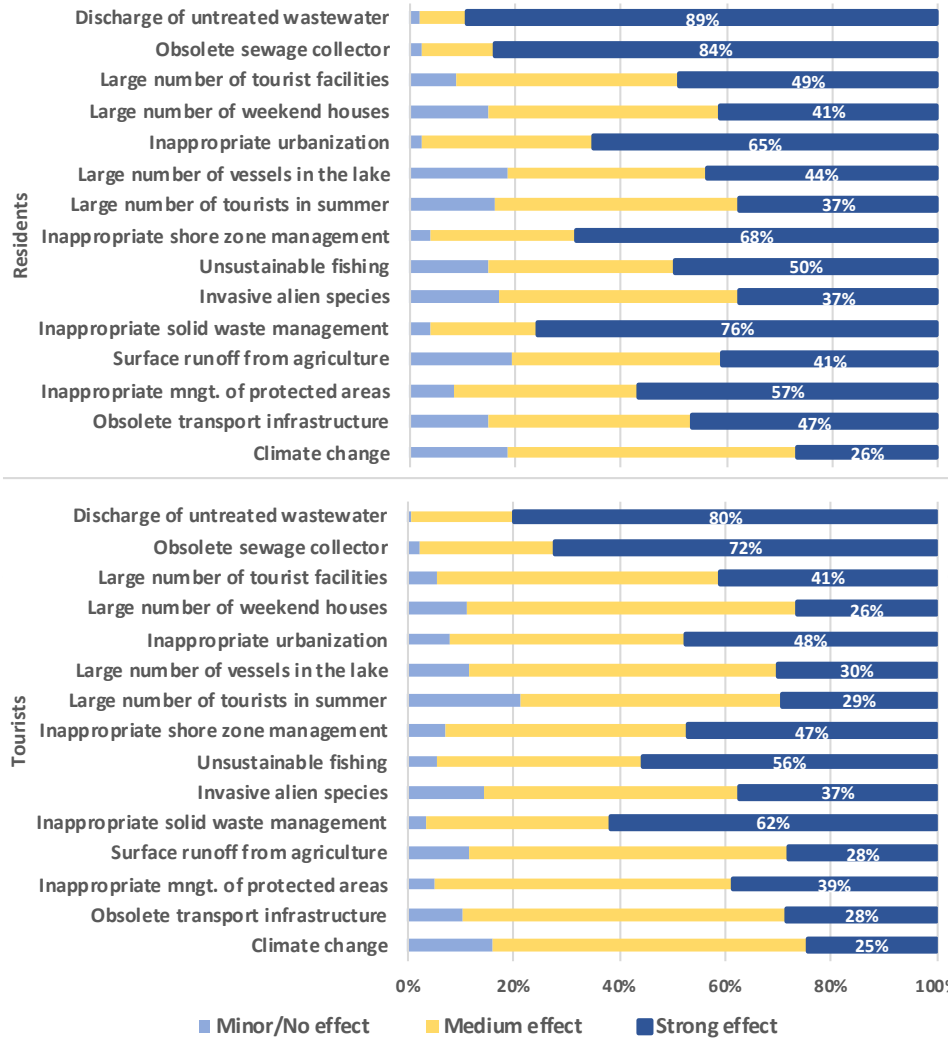
Fig. 3.5: Satisfaction with water quality and importance of biodiversity and endemism in Lake Ohrid



Awareness about pressures on water quality and biodiversity

In terms of the perceived pressures on the water quality and the biodiversity in the Lake Ohrid watershed, the main concern for the public (residents and tourists) is the discharge of untreated wastewater (sewage) into the lake (Fig. 3.6), with 89% of residents and 80% of tourists believing that it has a strong negative effect on the water quality and biodiversity. Furthermore, the obsolete sewage system is believed to be a strong effect as well, which goes hand in hand with the discharge of untreated wastewater.

Fig. 3.6: Ranking of pressures on water quality and biodiversity in Lake Ohrid



Solid waste mismanagement is the next pressure believed to have a strong negative effect. Inappropriate shore zone management is a pressure that is differently perceived by locals and tourists, i.e. locals are much more aware of the mismanagement of the Lake Ohrid shore zone, along with inappropriate urbanization.

Although the general trend is the same between locals and tourists, local residents assign greater importance on all but one pressure out of those listed in the questionnaire. Apart from the ones already mentioned, the difference is particularly visible for pressures such as “large number of weekend houses”, “large number of tourist facilities”, “obsolete transport infrastructure”, all of which are related to urban planning and infrastructure. Additionally, around 56% of the local population believe that inappropriate management of protected areas has a strong effect on the watershed biodiversity, while only around 39% of the tourists believe the same.

Benefits from protection of water quality

All benefits mentioned so far are to be enjoyed by a number of different stakeholders. Tourists and residents have practically equal opinion regarding which shareholders would benefit the most from a good water quality. Largest part believe that the local population would benefit the most, closely followed by tourist facilities, businesses and lastly the local industry (Fig. 3.7).

Fig. 3.7: Stakeholders benefits from maintenance of good water quality in Lake Ohrid (residents & tourists)

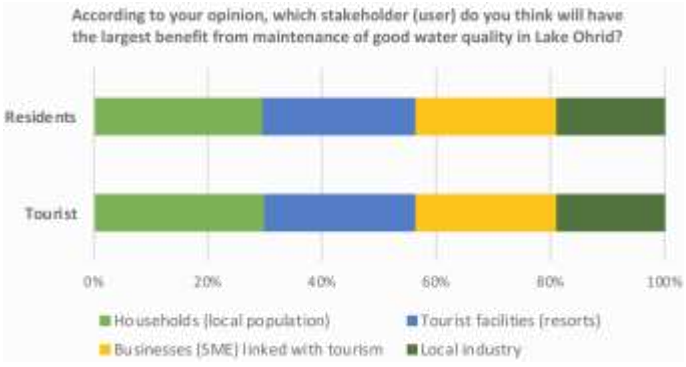
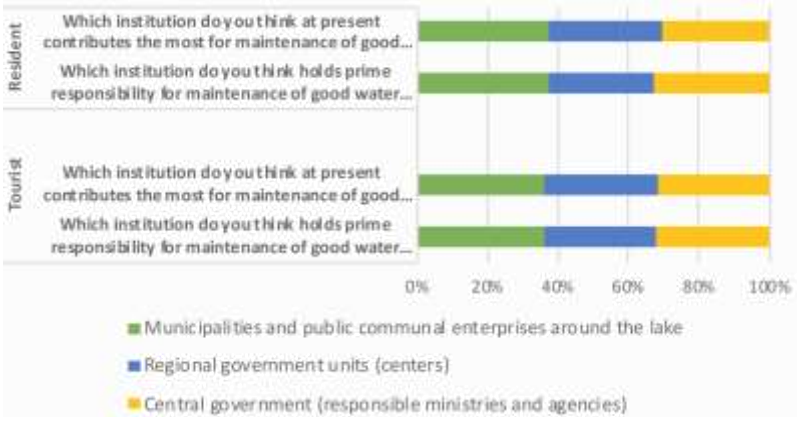


Fig. 3.8 presents the views regarding which institutions hold prime responsibility for maintenance of good water quality in the lake. The municipalities and public enterprises around the lake are seen as the most responsible and also the ones contributing the most towards maintenance. Regional centers and central government ministries are perceived as less responsible and less contributive, both with around 30-32% shares respectively.

Fig. 3.8: Contribution and responsibility for maintenance of good water quality in Lake Ohrid



4. Valuation of the Ecosystem Services of the Lake Ohrid Watershed

4.1. Valuing Natural Capital Principles

Ecosystem services, sometimes also called ecosystem benefits, are most broadly defined as the direct and indirect contributions of ecosystems to human well-being. The term Natural capital is described as the Earth's natural assets (e.g. soil, air, water, flora and fauna) and the ecosystem services resulting from them [1]. The origins of the concept of ecosystem services date back to the 1980-ties (e.g. [2, 3]), however, it has been widely popularized by the UN Millennium Ecosystem Assessment (MEA) in the early 2000s [4]. Further, ecosystem services approach is central to the EU's biodiversity strategy, presented by the European Commission (EC) in 2011 with the aim to stop their degradation in the EU by 2020 and to protect, value and restore biodiversity and the ecosystem services it provides by 2050 [1].

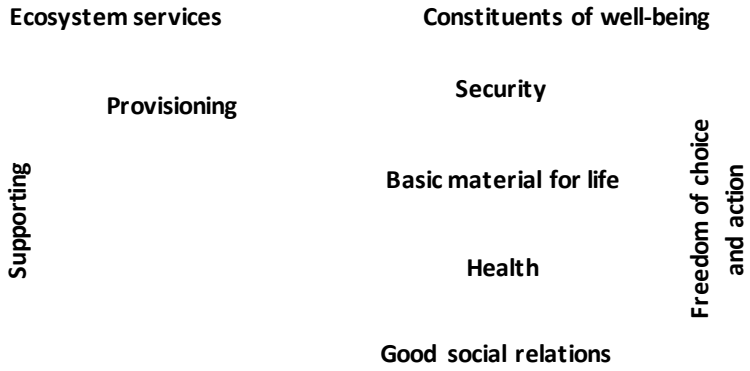
Regardless of the origin of the ecosystem services concept and their definition, when considering the links between nature, economic activities and human welfare clearly both quantity and quality attributes of biodiversity are important. Therefore, the extent of the analyzed ecosystems (e.g. forests or water resources), as well as the abundance of habitats and the specifics of the individual plants and animals within the ecosystems, are the critical components of natural capital shaping the multitude of delivered benefits, thus also determining the flow of values to human societies (Fig. 4.1).

One overarching question frequently found in a number of publications is why is there a need to value ecosystem services? A comprehensive answer to this question includes: “Economics is about choice and every decision is preceded by a weighing of values among different alternatives. Ecological life support systems underpin a wide variety of ecosystem services that are essential for economic performance and human well-being. Current markets, however, only shed information about the value of a small subset of ecosystem processes and components that are priced and incorporated in transactions as commodities or services, which poses structural limitations on the ability of markets to provide comprehensive pictures of the ecological values involved in decision processes. Moreover, an information failure arises from the difficulty of quantifying most ecosystem services in terms that are comparable with services from human-made assets. From this perspective, the logic behind ecosystem valuation is to unravel the complexities of socio-ecological relationships, make explicit how human decisions would affect ecosystem service values, and to express these value changes in units (e.g., monetary) that allow for their incorporation in public decision-making processes” [6]. Further, linking biophysical aspects of ecosystems with human benefits through the notion of ecosystem services is essential to assess the trade-offs (ecological, socio-cultural, economic and monetary) involved in the loss of ecosystems and biodiversity in a clear and consistent manner [7]. Thus, valuation of ecosystem services is not seen as an end in itself, but rather it is meant to provide a framework for better-informed decision-making and policy development.

The economic valuation of ecosystem services is based primarily on classification of these services and application of different methods to calculate (monetize) their values. In that respect, the MEA defines and divides ecosystem services into four broad categories:

- **Provisioning services** – food, fiber, timber, energy – i.e. all nutritional, non-nutritional material and energy outputs from living systems
- **Regulating services** – e.g. climate regulation, pollination, water purification, river flow – i.e. the ways in which living organisms mediate or moderate the ambient environment
- **Cultural services** – such as recreational, spiritual, aesthetic, educational – i.e. all non-material, non-consumptive outputs (benefits) that people obtain from contact with ecosystems
- **Supporting services** – soil formation, photosynthesis, nutrient cycling – ecosystems’ specifics (processes) that provide living spaces for plants or animals, or help the maintenance of the diversity of plants and animals.

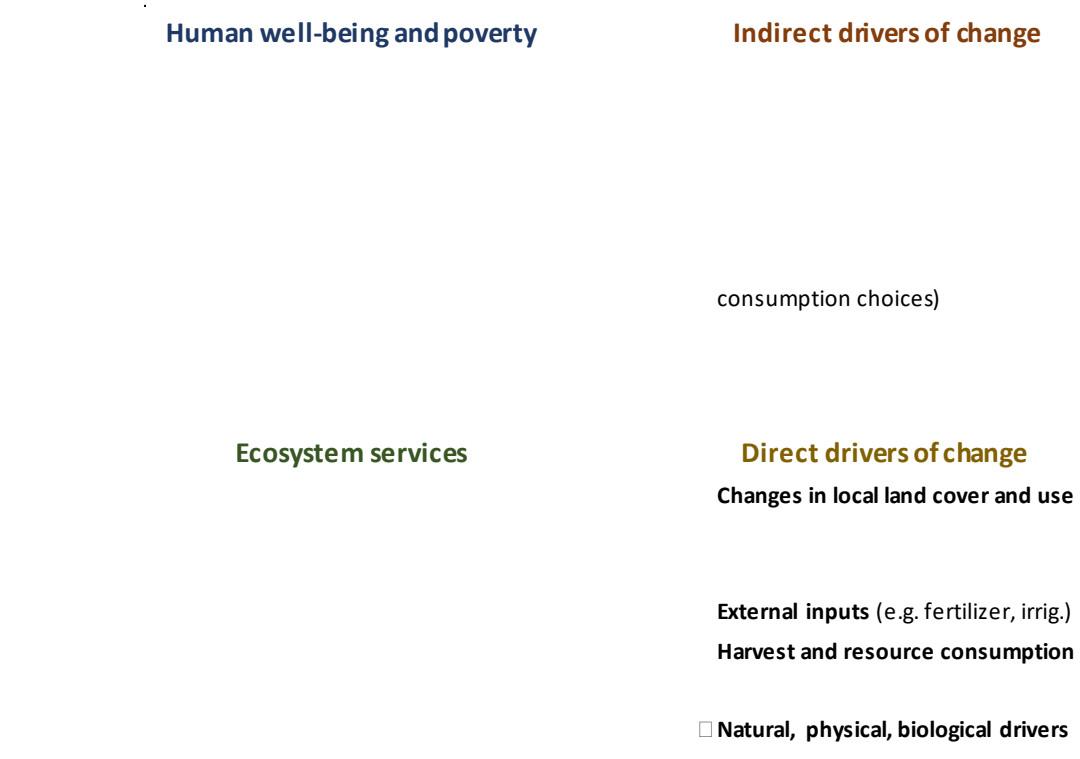
Fig. 4.1: Links between ecosystem services and human well-being[7]



Arrow's width shows the intensity of linkages

In addition to analyzing the links between ecosystem services and human well-being (Fig 4.1), the MEA also focuses on the dynamic interactions between humans and ecosystems by examining how changes in ecosystem services influence the constituents of well-being, as well as how changes in human conditions drive – directly and indirectly – changes in ecosystems (Fig 4.2). Thus, changes in drivers that indirectly affect biodiversity (e.g. population, technology) can lead to changes in drivers directly affecting biodiversity (e.g. changes in land-use or application of fertilizers), which result in changes to ecosystems and the services they provide, thereby affecting human well-being. Further, these interactions can take place at more than one scale and can cross scales.

Fig. 4.2: Interactions between ecosystem services, human well-being and drivers of change[8]



Strategies and interventions

Apart from the MEA, in the past decades a number of initiatives have been undertaken that result in creating frameworks aimed at mapping, increasing knowledge base and assessment of ecosystem services. Such

[7] Adopted from [4].
[8] Ibid.

initiatives include: (1) the Economics of Ecosystems and Biodiversity (TEEB) study [5], which started in 2007[9], has set a framework for valuing ecosystem services; (2) the Common International Classification of Ecosystem Services (CICES), a global initiative developed from the work on environmental accounting undertaken by the European Environment Agency [8]; (3) the Mapping and Assessment of Ecosystems and their Services (MAES), initiative of the EC aiming to provide policy-makers with the best information available on ecosystem services so as to guide land-use planning decisions; (4) the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), an intergovernmental body which, in response to requests from decision makers, assesses the state of biodiversity and of the ecosystem services it provides to society; (5) the Ecosystem Services Partnership; (6) the Integrating Biodiversity Science for Human Wellbeing (DIVERSITAS)[10], an international programme of biodiversity science, established to address complex scientific questions posed by the loss in biodiversity and ecosystem services and to offer science-based solutions to this crisis; (7) the System of Environmental-Economic Accounting (SEEA), a joint initiative of the UN, EC, FAO, OECD and the WB.

For purposes of appraising the economic value of the ecosystem services provided by the Lake Ohrid watershed, by and large the approach of the TEEB and the CICES are followed. The valuation process defined by the TEEB involves three tiers [5]:

1. Recognizing value, i.e. identifying the wide range of benefits in ecosystems, landscapes, species and other biodiversity-linked aspects
2. Demonstrating value, i.e. using economic tools and methods to make nature's services economically visible
3. Capturing value, i.e. incorporating ecosystem and biodiversity benefits into decision-making through incentives and price signals.

From an application aspect, the total economic output value (TEV)[11] of ecosystem services can be divided into two categories of use value (UV) and non-use value (NUV). The UV is further divided into direct use value, indirect use value, and option value. The NUV service category contains existence value, and bequest (heritage/altruist) value (Fig. 4.3). A brief summary description of each value category is given in Table 4.1.

In general, UVs are associated with goods and/or services for which market prices usually exist. Direct use values, which are a sub-category of UV, are related to benefits (goods) obtained from direct use of ecosystem services, such as extractive (e.g. food and/or raw materials) or non-extractive (e.g. aesthetic, recreational benefits from landscapes, etc.). Indirect use values usually refer to regulating services (e.g. air quality regulation, erosion prevention), which can be seen as public services that are generally not reflected in market transactions. Option value is, basically, related to extension of the time-frame in which values are considered, thus giving a possibility of valuing an optional or future use of a given ecosystem service.

Non-use values from ecosystems are those aspects that do not involve direct or indirect uses of ecosystem services. These, in general, reflect the satisfaction that individuals receive from the knowledge that biodiversity and ecosystem services are maintained (existence value), as well as from the knowledge that other people have or will have access to them (bequest/altruist value).

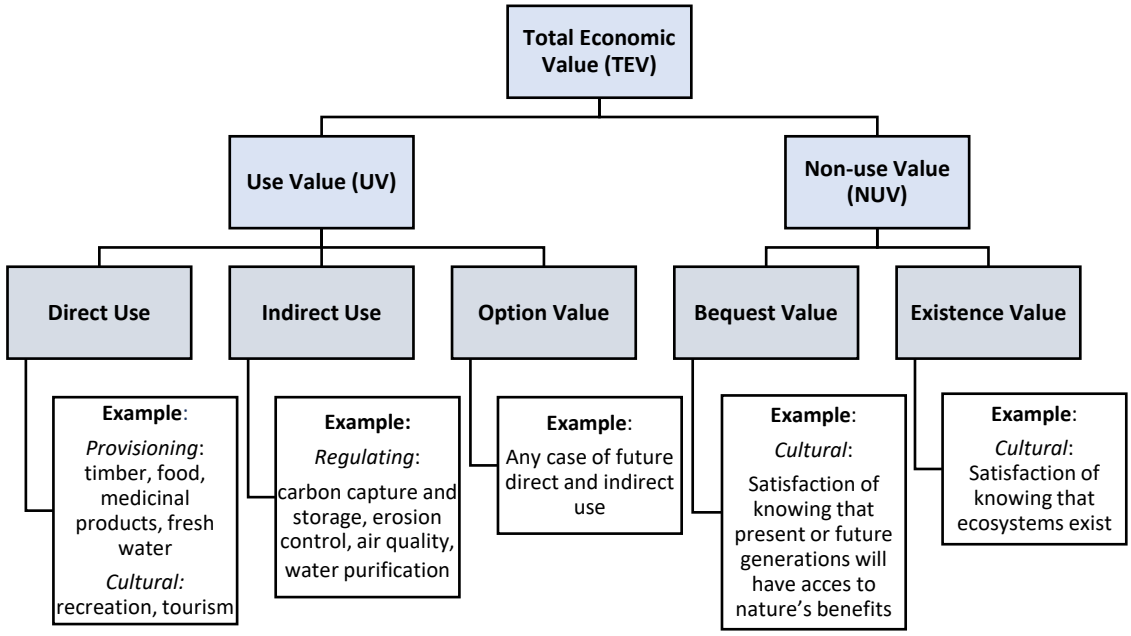
Another aspect related to the value categories of ecosystem services from an application point of view is their relative valuation ('calculation') complexity. Hence, NUV involve much bigger challenges for their valuation than UV, since they are related to aesthetic properties or moral principles for which markets usually do not exist, and which is different from goods or services that are associated with valuation of tangible things or conditions.

[9] In 2007 environment ministers from the governments of the G8+5 countries agreed to "initiate the process of analyzing the global economic benefit of biological diversity, the costs of the loss of biodiversity and the failure to take protective measures versus the costs of effective conservation." The TEEB emerged from that decision. The G8+5 included the G8 nations (Canada, France, Germany, Italy, Japan, Russia, the United Kingdom and the United States), plus five emerging economies (Brazil, China, India, Mexico and South Africa).

[10] UNESCO is one of the programme founders.

[11] The TEEB study introduces the TEV concept and makes explicit that "…in assessing trade-offs between alternative uses of ecosystems, the total bundle of ecosystem services provided by different conversion and management states should be included" [7].

Fig. 4.3: Ecosystem services value types[12]



It should be also pointed out that the economic benefits provided by ecosystems are difficult to capture, as well as that the economic valuation of ecosystem services has weaknesses. Several reasons are involved here, including: inherent difficulties associated with defining their values; estimated values remain approximations based on varying methods and assumptions; ecosystem services values are context-specific since the importance of an ecosystem varies according to local conditions; there are evolving views on the environment over time, etc. Further, there are ongoing discussions whether ecosystem services should be assigned marginal or present values, that is whether the value of a service should be associated with increasing or decreasing a specific variable (e.g. unit area of particular ecosystem which provides that service)[13], or based on what is at present with no attempt for assigning marginal values[14]. The latter approach is used in this report.

Table 4.1: Ecosystem services value typology

Value Type	Description
Use Value (UV)	
Direct Use	Results from direct human use of biodiversity (consumptive or non-consumptive)
Indirect Use	Derived from the regulation services provided by species and ecosystems
Option Value	Relates to the importance that people give to the future availability of ecosystem services for personal benefit
Non-use Value (NUV)	
Bequest/Altruist Value	Value attached by individuals to the fact that other people from present of future generations will also have access to the benefits from species and ecosystems
Existence Value	Value related to the satisfaction that individuals derive from the mere knowledge that species and ecosystems continue to exist (changes continuously with human understanding of the services of the ecosystem)

Apart from the marginality aspect, in any ES valuation based on the TEV approach it is also important to identify sources of double counting. In other words, many ecosystem services are not complementary, i.e. the provision

[12] Adopted from [6].
[13] Approach to ES valuation of Costanza at al., 1997.
[14] Approach to ES valuation by Boyd and Banzaf, 2007.

of one is precluded by others. Thus, the range of complementary and competitive services must be distinguished before an aggregated valuation is completed.

Recent research worldwide show that there are significant changes in evaluating methods of ecosystem services value. Some surveys also establish new models for mapping and quantification, as well as for assessment of the stability and sustainability of ecosystems and the services they provide. Of particular importance in this respect are lake and wetland ecosystems, because the interaction of these ecosystems is closely related to occupation factors that, in general, frequently affect human production activities.

Research on the interaction of lake and other ecosystems services is scarce in both North Macedonia and Albania, but as well in the broader Western Balkans region. At the same time, such research and assessments of ecosystem service values that are undertaken in the region are more focused on direct values, often underestimating indirect values. It is our understanding that a lake ecosystem service assessment system should fully reflect the direct contribution of the ecosystem to human well-being, while simultaneously improving the reliability of evaluation results and avoiding overly complex calculations.

4.2. Data Sources

There are a number of important sources of data and publications used in the analysis; detailed bibliography is provided in the report.

The data used in this analysis are divided into two categories: background information and questionnaire data. The background information refer mainly to statistical and other data used for development of the LOWMP. These data refer to the 2016-2018 period. The questionnaire data mainly includes a survey questionnaire to gather an insight into the end-users' (tourists and the local population) perception of the values and benefits arising from the natural characteristics of the LOW, awareness of the pressures impacting the status and quality of the water resources, as well as to determine willingness-to-pay (WTP) for improved protection and overall conditions in the LOW. The survey was conducted in the LOW region in the summer/spring of 2018, as described in other parts of this report.

4.3. Applied Methodology (Valuation Methods)

As mentioned before, the benefits provided by ecosystems are difficult to capture and there are important challenges that are inherent to the process of deriving an economic monetary value of these benefits. In general, within the TEV framework, values are derived from information reflecting the individual behavior provided by market transactions relating directly to an ecosystem service. In the absence of such information, price information must be derived from parallel market transactions that are associated indirectly with the good to be valued. However, if both direct and indirect price information on ecosystem services do not exist, hypothetical markets may be created in order to elicit values. These situations correspond to a common categorization of the available techniques used to value ecosystem services: (a) direct market valuation approaches, (b) revealed preference approaches and (c) stated preferences approaches [7].

Twelve ecosystem services provided by the LOW were valued using economic techniques such as direct and indirect market price and avoided cost (direct market valuation approach), benefit transfer and travel cost (revealed preference approach) and contingent valuation (stated preference approach) methods.

Market prices methods use prevailing prices for goods and services traded in domestic or international markets, and are often used to obtain the value of provisioning ecosystem services, since the commodities produced by provisioning services are often sold. In well-functioning markets preferences and marginal cost of production are reflected in a market price, which implies that these can be taken as an accurate information on the value of commodities.

The ***Avoided cost method*** is another market valuation approach used for valuation of ecosystem services, which relates to the assessment of costs that would have been incurred by the society in the absence of ecosystem services.

Benefit transfer (also called results reference) as a valuation method is defined as the use of research results from pre-existing primary studies at one or more sites (often called study sites) to predict welfare estimates or related information for other typically unstudied sites (often called policy sites). The method is based on use of one or more evaluation methods to estimate the economic value of a similar environmental service function. This estimator is amended and adjusted and then applied to the studied environment.

The ***Travel cost approach*** derives indirectly WTP for environmental benefits (ecosystem services) at a specific location by using information on the amount of money and time that people spend to visit the location. The method is based on the rationale that recreational experiences are associated with a cost, relating to direct expenses and opportunity costs of time, which is taken as a proxy for the value that people attach to a certain ecosystem.

The ***Contingent valuation method*** (CVM) constructs a hypothetical market to elicit respondents' WTP. In general, the CVM is based on use of questionnaires to ask people how much they would be willing to pay to increase or enhance the provision of an ecosystem service. In practice, the CVM is the only method that can measure option and/or existence (altruist) values and provide a true measure of total economic value.

4.4. Valued Ecosystem Services of Lake Ohrid Watershed

4.4.1. Ecosystem services of Lake Ohrid

Drinking water provision

The value of the drinking water supply service to households, commerce and industry was derived using data regarding the volume of annual water abstractions by municipalities in the LOW. The total population connected to public water supply systems, i.e. systems that are operated by a municipal public enterprise, is estimated at 115,842 (88% of the total population), or 56,372 household connections. In addition, roughly 3,700 residents in the basin use local community-based water supply system, and some 12,500 have a self-organized water supply. The number of commercial and industry connections to a public water supply system varies by municipalities with a peak of 2,300 connections in Ohrid, indicating the relatively large number of tourist facilities in the municipality. The total average annual volume of water abstraction for the listed uses is estimated at 14 mill m3. The overall unit water production (water input into the systems) equals 331 l/c/d and, based on data from literature, it varies between 520 l/c/d in Ohrid to 180 l/c/d in Pogradec municipality[15]. The volume of abstracted water is multiplied by the average price of a unit of drinkable water (0.55 $/m^3) defined by local water service companies operating in the LOW[16]. Thus, the estimated economic value of the service equals $5.78 mill annually.

Hydropower generation

Water resources of the LOW are also used for hydropower generation. A total of five small hydropower plants (SHPP) are located in the North Macedonia part of the basin (Fig. 4.4), with installed capacity ranging from 0.2 to 0.6 MW[17]. Apart from the SHPPs located within the LOW boundaries, waters draining from the lake into the Drin River feed a series of seven large cascade hydropower plants (HPP) along the flow to the Adriatic Sea: HPP Globochica and HPP Shpilje in North Macedonia; HPP Fierzë, HPP Komanit, HPP Vau I Dejës and HPPs Ashta 1 and Ashta 2 in Albania (Fig. 4.4). The combined installed capacity of the seven HPPs equals 1,520 MW, and the total annual electricity generation by the plants in 2016 equaled 5,230 GWh (4,700 GWh by HPPs in Albania and 540 GWh by HPPs in North Macedonia)[18]. In addition, over 80% of the total power produced in Albania in 2015 was from HPPs in the Drin basin. Waters from the LOW account for roughly 70% of the electricity generated by the two HPPs in North Macedonia, and 7%-8% of the total electricity generated by the HPP cascade on Drin

[15] Sources: North Macedonia: "Water Supply and Wastewater assessment of existing situation and Gap Analysis", The EU Operational Programme for Regional Development 2007-2013, Eptisa (2015); Albania: International Benchmarking Network for Water and Sanitation Utilities (IBNET, 2014).

[16] The average market price of the water supply service is assumed to be a proxy for the economic value of water used for drinking.

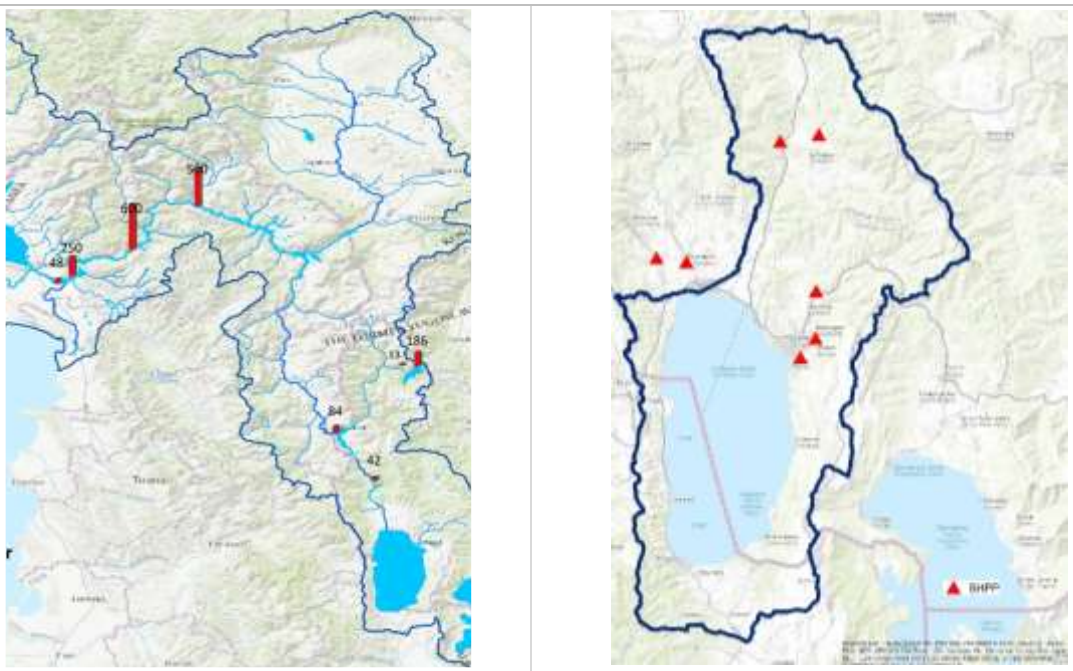
[17] Source: Energy Agency of North Macedonia (http://North.ea.gov.mk).

[18] Source: "Thematic Report on Socio-Economics of the Extended Drin River Basin; The Global Water Partnership – Mediterranean (GWP – Med), November 2017.

River.

The average annual economic value of the hydropower generated using water resources from the LOW (all HPP and SHPP) is derived by multiplying the power generated by all listed power plants in 2016 but using only water quantities that drain from the basin and the average cross-border electricity price in the same year ($74/MWh), equaling $55.53 mill.

Fig. 4.4 Hydropower plants fed by water resources of the LOW – wider Drin River Basin and LOW



Commercial fishery

Commercial fishery occupies an important place in the socio-economic development of the LOW, as it contributes substantially to income generation for some of the most vulnerable groups of the local population. Although Fishery Master Plan for Lake Ohrid exists in both countries (Albania and North Macedonia), adequate fish catch survey in terms of catch structure (size, weight, age and sex) indicating the main determinants for controlling and proper protection of fishes in the lake is lacking. This is mainly a concern for the endemic Salmonid species in the lake – Ohrid Trout and Belvica – that are the main market demanded fish species.

Table 4.2: Fish catch in Lake Ohrid

Lake Ohrid – Fish Species and Catch (t)										
Fish species	**Albania**			**North Macedonia**			**Total**			**% (2014)**
	2012	**2013**	**2014**	**2012**	**2013**	**2014**	**2012**	**2013**	**2014**	
LO trout	50.5	50.0	51.8	0.2	0.9	1.1	50.7	50.9	52.9	28.9%
Belvica	11.7	12.0	12.5	1.0	8.0	14.7	12.7	20.0	27.2	14.9%
Carp	4.2	4.0	4.9	3.6	14.3	21.7	7.8	18.3	26.6	14.6%
European eel				0.2	1.1	1.1	0.2	1.1	1.1	0.6%
Bleak	54.9	58.0	56.1	3.6	5.0	5.7	58.5	63.0	61.8	33.9%
Roach				0.0	0.6	0.0	0.0	0.6	0.0	0.0%
Chub	5.0	4.2	6.5	0.5	3.1	3.1	5.5	7.3	9.6	5.3%
Rudd				0.1	0.1	0.0	0.1	0.1	0.0	0.0%
Barbel				0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Prussian carp	3.4	3.0	3.2	1.0	0.4	0.3	4.4	3.4	3.5	1.9%
Total (t)	**129.7**	**131.2**	**135.0**	**10.1**	**33.4**	**47.6**	**139.8**	**164.6**	**182.6**	**100%**

Based on available data regarding fish catch in 2014 in Lake Ohrid (Table 4.2) and average cross-border fish market prices for 2016[19], the total value of the annual catch in Lake Ohrid is estimated at roughly $1 mill.

[19] Source: UN FAO GLOBEFISH, European Price Report, Issues 2016.

Commercial boating

Cruising and boating are important recreational and tourism activities in Lake Ohrid, and commercial boating is another economic activity directly linked with the ecosystem that is of importance for the local population. Based on information given by the Port Authority in Ohrid, there are two types of watercrafts used in Lake Ohrid – recreation and/or fishing boats (smaller vessels with length up to 12m, largely for personal use) and larger water taxi (sightseeing/passenger) boats used for public transport. There are a total of 2,268 recreation and fishing boats registered by the Port Authority since 1999, of which 500-600 of these are in regular use at present, and 4 sightseeing boats in use on the North Macedonia part of the lake. Nevertheless, it is also reported that some 40-50 private recreation boats are in use for transport of passengers on commercial basis. Data on the boats in use on the Albanian side of the lake are not available; it is estimated, however, that there are not more than roughly 200 small boats used for recreation and fishing.

Table 4.3: Commercial boat transport in Lake Ohrid (North Macedonia)

Lake Ohrid boat transport	2014	2015	2016	2017	2018
Number of passenger boats	4	4	4	4	4
Capacity (passengers)	530	530	530	530	530
Total annual number of passengers	36,620	38,685	30,430	44,510	46,590
Total number of passenger kilometers	741,000	875,000	898,000	1,007,000	1,082,000
Average km/passenger	20	23	29	23	23

Summary information on the commercial boat transport on Lake Ohrid is given in Table 4.3[20], which is used as a key input data in this analysis. The economic value of the service is estimated based on the average number of transported passengers over the 2014-2018 period (approximately 40,000 annually), which is increased by 50% to reflect the commercial transport provided by recreation boats[21], and multiplied by the average ticket price per passenger of $12. Thus, the average annual value of the boating service equals roughly $700,000.

4.4.2. Ecosystem services of forests, protected and agricultural areas in the watershed

Wood materials – timber and fuelwood

The value of wood materials such as timber, fuelwood, etc., is calculated using the market price valuation method. The basis of it is the annual marketable (commercially viable) wood mass, calculated as 75% of the annual biomass growth (m^3), as suggested by the Public Enterprise managing forestry resources in North Macedonia ('Nacionalni Shumi'). The annual biomass growth throughout the watershed is approximately 2% of the total biomass stocks. The wood biomass stocks (m^3) are calculated by multiplying the area under a certain forest type (ha) by its stock volume (m^3/ha; Fig. 4.5). Obtained annual marketable wood mass is 74,686 m^3. In order to obtain the economic value of these wood materials on a watershed level a weighted average price of wood products sold annually by the NP Galichica was calculated (approx. 50 $/$m^3$), and was applied to the marketable wood mass of the entire watershed. The total value of marketable wood materials in the watershed is estimated at $3.74 million per annum.

Medicinal resources (herbs) and food products from forests

A number of studies are available with data on various parts of the LOW relating to terrestrial plant species (herbs) and food products (fungi) present in the watershed forests and protected areas. However, most of these studies focus on the number of plant varieties, biodiversity and protection aspects, whereas very limited data exist regarding their quantities. Therefore, the assessment of the provisioning ecosystem services originating from these areas in the basin is based on secondary sources, i.e. studies [10, 11] that do provide reliable information on the economic value of terrestrial plants and products in the watershed.

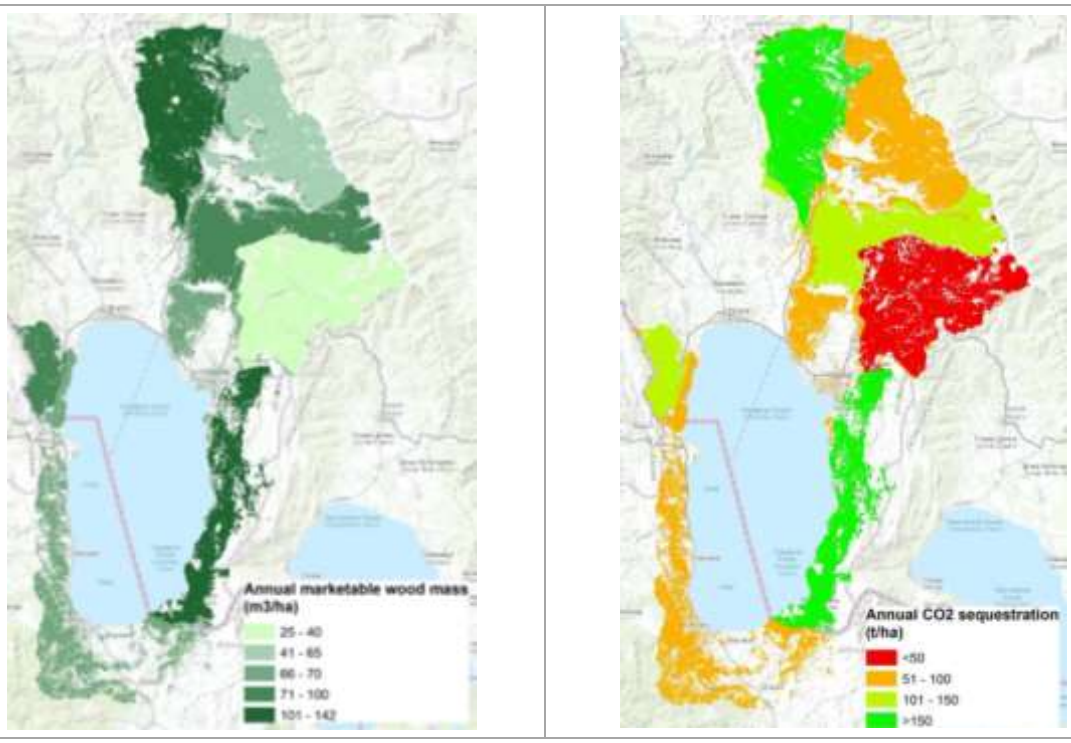
A total of 45 species of medicinal and aromatic herbs are identified in the National Park Galichica in North Macedonia that are od importance for pharmaceutical and cosmetics production, and their total market value is estimated at $5.3 mill annually. This figure is increased by roughly $360,000 as a market value for medicinal

[20] Source: State Statistical Office of North Macedonia (2019).

[21] Source: Expert judgment based on information from the local population and individual service providers.

herbs in the Albanian part of the basin [11]. A total of 364 types of fungi are present in NP Galichica, of which roughly 10 have important commercial value. The market value of the annual production of fungi in the park is estimated at $4mill, and increased by $256,000 as an estimate for Albania [11]. The remaining terrestrial organisms (products) with important commercial/market value are lichen, with estimated total economic value $1.46 mill annually [10].

Fig. 4.5: Annual unit marketable wood mass (m^3/ha) and CO_2 sequestration (t/ha) in LOW



Agricultural production

Agriculture is a dominant form of land management globally, and agricultural ecosystems cover nearly 40% of the terrestrial surface of the Earth (FAO 2009). In the EU agricultural land use is the primary land use accounting for 45% of the territory [9]. Agroecosystems are both providers and consumers of ecosystem services. People value ecosystems mainly for their provisioning services. In turn, agroecosystems depend strongly on a suite of ecosystem services (above all supporting and regulating services) provided by natural ecosystems. Such ES flowing to agriculture include: biological pest control, pollination, water quantity and quality, soil structure and fertility, etc. [18]. It is for this reason why agriculture production is among the valued ecosystem services of the LOW.

Agricultural production in the LOW is by and large organized within small households. Of the total number of households in the Southwestern region in North Macedonia, more than 72% are smaller than 1 ha, while more than 95% are up to 3 ha, divided into several parcels with average size less than 0.1-0.2 ha. Statistical data for Albania reveals similar situation as well, regarding the farm and parcel size. Most of the production is for self-consumption or for green markets during the tourist season.

Estimation of the land use in the North Macedonia part of the LOW is based on the Land Parcel Identification System (LPIS), which allows identification of land use on a parcel level within several categories. For the Albanian part of the basin statistical data coupled with photo-interpretation of a satellite image from 2018 vegetative season (Sentinel 2) was used for identification of areas under different categories of land use.

The total agricultural land in the LOW equals nearly 25,500 ha including pastures (Table 4.4). The category field crops covers major part of the agricultural land (92.6%). Most of the area under field crops, according the data from performed field visits, consist of cereal crops: wheat and maize, and small areas of forage crops, indicating that the majority of this category is under extensive, low input, systems of agricultural production. There are

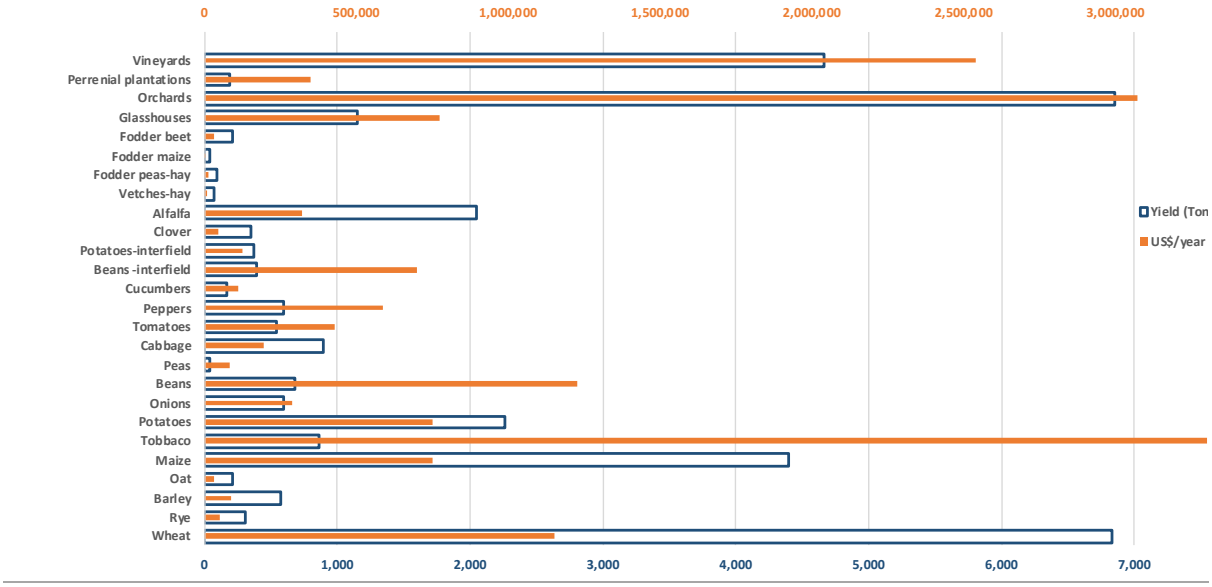
certain areas of vegetable production within the category of mixed land use mainly within the house yards in the villages, like: potato, cabbage and beans production. More significant production of beans is present in the Cherave region of the LOW in Albania. Orchard and vineyards are more intensive systems of agricultural production with higher inputs of fertilizers and pesticides. The majority of these land use types with a total of 10.44% of the agricultural land are spread in north/north-east part of the basin along Ohrid Lake, as well as in parts in the south near Cherave river and Pogradec. The total area of greenhouses in the watershed is negligible. The remaining part of the agricultural land is covered with meadows, permanent grass land or pastures.

Table 4.4: Land use and agricultural production in the LOW[22]

Water Body	Land use (ha)						
	Field crops	Orchards	Perennial plantations	Mixed per. plantations	Vineyards	Pastures	Total
Lake Water Bodies							
L-Radozhda	21.5	0.7	0.8	0.0	1.6	23.8	48.4
L-Kalishta	118.4	0.1	0.4	0.3	0.0	80.1	199.4
L-Struga-Black Drin	345.8	23.8	5.6	0.4	0.5	118.8	494.9
L-Sateska							
L-Koselska							
L-Ohrid bay							
L-Velidab	137.9	4.6	39.8	1.2	20.4	4,872.6	5,076.6
L-Bay of St. Naum							
L-Tushemisht							
L-Pogradec	950.1	67.4	11.5	0.0	62.4	516.3	1,607.8
L-Udenisht	256.3	17.9	0.0	0.0	16.6	53.1	343.9
L-Lin	204.9	13.1	0.0	0.0	12.2	34.6	264.7
L-Lake Ohrid-Pelagic							
River Water Bodies							
R-Sateska 1	2,054.4	14.6	9.4	0.0	0.4	4,844.1	6,922.8
R-Sateska 2	429.3	91.4	17.7	0.0	106.6	293.4	938.3
R-Sateska 3	810.4	153.5	18.5	1.1	35.1	247.2	1,265.8
R-Koselska 1	12.6	0.6	0.0	0.0	0.0	779.7	793.0
R-Koselska 2	943.0	315.3	28.1	0.9	70.3	1,533.1	2,890.8
R-Cerave	1,370.5	162.0	16.6	0.8	107.0	494.2	2,151.0
R-Sushica	538.4	184.5	41.5	2.2	24.3	1,578.5	2,369.4
AWB- Studenchishki kanal	32.2	4.1	3.7	0.0	9.3	67.3	116.6
Total	**8,225.8**	**1,053.8**	**193.6**	**6.8**	**466.6**	**15,536.8**	**25,483.3**
	32.3%	***4.1%***	***0.8%***	***0.03%***	***1.8%***	***61.0%***	

The average annual economic value of agriculture production is estimated based on the specific crop mix for the basin, multiplied by the average multi-annual yield for each applied crop (Fig 4.6) and by market prices for

Fig. 4.6: Agriculture production – average annual yield (tons) and market value (US$) in the LOW



[22] Source: Lake Ohrid Watershed Management Plan, Draft Report, GWP-Med (2019).

analyzed products in 2018, which are adopted based on the Agricultural Market Information System in North Macedonia (AMIS)[23] and assumed to be applicable to the local market conditions in Albania. Assessed value equals $17.48 mill.

Erosion prevention (soil protection)

The erosion prevention (soil protection) services is provided by forests; it emerges as a decrease in soil erosion for forest land compared to croplands or other land-use types. Thus, the economic value of soil protection is estimated as the avoided cost of restoring soil where erosion might occur. Because forest ecosystems are the most effective in soil protection, the value is estimated by the difference in the potential erosion between forested and non-forested land.

In this analysis non-forest (non-F) land consisted of agricultural areas, scrub and/or herbaceous vegetation associations. Potential erosion levels between forests (F) and non-forests (non-F) land is distinguished in terms of slope using soil erosion risk and slope thematic maps. The slope was calculated by DEM with 25 m of resolution and divided into five categories: <5, 5–10, 10–20, 20–50 and >50%. The results corresponded to the average value of potential erosion for F and non-F in the five slope classes. Main disadvantage was that the erosion map of Albania was obtained at coarser resolution [15], and for a better utilization the dataset was subsequently transformed into points and then nearest neighbor-interpolated, which does not entail a better quality data. However, this form is more suitable for the subsequent erosion hazard assessment. For North Macedonia erosion maps on scale 1:50000 were available [16].

The difference of soil loss, expressed as t/ha/yr for Albania (converted to m^3/km^2 using soil density 1.4 t/m^3) and m^3/km^2 for North Macedonia from F and non-F areas with identical slopes is the basis used for estimating the contribution to erosion reduction, as described in E. Morria et al (2014) [17]. This contribution is multiplied by an average cost for transporting and restoring a unit volume of soil ($12 per m^3). The data shows that the greater forest performance (a higher difference between non-Forested and Forested land) in soil protection mainly occurred in higher slope classes (20–50 and >50%; Table 4.5).

Table 4.5: Soil protection values for corresponding slope classes

Slope	Soil erosion non-F-F m^3	Soil protection value
<5%	236	$ 2,838
5-10%	430	$ 5,160
10-20%	-316	-€ $,797
20-50%	15,159	$ 181,911
>50%	8,555	$ 102,664
Total	**24,065**	**$ 288,776**

CO^2 sequestration (Aboveground biomass carbon stock change)

Vegetation accumulates carbon into the biomass through the absorption of atmospheric CO^2. The value of a ton of sequestered carbon can be approximated by the value of tradable emission permits. Carbon is stored in various pools in an ecosystem, including the living biomass, dead organic matter and soil organic matter (IPCC, 2003).

The CO_2 sequestrated annually by the forests in the LOW is calculated based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories [12]. Forested areas for the two years that were considered, 2012 and 2015, were obtained from the Copernicus Land Monitoring Service [13]. The stock volumes were obtained from reports prepared by the NP Galichica [10] and the Public Enterprise managing forestry resources in North Macedonia ('Nacionalni Shumi'). For the areas falling out of the forest enterprises, average values from obtained data were assumed for broadleaved and coniferous forests. Wood densities (ton/m^3) were calculated for both forests types taking into consideration the species composition of broadleaved and coniferous forests of the NP Galichica [10], for which best data is available, and basic wood densities available from literature. The CO_2 stocks for 2012 and 2015 are calculated according to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories [12], obtaining a mass of CO_2 stored for the respective years. The increase in CO_2 stock between 2012-2015 is

[23] Source: http://zpis.gov.mk/About

considered the sequestration that occurred in that period, which is divided by 3 to reduce it to an average annual sequestration of 178,170 tons CO_2. A price of $13.5 eur/ton CO_2, a 5-year average (2014-2019) of the European Emissions Allowance (EUA) market [14] is multiplied by the annual CO_2 sequestration, returning a value of $2.42 million worth of annual CO_2 sequestration. Details on the calculation are given in Appendix 1.

4.4.3. Ecosystem services related to the entire watershed

Tourism and recreation

Tourism and recreation are the dominant economic activities in both countries around Lake Ohrid. For several decades Lake Ohrid has been by far the key tourist destination in North Macedonia; since the early 1990-ties it is also a destination with growing significance for tourism in Albania. The climate, geography and physical variety of the territory represented by the lake and mountain ranges accompanied by exceptionally rich biodiversity of flora and fauna, as well as by culture monuments and historical sites, make the entire LOW an attractive and highly-valued tourism site. A number of national parks and nature reserves are also located within the basin, offering possibilities for development of various types of tourism and travel experiences. Finally, Lake Ohrid is declared as a World Heritage Site by UNESCO since 1979.

The key types of tourism activities in the LOW are: (1) Water/lake-based tourism, which includes various kinds of leisure activities in the form of 'beach and sun' tourism; (2) Alternative/adventure tourism, which includes all kinds of rural tourism, eco-tourism and nature-based activities: paragliding, mountain biking, fishing, trekking, climbing, hiking, study tours, etc., in basin's natural parks; (3) Culture and history based tourism, concentrated around the various kinds of archeological and spiritual sites in the region; and (4) Business and transit tourism, is the last type of tourism present in the LOW, which is by and large related to business trips and associated activities (e.g. meetings, conferences, exhibitions) taking place primarily in the bigger cities (municipal centers).

Table 4.6 provides an overview of registered visitors within the LOW for the 2011 – 2017 period. The number of visitors in the region has increased from nearly 290,000 in 2011 to over 410,000 in 2017, which is a 142% increase, while the number of registered overnights has increased from 1.28 million to nearly 1.44 million over the same period.

Table 4.6: LOW: Tourism statistics[24]

Municipality	Administrative Unit	Tourists, domestic and foreign 2011 - 2017							Average
		2011	2012	2013	2014	2015	2016	2017	
Pogradec	Buçimas	51,100	50,000	50,000	50,000	52,500	55,125	57,881	52,372
	Çerravë								
	Dardhas								
	Pogradec								
	Udenisht								
Debrca	N/A								
Ohrid	N/A	178,277	183,335	192,746	197,196	219,944	234,361	275,613	211,639
Struga	N/A	59,079	55,556	59,526	59,171	64,094	74,415	77,238	64,154
TOTAL in LOW		**288,456**	**288,891**	**302,272**	**306,367**	**336,538**	**363,901**	**410,732**	**328,165**

Municipality	Administrative Unit	Overnights, domestic and foreign 2011 - 2017							Average
		2011	2012	2013	2014	2015	2016	2017	
Pogradec	Buçimas	153,300	150,000	150,000	150,000	157,500	165,375	173,644	157,117
	Çerravë								
	Dardhas								
	Pogradec								
	Udenisht								
Debrca	N/A								
Ohrid	N/A	810,795	823,666	796,048	754,048	818,175	830,333	937,041	824,301
Struga	N/A	317,143	295,726	276,920	260,090	300,791	311,624	330,489	298,969
TOTAL in LOW		**1,281,238**	**1,269,392**	**1,222,968**	**1,164,138**	**1,276,466**	**1,307,332**	**1,441,174**	**1,280,387**

The number of both foreign and domestic visitors has increased in the past decade, albeit at different rates. Thus, in Ohrid and Struga municipalities, for which detailed statistical data are available, the number of foreign visitors has more than doubled over the 2011 – 2017 period, while the number of domestic visitors over the

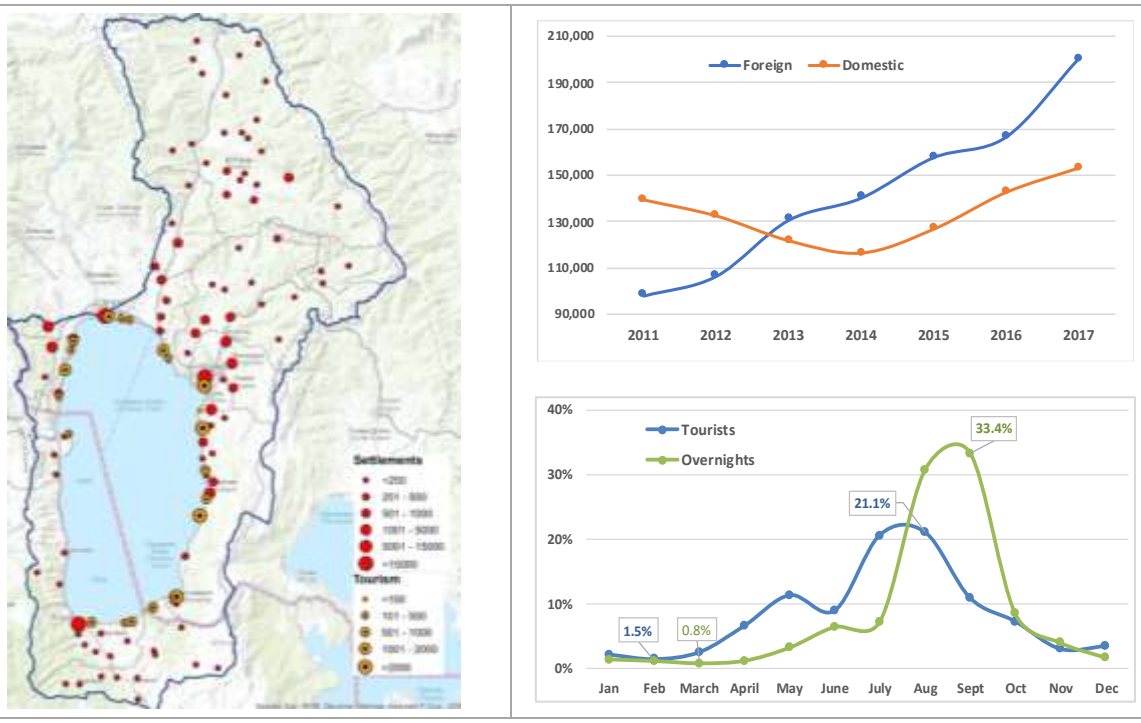
[24] Sources: North Macedonia – State Statistical Office; Albania – [11];

same period has had a declining trend in 2013/14 followed by a constant increase, reaching a 10% increase for the analyzed period as a whole (Fig 4.7).

Further, based on available data roughly 73% of the tourists visit the Lake Ohrid region in North Macedonia during the summer period (May through September), and even over 85% of the overnights take place during the June – October period (Fig 4.7). It is assumed that a similar pattern of visitors is applicable also on the Albanian part of the basin.

The major tourism and recreation facilities in the basin are located around the three municipal centers of Pogradec, Ohrid and Struga, but as well along the eastern shoreline (Ohrid town to the village of Peshtani), the south-east part around the villages of Trpejca, Ljubanishta and St. Naum and the north-west section from Struga to Kalishta in North Macedonia, and on the stripe from Tushemisht to Pogradec and the Lin peninsula in Albania (Fig. 4.7).

Fig. 4.7: (1) Major tourism sites in LOW (tourists per day); (2) Foreign/domestic tourist trends in Ohrid and Struga (2011 – 2017); (3) Annual distribution of tourists and overnights in Ohrid and Struga (average 2015 - 2017)



The average annual economic value of tourism and recreation, which represent a specific provisioning ES, is estimated using the Travel cost method. The assessment refers to 2017 and is based on statistical data from the SSO (North Macedonia)[25]. Used data include: average spending by domestic tourists per day/night including transport ($21); average spending by foreign tourists per day/night (on accommodation, food, local transport, other costs – $165); and average spending by foreign tourists on travel to the region ($210). Thus, for the number of foreign and domestic visitors and overnights, the economic value of tourism and recreation in the LOW is $191.44 million as an annual average.

Existence, bequest, spiritual and symbolic values of the LOW

The existence, bequest and spiritual values of the LOW are calculated using the contingent valuation method. The aim of the CVM is to elicit individual preferences (in monetary terms) for values, or changes in quantity and/or quality, of non-marketed goods and services. As mentioned before, a survey was conducted in the Lake Ohrid region for the purpose. The survey was conducted in August/September 2018 and covered 220 residents

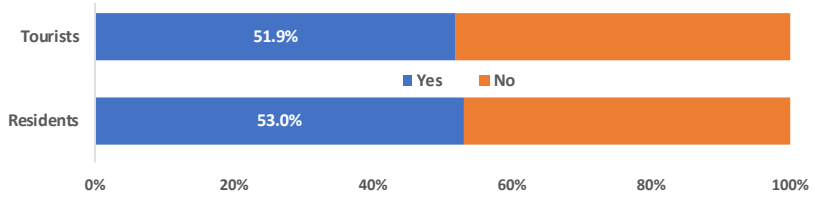
[25] It is assumed that official statistical data from the SSO on travel and other expenditures of tourists visiting the Ohrid region is applicable to both countries.

of the LOW and 212 tourists, both domestic and foreign[26]. Two questionnaires were developed, distributed to administrative units within the Pogradec municipality, and selected settlements in the three municipalities of North Macedonia.

Conducted survey consisted of the following three question groups: (1) Perception of Lake Ohrid Watershed values and benefits; (2) Contingent Valuation of Lake Ohrid Watershed; and (3) Basic Information. Respondents' WTP was obtained from part 2, where the questionnaire asked whether the respondent would be willing to pay money annually to a fund for protection and promotion of water resource and biodiversity in the Lake Ohrid basin. Furthermore, they were asked how much they would pay to the fund annually.

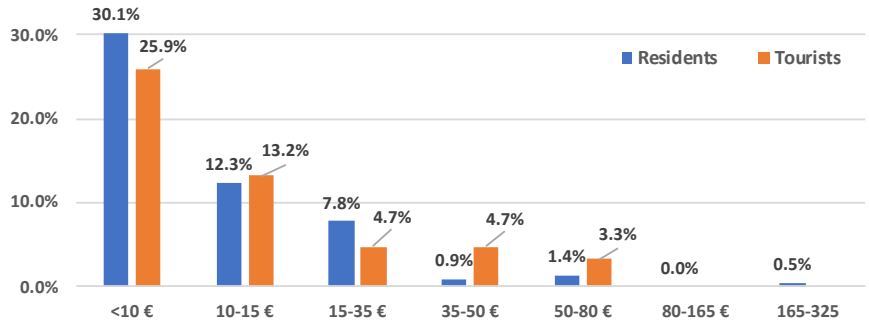
Out of the 212 questioned tourists, 51.9% agreed to contributing annually to the Fund, while 53% of residents answered positively (Fig. 4.8). Residents were asked for the amount they would contribute per household, while the tourists were asked how much they would contribute per person. The majority of both tourists (25.9%) and

Fig. 4.8: Tourists and residents: percentage of respondents willing to contribute resources



local population (30.1%) are willing to contribute less than €10 annually. There is a gradual decrease in the percentage of respondents willing to pay more than €10 to the annual fund, as 12.3% and 13.2% of residents and tourists respectively are ready to pay €10-€15 annually, while only 1.4% (residents) and 3.3% (tourists) are willing to pay €50-€80 (Fig. 4.9).

Fig. 4.9: WTP - % of responses and amounts of annual payment



The mean WTP is calculated as weighted average WTP of the entire sample size. Residents' mean WTP is €8.9 per household annually, while tourists' mean WTP is €9.6 per person (Table 4.7). Based on this analysis, the average spending equals, in monetary terms, the existence, bequest and spiritual values of the LOW of $5.1 mill.

Table 4.7: LOW: Mean WTP

Mean WTP (€)	Residents (per household)	Tourists (per person)
	8.9	9.6

[26] Although the WTP that tourist 'attach' to the ecosystem services of the LOW was revealed using the travel cost method, it is confirmed that the travel cost approach considers only the benefits of direct consumption (use values) of environmental services, which are different from non-use values such as existence and bequest [19]. Thus, educing tourists' WTP for non-use values is regarded as assessing how much they are willing to pay on top of their travel expenses, and therefore not considered as double counting.

The CVM model further uses WTP as the dependent variable and personal characteristics of respondents as an independent variable, and then uses a logistic model to test the validity of WTP. The entire analysis of WTP and details of other statistical analysis are given in Appendix 2.

An interesting insight, however, provides the overview of the reasons to pay expressed by the survey respondents that are willing to pay (Fig. 4.10), vs. the reasons not to pay given by respondents that answered disapprovingly (Fig. 4.11). Thus, for those that expressed positively their WTP the Lake Ohrid region clearly has bequest value for residents (27% have stated that Lake Ohrid is important for future generations), while the tourist value fairly equally the existence and bequest aspects.

Fig. 4.10: WTP – reasons to pay

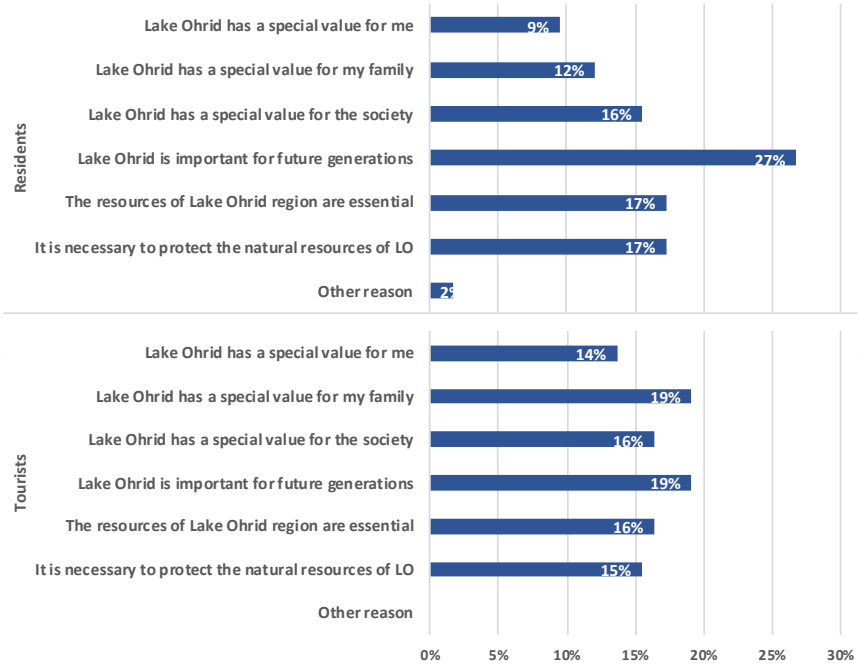
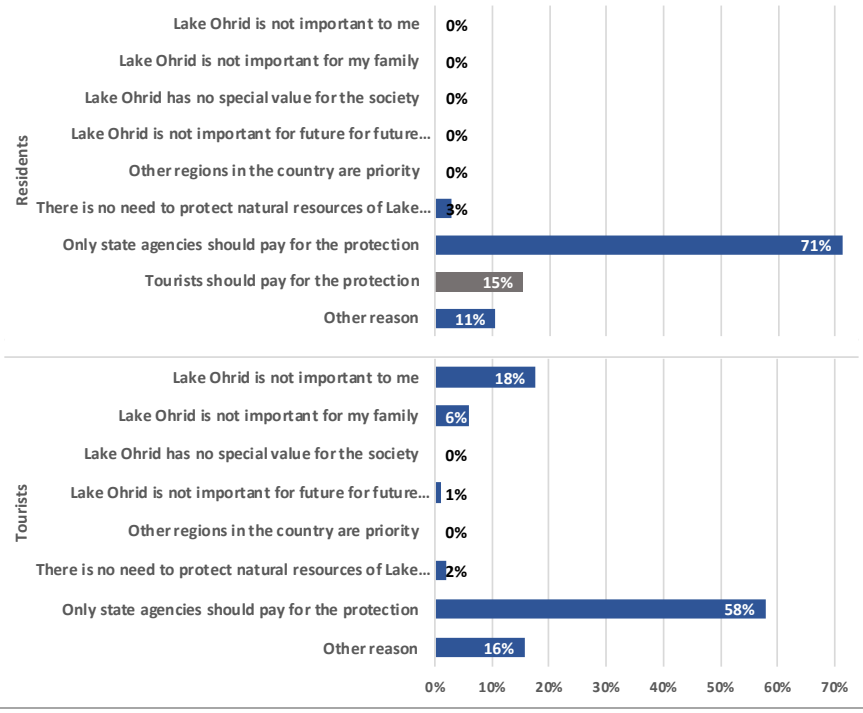


Fig. 4.11: WTP – reasons not to pay



On the other hand, majority of the respondents that answered avertedly to the WTP question have stated that the key reason for not willing to pay is because of their opinion that only state agencies should cover expenses for protection of the lake and its environment. Thus, it can be concluded that majority of these respondents do too assign values to the natural and cultural assets of the region, but the direct responsibility for their protection is in the hands of the authorities using funds levied by regular taxes and charges for the purpose.

5. Results and Conclusions

5.1.1. The TEV of ecosystem services of the LOW and its structure

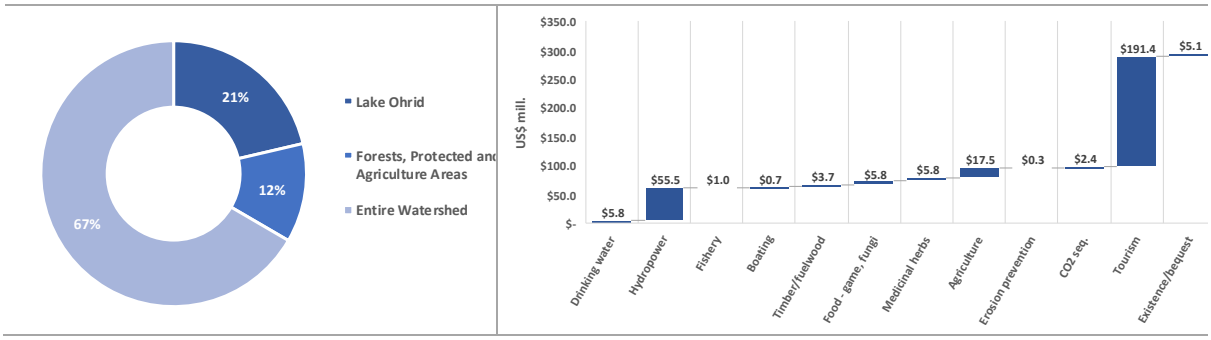
The results of the ES valuation are summarized in Table 5.1 and Fig. 5.1 below. The total value – expressed in monetary units – of the ecosystem services of the LOW in 2017[27] is $295.1 million. The unit value per area, taking into consideration the entire area of the watershed, equals $2,102/ha. Within this, the value of services of Lake Ohrid is $63.3 mill, or 21.4% of the total value; the value of services of forests, protected and agriculture areas within the watershed is $35.52 mill. (12% of the TEV); and the value of services that are related to the entire watershed is $196.55 mill, or 66.6% of the total value.

Table 5.1: Total economic value of LOW ecosystem services

Watershed part	Ecosystem Services	Service Type	CICES Division	Service value type (TEV approach)	Valuation method	Estimated ES value ($)	% of Total
Lake Ohrid	Drinking water - households, industry	Provisioning	Water	Use value - direct	Market price	$ 5,780,135	2.0%
	Hydropower generation	Provisioning	Water	Use value - direct	Market price	$ 55,525,470	18.8%
	Commercial fishery	Provisioning	Water	Use value - direct	Market price	$ 1,016,506	0.3%
	Commercial boating	Provisioning	Water	Use value - direct (NC)	Market price	$ 708,606	0.2%
Forests, Protected and Agriculture Areas	Raw materials -- timber, fuelwood	Provisioning	Biomass	Use value - direct	Market price	$ 3,735,613	1.3%
	Food - game, fungi	Provisioning	Biomass	Use value - direct	Market price	$ 5,774,725	2.0%
	Medicinal resources -- herbs	Provisioning	Biomass	Use value - direct	Market price	$ 5,761,573	2.0%
	Agriculture production (crops)	Provisioning	Biomass	Use value - direct	Market price	$ 17,480,000	5.9%
	Erosion prevention/soil protection	Regulating	Reg. of conditions	Use value - indirect	Avoided cost	$ 346,531	0.1%
	CO2 sequestration	Regulating	Reg. of conditions	Use value - indirect	Market price	$ 2,423,878	0.8%
Entire Watershed	Tourism and recreation	Cultural	Direct interaction	Use value - direct (NC)	Travel cost	$ 191,438,339	64.9%
	Existence/bequest/altruist value	Cultural	Indirect interaction	Non-use value	Contingent valuation	$ 5,114,937	1.7%
NC - non consumptive					**Total Value**	**$ 295,106,314**	100%
					Unit Value ($/ha)	**$ 2,102**	

Viewed from another perspective, the provisioning services value is $78.3 mill, accounting for 26.5%; regulating services value is $2,77 mill, accounting for 1% of the total value; agriculture production service value is $17.48 mill, accounting for 5.9% of the total value[28]; and the cultural (social) service value is $196.55 mill, accounting for 66.6% of the total value. Within the cultural service category, the value of tourism and recreation service is highest, accounting for 64.9% of the total value.

Fig. 5.1: Allocation of the total economic value



The order of analyzed ES by value is: Tourism and recreation ($191.44 mill) > Hydropower generation ($55.53 mill) > Agriculture production ($17.48 mill) > Drinking water supply ($5.78 mill) > Food ($5.77 mill) > Medicinal herbs ($5.76 mill) > Existence/bequest ($5.11 mill) > Timber/fuelwood ($3.74 mill) > CO_2 sequestration ($2.42 mill) > Fishery ($1 mill) > Commercial boating ($0.78 mill) > Soil protection ($0.35 mill).

[27] As indicated before, due to data availability the analysis are for the period 2016 – 2018. However, all valued ecosystem services are on an annual basis, thus 2017 is assumed as an 'average year'.

[28] Agriculture production is assumed as a proxy for supporting services and treated as a separate category from the provisioning (production) services.

In summary, three of the twelve analyzed ES – Tourism and recreation, Hydropower and Agriculture – account for nearly 90% (89.6%) of the total estimated value. Of the remaining services, Drinking water, Food, Medicinal herbs and Existence/bequest, account for 2% of the total each.

5.1.2. Discussion and conclusions

Several methods were combined for valuation of the ecosystem services of the LOW. Essentially, the values of drinking water supply, hydropower, fishery, boating, raw materials, food/fungi, medicinal herbs and carbon sequestration were assessed using monetary values derived from market prices. These services were selected because they are among the most important and can be straightforwardly valued with available data.

The values of erosion prevention/soil protection and tourism and recreation were assessed using surrogate market prices – avoided costs and travel costs respectively. The main contribution to the soil protection service value was provided by forests located in higher slope classes. The carbon sequestration service is likely to be overestimated since cutting and fires were neglected. Simultaneously, some underestimation may be present because of different CO_2 sequestration by forest typologies and volatility of CO_2 market prices.

The ecosystem service of non-use value type – existence/bequest – was assessed using the CVM approach, which educes the individual preferences (respondents' perceptions) gathered with a survey of local residents and visitors of the LOW. Estimated monetary value of $5.1 mill as annual average appears as ambiguous and can be somewhat misleading. It is thought to be a direct consequence of the current relatively low(er) level of local economic development and living standard in both countries sharing the watershed (Albania and North Macedonia), and as such should even be regarded as an affirmative indication. In addition, however, it is also believed that by and large it reflects the true awareness level of the local population regarding the (non)existence of important anthropogenic pressures on natural resources in the basin. Nevertheless, it is likely that the value of this service, when expressed in monetary units, is likely to increase in future.

The recreational ecosystem service, labelled as Tourism and recreation throughout the report, quite expectedly has by far a dominant monetary value among all assessed ecosystem services of the LOW, accounting for no less than 65% of the TEV. This aspect, however, implies further reflection as any change in its value – positive or negative – creates profound changes in the overall status. For example, a 20% increase or decrease of the elements creating the monetary value of the recreation service, given that all other service values remain constant, will result in nearly 15% upward or downward change of the TEV. Thus, taking into consideration that the key attribute creating the monetary value of the recreational ES is the number of visitors to the region, and especially the foreign visitors, an inevitable conclusion is that meticulous attention should be given to the tourists' perceptions of what truly distinguishes the LOW from other recreational sites, as well as to what are the threats (pressures) as seen by the visitors that might negatively affect the current advantages. So, going back to part 3 of this report (Fig. 3.2, 3.3 and 3.6), the key advantages identified by the tourists and local residents include: the biodiversity, aesthetic and natural values, cultural values (spiritual and other heritage sites in the region) and the prominent UNESCO World Heritage Site status; the key pressures on water quality in the lake – or on natural resources, in general – are deficient wastewater and improper solid waste management.

Finally, although a variety of methods to estimate the services were used, the analysis did not establish a complete ecosystem services evaluation system. Nevertheless, notwithstanding the methodological limitations and result uncertainties linked to the needed simplification of ecological processes, it is believed that the analysis provides useful insights suitable for fostering further informed debate concerning the definition of regional resource protection policies. After all, the main objective for conducting the assessment was to generate an indication in the form of order of magnitude regarding the average annual economic (monetary) value and its drivers of the natural and cultural capital of the LOW. Therefore, the inexorable uncertainty of value-based information could be considered acceptable for scoping a strategic management plan for water resource protection at the lake basin scale.

6. References and Publications

1. European Parliamentary Research Service (EPRS), Briefing (March 2015); Members' Research Service *Ecosystem Services, Valuing Our Natural Capital*; Author: Didier Bourguignon.
2. Constanza R, at all., *The Value of the World's Ecosystem Services and Natural Capital*, Nature, Vol. 387, May 1997.
3. Daily, G. (ed.) (1997); *Nature's Services: Societal Dependence on Natural Ecosystems*, Island, Washington DC.
4. Millennium Ecosystem Assessment, (2005); *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC.; World Resources Institute, 2005.
5. TEEB (2010); The Economics of Ecosystems and Biodiversity: *Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB*.
6. TEEB (2010); The Economics of Ecosystems and Biodiversity: *Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB, Chapter 5: The economics of valuing ecosystem services and biodiversity*.
7. TEEB (2010); The Economics of Ecosystems and Biodiversity: *Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB; Chapter 1: Integrating the ecological and economic dimensions in biodiversity and ecosystem service valuation*.
8. Haines-Young, R. and M.B. Potschin (2017); *Common International Classification of Ecosystem Services (CICES) V5.1 and Guidance on the Application of the Revised Structure*.
9. Maes J, Teller A, Erhard M, Grizzetti B, Barredo JI, Paracchini ML, Condé S, Somma F, Orgiazzi A, Jones A, Zulian A, Vallecilo S, Petersen JE, Marquardt D, Kovacevic V, Abdul Malak D, Marin AI, Czúcz B, Mauri A, Loffler P, Bastrup- Birk A, Biala K, Christiansen T, Werner B (2018): *Mapping and Assessment of Ecosystems and their Services: An analytical framework for ecosystem condition*. Publications office of the European Union, Luxembourg.
10. Management Plan for National Park Galichica 2010 - 2020
11. Towards Strengthened Governance of the Shared Transboundary Natural and Cultural Heritage of the Lake Ohrid Region: *Baseline Assessment of the Lake Ohrid Region – Albania*; IUCN – ICOMOS joint draft report, January 2016.
12. Aalde, Harald, and Michael Gytarsky. Chapter 2: *Generic Methodologies Applicable to Multiple Land-Use Categories*. 2006 IPCC Guidelines for National Greenhouse Gas Inventories , edited by Patrick Gonzalez, IV, IPCC, 2006, www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf.
13. Status Maps - Copernicus Land Monitoring Service, European Comission, 5 June 2018, land.copernicus.eu/pan-european/high-resolution-layers/forests/forest-type-1/status-maps.
14. Carbon Price Viewer, Sandbag, 2019, sandbag.org.uk/carbon-price-viewer/.
15. Borrelli P. et al., *An assessment of the global impact of 21st century land use change on soil erosion*. Nature Communications, 8 (1): art. no. 2013," 2017.
16. Gorgevic M., Jelic D., Trendafilov A., Gorgievski S., Popovski A., (1993): *Erosion map of North Macedonia, Water Development Institute*.
17. E. Morria et al., "A forest ecosystem services evaluation at the river basin scale: Supply and demand between coastal areas and upstream lands (Italy)," Ecol. Indic., pp. 210–219, 2014.
18. Alison G. Power: *Ecosystem services and agriculture: tradeoffs and synergies*; The Royal Society Publishing. Published: 27 September 2010 (https://doi.org/10.1098/rstb.2010.0143)
19. European Commission, Directorate-General for Regional and Urban Policy, *Guide to Cost-Benefit Analysis of Investment Projects, Economic appraisal tool for Cohesion Policy 2014-2020*.
20. Trajanovski S., Albrecht C., Schreiber K., Schultheiß R., Stadler M., Benke M. & Wilke T. (2010): *Testing the spatial and temporal framework of speciation in an ancient lake species flock: the leech genus Dina (Hirudinea: Erpobdellidae) in Lake Ohrid*. Biogeosciences 7: 3387–3402.
21. Albrecht C. &Wilke T. (2008): *Ancient Lake Ohrid: biodiversity and evolution*. Hydrobiologia 615: 103–140.
22. Watzin, M. C., Puka, V., and Naumoski, T. B.: *Lake Ohrid and its watershed: state of the environment report*, Lake Ohrid Conservation Project, Tirana, Albania and Ohrid, Macedonia, 2002.

23. Levkov, Z., Krstic, S., Metzeltin, D. &Nakov, T. (2007): *Diatoms of Lakes Prespa and Ohrid*. Iconographia Diatomologica 16: 1–603. A.R.G. Gantner Verlag K.G
24. Levkov Z. & Williams D. (2012): *Checklist of diatoms (Bacillariophyta) from Lake Ohrid and Lake Prespa and their watersheds*. Phytotaxa 45: 1–76.
25. Spirkovski, Z., Avramovski, O. & Kodzoman A. (2001): *Watershed management in the LakeOhrid region of Albania and Macedonia*. Lakes & reservoirs. 6: 237-242.
26. Kostoski, Z., Albrecht, C., Trajanovski, S. & Wilke. T. (2010): *A freshwater biodiversity hotspot under pressure – assessing threats and identifying conservation needs for ancient Lake Ohrid*.
27. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (2017): *Shorezone Functionality, Ohrid Lake*; Implementing the EU Water Framework Directive in South-Eastern Europe.
28. Technical Assistance for Strenghtening the Capacity of the Ministry of Environment in Albania for Law Drafting and Enforcement of National Environmental Legislation, EuropeAid/130987/C/SER/AL (2013): *Pogradec Terrestrial/Aquatic Territory Protected Landscape Area Management Plan*.
29. Cerroni, M., (2013): *Breaking new grounds in conservation in the Republic of (North) Macedonia: The economic case for long-term protection of the Ezerani Nature Park*; Integrated Ecosystem Management in the Prespa Lakes Basin project, implemented by UNDP with financial support from the Global Environment Facility (GEF).
30. Misla, Skopje (1995): *(North) Macedonia Cultural Heritage*.

7. Maps and Annexes

Map 1: Hydrology of LOW

Map 2: LOW – Land Cover

Map 3: LOW – Protected Areas

Appendix 1: Carbon sequestration methodology

The CO_2 sequestrated annually by the forests is calculated by the following formulas, following the 2006 IPCC Guidelines for National Greenhouse Gas Inventories [9]:

$$\Delta C = \frac{\left(C_{t_2} - C_{t_1}\right)}{(t_2 - t_1)}$$

$$C = A \cdot V \cdot D \cdot (1 + R) \cdot CF$$

Where:

ΔC – annual change in carbon stocks in biomass, tons C yr^{-1}

C_{t1}, C_{t2} – total carbon in biomass at times t_1, t_2, tons C, as calculated by the second equation

A – area of land remaining in the same land-use category, ha

V – stock volume, m^3/ha

D – basic wood density, ton/m^3 biomass

R – ratio of below-ground biomass to above-ground biomass, ton dry mass below-ground biomass / ton d.m. above-ground biomass

CF – carbon fraction of dry matter, ton C / ton d.m.

Forested areas for the two years that were considered, 2012 and 2015, were obtained from the Copernicus Land Monitoring Service [7].

The stock volumes were obtained from reports prepared by the NP Galichica [1][2] and "Nacionalni Shumi" [8]. The stock volumes were calculated for most forest enterprises in the watershed, using the following formula:

$$V = WM/A$$

WM – wood mass, m^3

For the areas falling out of the forest enterprises, average values from the obtained data were taken, for each broadleaved and coniferous forest (65 m^3/ha and 67 m^3/ha for coniferous and broadleaved respectively). When the average values were calculated, the NP Galichica's values were not taken into consideration, as they are significantly higher than the rest of the watershed's (111 m^3/ha and 137 m^3/ha).

The wood densities (ton/m^3) were calculated for both coniferous and broadleaved forests. Taking into consideration the species composition of broadleaved and coniferous forests of the NP Galichica[1][2], for which best data is available, and basic wood densities available from literature [3][5][6], average values for the two types of forests were obtained using the following formula:

$$D_i = \sum D_{i,s} \times \frac{A_{i,s}}{A_{i,tot}}$$

D – basic wood density, for type of forest *i* and species *s,* ton/m^3

$A_{i,s}$ – area falling under type of forest *i* and species *s,* ha

$A_{i,tot}$ – area falling under type of forest *i*, total, ha

The ratio of below-ground to above-ground biomass and the carbon fractions for the two types of forests were obtained from the IPCC Guidelines report[3].

While these calculations give stock and stock variations in mass of carbon, there is further need to convert it to CO_2, using the C to CO_2 mass conversion factor of 3.667 gCO_2/gC.

CO_2 sequestration					
ton CO_2				Economic worth of sequestrated CO_2	
2012	2015	eur/tonCO_2		2012	2015
6580455	**7114963**	11.34		**€ 74,602,274**	**€ 80,661,970**
Annual CO_2 sequestration				Annual	
178170				**€ 2,019,899**	

The mass of CO_2 was economically valuated by considering a 5-year average European Emissions Allowances (EUA) price of CO_2, obtaining a value of 80.6 million euro of CO_2 stocks in 2015, or an annual average sequestrated CO_2 worth of a little more than 2 million euro.

References:

[1] Public Institution National Park Galichica, Ohrid (2012) *Special plan for protection and management of forests; Forestry Economy Unit "Galichica 1"*; Validity period: 2013-2022

[2] Public Institution National Park Galichica, Ohrid (2012) *Special plan for protection and management of forests; Forestry Economy Unit "Galichica 2"*; Validity period: 2013-2022

[3] Aalde H., Gonzalez P., Gytarsky M. Krug T., Kurz W.A., Ogle S., Raison J., Schoene D., Ravindranath N.H., Elhassan N.G., Heath L.S., Higuchi N., Kainja S., Matsumoto M., Sanz Sanchez M.J., Somogyi Z. (2006). *Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use*. Task Force on National Greenhouse Gas Inventories, IPCC.

[4] *Carbon Price Viewer*, Sandbag, 2019, sandbag.org.uk/carbon-price-viewer/.

[5] Nestorovski Lj., Nacevski M., Trajanov Z., Trajkov P. (2014). *Analysis of Energy Value of Some Tree Species*. Nova meh. Sumar. 35.

[6] Korkut S., Guller B. (2007). *Physical and mechanical properties of European Hophornbeam (Ostrya carpinifolia Scop.) wood*. Bioresource Technology

[7] "Status Maps." Status Maps - Copernicus Land Monitoring Service, European Comission, 5 June 2018, land.copernicus.eu/pan-european/high-resolution-layers/forests/forest-type-1/status-maps.

[8] Public Enterprise "Nacionalni Sumi", 1998-2018.

[9] Aalde, Harald, and Michael Gytarsky. Chapter 2: *Generic Methodologies Applicable to Multiple Land-Use Categories*. 2006 IPCC Guidelines for National Greenhouse Gas Inventories , edited by Patrick Gonzalez, IV, IPCC, 2006, www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf.

Appendix 2: Contingent Valuation

In order to understand the reason behind the respondents' WTP a probit linear model was run. The first regression was made for the dependent variable: Would you be willing to contribute resources from your household budget for annual payments in the Fund?, and a selection of independent variables from the conducted survey. A number of variables were selected from two question groups. The first group of questions' goal was to assess the perception of values and benefits of the watershed (1); while the other group (3) aims to picture the social, educational and economical background of the respondents.

With the model ran here, assumptions can be made whether these factors influence the respondents' WTP. The most statistically significant independent variables from the above mentioned question groups are reported in tables 1 and 2, for residents and tourists respectively, as the two are considered separate socio-demographic groups with different views and priorities who cannot be grouped together.

Table 1 Residents regression parameters WTP (yes/no)

Dependent variable: Would you be willing to contribute resources from your household budget for annual payments in the Fund? (residents)			
Parameter	**B**	**Std. Error**	**Sig.**
Hydrological regulation: flood protection, erosion prevention, water retention/landscape	-0.533	0.2986	0.074
Maintenance of biological diversity (populations and habitats)	1.011	0.3754	0.007
Protection of region's prominent status (UNESCOsite, etc.)	0.477	0.2469	0.053
Unsustainable (intense) fishing	-0.431	0.2098	0.040
Introduced invasive alien species in the lake	0.474	0.2373	0.046
Education	0.290	0.1384	0.036
Percentage of all family income that is directly connected to Lake Ohrid	0.338	0.1338	0.011
Have you donated for humanitarian/development activity in the last two years?	-0.702	0.2774	0.011

The most statistically significant independent variable for the local population is "Maintenance of biological diversity", meaning that the people who place high importance on Ohrid Lake's help in the maintenance of existing biodiversity are also willing to pay to the annual fund (Figure 1.a).

Other statistically significant independent variables are the level of education (the higher the education level the more prone people are to contributing to the fund (Figure 1.b) and the percentage of the family monthly income that is directly connected to Lake Ohrid (the higher the percentage, the more willing to pay).

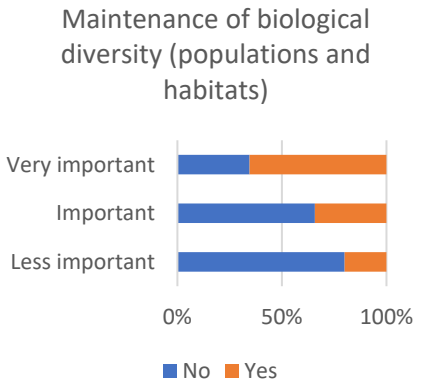


Figure 1.a WTP (yes/no) and biodiversity benefit (residents)

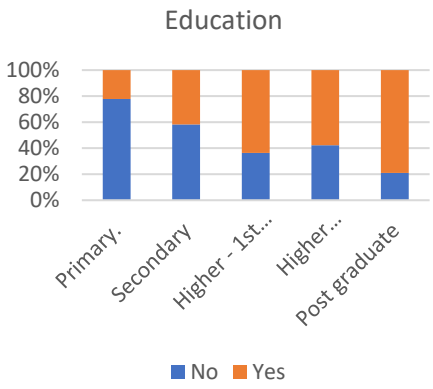


Figure 71.b WTP(yes/no) and education levels (residents)

While the regression model did not show a statistical significance between WTP and total household earnings, from Figure 2 it is visible that the more a family earns the more probable they are to contribute to the fund, with the exception of the last income bracket (more than 100.000 MKD). However, this bracket only consists of one single individual.

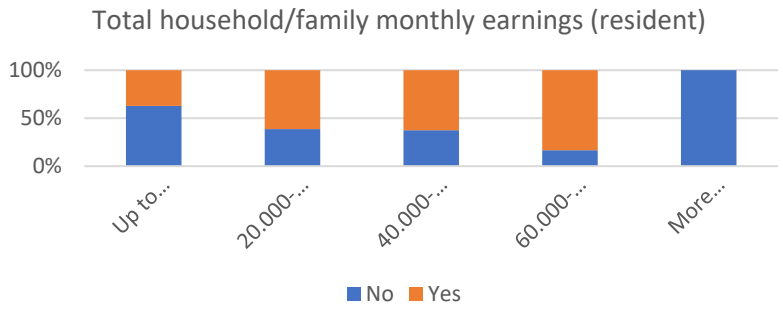


Figure 2 WTP (yes/no) and income levels (residents)

As regards the tourists, the findings are strange to some extent. Those who believe that protection of the water biodiversity is a non-important benefit that the good water quality of the watershed provides are those that are willing to pay to the annual fund. The trend is the same with those who believe intense fishing has minor or no effect on the water quality and biodiversity. However, those that are not satisfied with water quality in the lake are more willing to pay than those who are.

Furthermore, the awareness regarding the endemism of Lake Ohrid is positively correlated to the respondents' willingness to pay (Figure 3), even though the regression coefficient is not that strong (0.383). For both tourists and residents, there is a positive correlation between WTP and whether the respondent has donated for humanitarian/development activities in the past two years, however the statistical significance is much better for residents ($p<0.05$) compared to tourists ($p<0.07$).

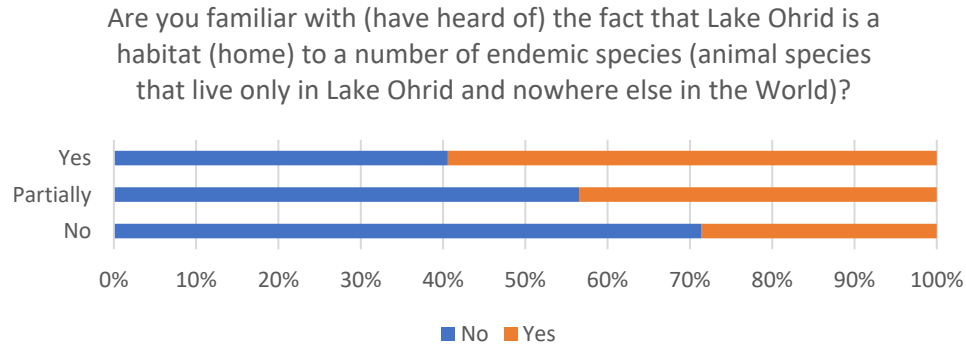


Figure 71 WTP(yes/no) and Lake Ohrid endemism awareness (tourists)

Table.2 Tourists regression parameters WTP (yes/no)

Dependent variable: Would you be willing to contribute resources from your household budget for annual payments in the Fund? (tourists)			
Parameter	**B**	**Std. Error**	**Sig.**
Protection of biological diversity	-0.993	0.3444	0.004
Increased tourism	-0.348	0.1977	0.078
Are you satisfied with the quality of the water in Lake Ohrid?	-0.586	0.2451	0.017

Are you familiar with (have heard of) the fact that Lake Ohrid is a habitat (home) to a number of endemic species (animal species that live only in Lake Ohrid and nowhere else in the World)?	0.383	0.1892	0.043
Large number of boats/vessels in the lake – emission of hazardous substances in the water	0.476	0.2155	0.027
Unsustainable (intense) fishing	-0.461	0.2308	0.046
Have you donated for humanitarian/development activity in the last two years?	-0.446	0.2417	0.065

Apart from a regression where the dependent variable is whether the respondent is willing to pay to the annual fund, an ordinal probit linear regression model was run with the dependent variable being: How much are you prepared to pay in the Fund annually, again, for residents and tourists separately, with the same selection of independent variables. The goal of this model run is to identify the most important factors that guide the amount of money a respondent's willing to pay in the annual fund. For residents there are 6 independent variables with a strong statistical significance ($p<0.05$) and 3 more with a significance $p<0.07$ (Table 3).

Table 3 Residents regression parameters WTP (amount prepared to pay)

Dependent variable: How much are you prepared to pay in the Fund annually? (residents)			
Parameter	**B**	**Std. Error**	**Sig.**
Aesthetic and natural values of the region	3.005	0.5670	0.000
Cultural values: historical heritage; cultural heritage; educational, scientific, religious values	-1.711	0.4360	0.000
Improved quality of living	-1.949	0.6768	0.004
Improved health conditions	1.121	0.6139	0.068
Improved water supply (for all needs)	0.898	0.3851	0.020
Are you satisfied with the quality of the water in Lake Ohrid?	-0.519	0.2783	0.062
Large number of tourist accommodation and hospitality facilities around the lake	-1.020	0.3760	0.007
Large number of individual recreational facilities (weekend/holiday houses)	-0.776	0.3958	0.050
Large number of boats/vessels in the lake – emission of hazardous substances in the water	0.851	0.4574	0.063

The strongest positive correlation with the highest significance independent factor is with the "Aesthetic and natural values of the region" benefit; i.e. those who believe the aesthetic and natural values are very important benefits provided by Lake Ohrid are willing to leave more money in the fund annually. On the other hand, there is a strong negative correlation with the "cultural values" benefit that Lake Ohrid provides, as well as with the "improved quality of living" benefit. There is no significant correlation between the amount residents are willing to pay and any of the socio-economic variables (from the (3) group of questions).

Table 4 Tourists regression parameters WTP (amount prepared to pay)

Dependent variable: How much are you prepared to pay in the Fund annually? (tourists)			
Parameter	**B**	**Std. Error**	**Sig.**
How often do you visit the Lake Ohrid region?	-0.252	0.1271	0.047
Water supply	1.810	0.5084	0.000
Commercial and recreational fishing	-0.779	0.3827	0.042
Aesthetic and natural values of the region	-1.160	0.6211	0.062
Increased/sustainable fishery	-0.891	0.4064	0.028
Improved water supply (for all needs)	1.369	0.4749	0.004
Discharge of untreated wastewater (sewage) into the lake	-0.937	0.4726	0.047
Obsolete (not fully functional) sewage collecting system	-1.871	0.5545	0.001
Large number of tourists during the summer season	0.633	0.3131	0.043
Climate change	0.904	0.3545	0.011
Education	0.708	0.2294	0.002

Total household/family monthly earnings (tourist)	0.893	0.2144	0.000

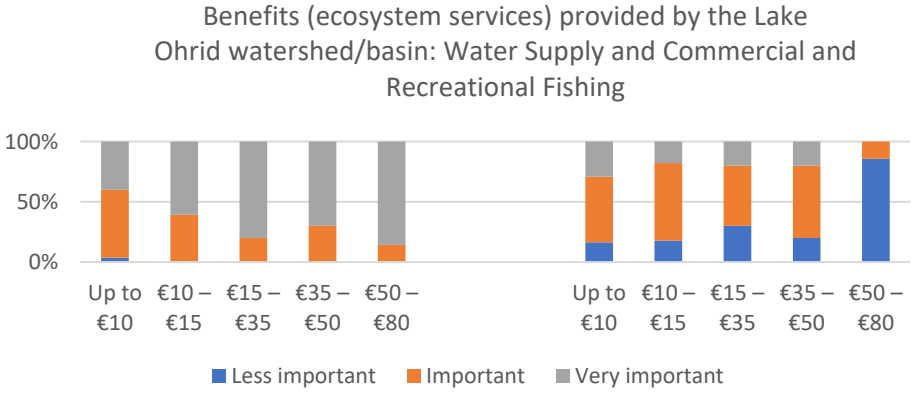


Figure 4.a WTP(amount prepared to pay) and water supply benefit (tourists)

Figure 4.b WTP(amount prepared to pay) and commercial and recreational fishing benefit (tourists)

As for the tourists, there are 11 variables with p<0.05 and 1 more with a p<0.07 significance. (see table 4) The strongest correlation with the biggest significance is with the "water supply" benefit. The more important water supply is in tourists' eyes, the more money they are willing to leave in the fund. On the contrary, the correlation with the "commercial and recreational fishing" benefit is negative. (see figures 4.a & b) While for the residents the socio-economic independent variables had no significant impact over the WTP, for tourists there are positive correlations with both education and total household income, hence tourists that earn more and are better educated are also willing to leave more money in the fund (Figure 5).

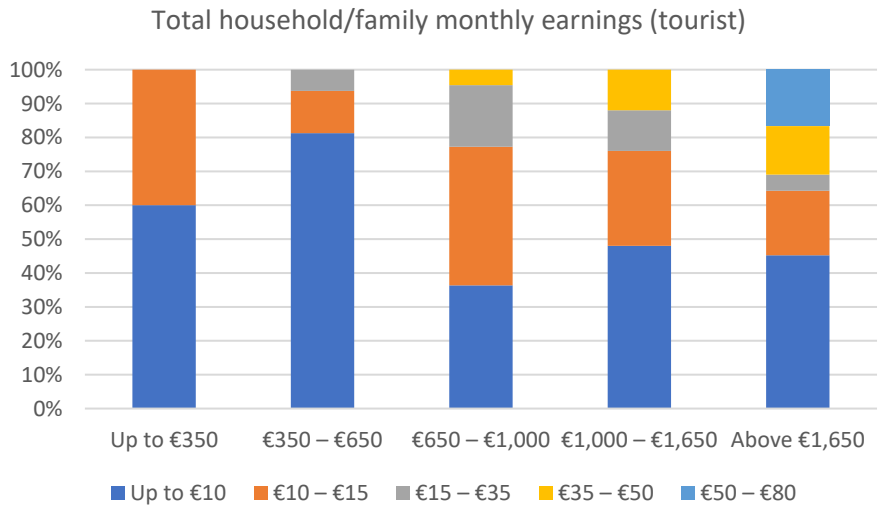


Figure 5 WTP(amount prepared to pay) and income levels (tourists)

Appendix 3: Survey Questionnaires

Appendix 4: Major Cultural Heritage Sites in the North Macedonia part of the Lake Ohrid Watershed[29]

Site Name	Type/period
Prehistoric Sites	
Vranishta, *Crkveni Livadi*, Struga	Neolithic/Eneolithic period
Mouth of Drin River, Struga	Neolithic/Eneolithic period
Dolno Trnovo, Ohrid	Neolithic period
Gorno Sredoreche, *Zlastrana*, Ohrid	Neolithic period
Vranishta, *Crkveni Livadi*, Struga	Bronze age
Gorenci, *Tri Chelusti*, Ohrid	Iron age
Rechica, *Lozhishta*, Ohrid	Iron age
Antique Sites	
Ohrid, *Gabavski Rid* – St Erazmus	Pre-Roman town/fortress
Ohrid, *Gorni Saraj* (Hellenic Lychnidos)	Pre-Roman town/fortress
Lychnidos – Ohrid (Old part of the town)	Roman town
Delogozhdi, *Sv. Ilija*, Struga	Pre-Roman necropolis
Opejnca, Ohrid	Pre-Roman necropolis
Trebenishte, Ohrid	Pre-Roman necropolis
Ohrid, *Deboj*	Pre-Roman necropolis
Oktisi, Struga	Significant Early-Christian basilica
Radolishta, Struga	Significant Early-Christian basilica
Mediaeval Cultural Monuments	
Ohrid, Old part of present-day Ohrid	Mediaeval town
Velestovo, Ohrid	Mediaeval church/monastery
Kalishta, Struga, St. Athanasius	Mediaeval church/monastery
Ohrid, The Archangels Gabriel and Michael(St. Nahum's Monastery)	Mediaeval church/monastery
Ohrid, The Holy Mother of God Bolnichka	Mediaeval church/monastery
Ohrid, The Holy Mother of God Peribleptos (St. Clement)	Mediaeval church/monastery
Ohrid, The Holy Mother of God Chelnica	Mediaeval church/monastery
Ohrid, The Physician Saints (Miraculous Healers: Anargyroi)	Mediaeval church/monastery
Ohrid, St. Demetrius	Mediaeval church/monastery
Ohrid, Cave Church of St. Erasmus	Mediaeval church/monastery
Ohrid, St. John the Divine at Kaneo	Mediaeval church/monastery
Ohrid, Ss. Constantine and Helena	Mediaeval church/monastery
Ohrid, St. Nicholas Bolnichki	Mediaeval church/monastery
Ohrid, St. Pantelejmon (Clement's Monastery at Imaret)	Mediaeval church/monastery
Ohrid, St. Sophia	Mediaeval church/monastery
Ohrid, Cave Church at St. Stephen	Mediaeval church/monastery
Radozhda, Struga, The Cave Church of Archangel Michael	Mediaeval church/monastery
Trpejca, Ohrid, The Holy Mother of God of Zahum (Zahum Monastery)	Mediaeval church/monastery
Leskoec, Ohrid, The Ascension of Christ	Mediaeval church/monastery
Ohrid, Imaret Mosque	Mediaeval Islamic edifice
19-th Century Cultural Monuments	
Ohrid, The Holy Mother of God of Kamensko (Sveta Bogorodica Kamensko)	Church/monastery
Ohrid, The Physician Saints (Sveti Vrachi)	Church/monastery
Ohrid, St. Nicholas of Gerakomia (Sveti Nikola Gerakomija)	Church/monastery
Struga, St. George (Sveti Georgija)	Church/monastery
Ohrid, The Holy Mother of God of Kamensko (Sveta Bogorodica Kamensko)	Iconostas
Ohrid, The Holy Mother of God of the Hospitals (Sveta Bogorodica Bolnichka)	Iconostas

[29] Source: North Macedonia Cultural Heritage (1995).