Drin Dialogue

Consultation process for the establishment of a
Shared Vision for the management of the extended Drin Basin

Multi-stakeholders Consultation Meeting at the transboundary level

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Drin Basin: Situation Analysis and Steps Forward

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A. Drin Basin - Pressures, subsequent resulting State of the environment, and Impacts caused.

The extended Drin Basin system receives a variety of pressures. The available information including this regarding the resulting state of the environment along with the impacts caused by the variety of pressures is given in the following pages.

- ***Water Balance***

The diversion of Devoll River in Albania (in the 70's) to discharge water into the **Micro Prespa Lake** during winter months using it as an irrigation reservoir for the summer months (related activities stopped in 2001) has led to the permanent alteration of the hydrological system in this lake due to increased sedimentation. It has been reported that, because of the sedimentation, underground springs have been blocked (see "Sediment Balance" below).

A significant decrease of the water level over the years has resulted in an obvious shift in the habitats on the Albanian side and probably in some alteration in the composition of the ecosystem. It is believed that this decrease is part of the natural hydrological cycle since pressures due to irrigation are currently minimal in this part of Albania.

There has been an oscillation of the water level in **Macro Prespa Lake** during the past decades. Overall, the water level has decreased by more than 7 meters over the past 50 years.

Much of the lowering of water level is attributed to changes in precipitation patterns in conjunction to the underground water flow from Prespa to Ohrid watershed through karstic formations; this flow is not considered to be constant. Overuse of water for irrigation in FYR Macedonia –mostly through illegal groundwater abstractions- lead to additional losses that seem to have an impact on the water level. Water abstracted for irrigation and household use on the Albanian side has a rather insignificant effect in this regard.

The lowering of the water level has resulted in shifting or loss of priority shoreline and wetland habitats e.g. the reed biotope in FYR Macedonia remained on dry terrain, while a succession of other communities characterizes now the immediate shoreline belt. Spawning areas have been lost, impacting the fish population, especially of the carp. Furthermore it has caused changes in the food chain potentially endangering the overall balance of the aquatic ecosystem.

Additionally, it has led to exploitation of former wetlands transformed into agricultural or pasture lands increasing the potential for pollution from agrochemicals as well as organic pollution.

The hydrology of the "extended" **Drin Basin** has been dramatically altered by the construction and use of a cascade of dams for hydropower production (HP). The significance of the river in this regard is high; in Albania the capacity of the plants installed equals to about 70% of the total hydro and thermal installed capacity in the country. The effects of the altered flow patterns include: erosion of land adjacent to the river; disturbance of the sediment distribution regime being a contributing factor with regard to the erosion of the Adriatic coast (see below under "Sediment balance") etc.

In addition, major pressure is exerted on biota by the interruption of bio-corridors and habitat fragmentation. Preventing fish from migrating upstream to spawn is one of the direct impacts of

dams. A characteristic example is the Atlantic eel (*Anguilla anguilla*), which historically used the Drin River to migrate between Lake Ohrid and the Adriatic Sea; this species has disappeared from the Lake Ohrid. Other riverine species have also been affected by the dams and the altered flow patterns throughout the watershed. Overall, the pressures exerted upon the ecosystems are major.

New dams are under construction or planned in Albania. A number of small HP plants in the Drin watershed in FYR Macedonia and a cascade of dams in the Moraca River in Montenegro are in the "pipeline".

Furthermore, the flow patterns in Drin downstream the dams are influenced by both licensed as well as uncontrolled gravel extraction.

Hydropower production is also linked to **oscillations** of the **water level** recorded in the lakes **Ohrid and Shkoder/Skadar** with impacts on their ecological, economic and cultural values.

Variations in the water level in **Ohrid Lake** is linked with the function of the dams and the associated HP production stations downstream in FYR Macedonia, and occasionally with extreme precipitation incidents. Floods in the Ohrid Lake sub-basin are closely associated to the aforementioned phenomena. Lack of close coordination between Albania and FYR Macedonia with regard to the management of the outflow from the dams in both countries is an additional factor to be taken into account. Attempts to increase water withdrawals from Lake Ohrid in the last few years, in order to increase hydropower generation in the downstream HP plants in FYR Macedonia caused concern and reactions, mainly at the Albanian side. Permanent decrease or significant oscillations in the water level may lead to the shift of littoral zone habitats and/or deterioration or even elimination of the wetlands hence, deterioration of biodiversity. Commercial fishing will be also negatively affected since these habitats provide the spawning grounds for four commercial species, including the endemic Ohrid trout (*Salmo letnica*) – currently under protection in FYR Macedonia- and the smaller size B*elvica* species (*Salmo ohridana*).

In addition it should be noted, that deficiencies in the basin management in Albania could have direct and indirect impacts in upstream countries. For instance, at least in one case during the winter of 2009-2010, the reduction of the flow of water from Ohrid to Black Drin in FYR Macedonia as a measure to mitigate floods in the northern part of Albania –in the Shkoder/Skadar Lake sub-basin- led to the raising of the water level in the Lake Ohrid by 50 cm affecting negatively the anthropogenic (e.g. sewage system) and natural environment.

The altered water flow regime both upstream and downstream of the dams affects the habitats in the **Black Drin** River. Floods in the Black Drin sub-basin in FYR Macedonia, is partially attributed to the decrease of the forest cover in the Jablanica mountain; a lower economic activity, however, has led to the reversal of the negative trend.

The outflow of the **Shkoder/Skadar Lake** through Buna/Bojana River is impeded during periods of high waters in the Drin River. This phenomenon is a result of water releases from the artificial lakes upstream. Under specific conditions Drin water even enters in the Lake Shkoder/Skadar resulting in a significantly raised water level. This occurs mostly from December to February, but may also occur during other periods, depending on the water quantity released from the hydro-power dams (Vau Dejes), which, in turn, depends on both rainfall and electricity demand.

Furthermore, increased flow in the Drin River causes sediment deposition in the river channels at the confluence point of the two rivers, thereby further obstructing the flow in the Buna/Bojana River and the outflow from the lake.

Altered patterns of oscillation of the water level of **Shkoder/Skadar Lake** exert pressures on the ecosystems, as well as on the agriculture and the microclimate around the lake. Shkoder/Skadar Lake is a shallow floodplain type of lake, with regular and extensive flooding of low gradient areas. The flooded areas are an essential habitat for maintaining the overall biodiversity of the lake. They provide essential spawning grounds and nursery areas for many fish species hence, they support the high fisheries productivity in the lake and the river. The flood regime, the timing and amplitude of changes in water levels, are important factors for successful fish spawning. Disturbance of this regime alter the characteristics of the habitats.

In fact, increased frequency and intensity of flooding in the Shkoder/Skadar – Buna/Bojana area during the past two-three years has had detrimental socioeconomic effects in the region; the latest was the most severe flood recorded in the last 80 years. While there is a need for these phenomena to be further studied it is believed that they are the result of the combined effect of:

- flow variability due to both natural and anthropogenic factors (extreme weather phenomena, water releases from the dams on Drin River);
- high sediment input through the tributaries of Drin in Albania, downstream the dams due to erosion caused by gravel extraction and loss of plant coverage;
- accumulation of alluvium in the tributaries of Drin, Drin itself and Buna/Bojana. In the case of Drin this is due to the decreased sediment transport capacity as a result of the controlled outflow from the artificial lakes; in the case of Buna/Bojana the latter is combined with the low gradient of the riverbed;
- blockage of the natural secondary channels of the Buna/Bojana River in the delta area in the Albanian side; the peak flows exceed the capacity of the main (existing) channel;
- the poor maintenance of the irrigation channels and flood preventing constructions in Albania.

Climate change and variability leading to the increase of the frequency of extreme precipitation events should be taken into consideration as a possible explanation of recent intensive flooding phenomena. It is noteworthy that similar “localized” floods are becoming more frequent throughout the world, attributed by many scientists to already occurring climate change.

- ***Sediment Balance***

The diversion of Devolli River in Albania (in the 70’s) into **Micro Prespa Lake** has lead to the deposition of considerable amounts of solid material causing a permanent alteration of the character and functions of the site; almost the total of the Albanian part of Micro Prespa Lake transformed from a shallow lake into a wetland. Despite their ecological significance for wildlife, in particular avifauna, and as buffer zones, extensive growth of reed belts accelerates ageing and succession processes of the lake.

Increased sediment loads entering both **Micro and Macro Prespa Lakes**, has been the outcome of deforestation and overgrazing in both Albania and FYR Macedonian sides and unsustainable agricultural practices in FYR Macedonia. Further to the increased sedimentation, nutrients and micro-pollutants can be transported in the water body adsorbed and absorbed on particulate matter.

It seems that the main problem in terms of excessive sediment loads entering the **Ohrid Lake** lies mostly with the diversion of the Sateska River to the Lake in FYR Macedonia. Deforestation in its watershed of Sateska is a major pressure resulting in erosion and disturbance of the riverbed. Illegal extraction of sand and gravel from the riverbed influence water flow patterns and cause the increase of sediment loads entering the Lake. Overall, the load of silt entering the Lake Ohrid is large. A delta including a small island has been formed into the lake at the river mouth. Reforestation is planned. Increased sediment loads and soil erosion due to deforestation and agricultural activities is an issue in other parts of the Ohrid watershed as well.

Increased sediment loads into the **Black Drin River** in FYR Macedonia, is a result of uncontrolled grazing and logging. Illegal gravel extraction from the Black Drin riverbed leads to disturbance of the sediment and the habitats and has an effect on the river flow patterns causing erosion of the adjacent land; the changes of the shape of the river channel undermine infrastructure, bridges and roads, and productive land.

Overall, increased fine sediment load that characterize unstable rivers may also have impacts on fish and wildlife habitats, even in the absence of other water pollution problems.

Erosion is an important and complicated issue in the **Drin River and Buna/Bojana River watersheds** extending in Albania that is not sufficiently studied and understood. Among its causes –the significance of each one may vary in different areas- are the: (i) deterioration and destruction of plant coverage as a result of over-grazing, logging, forest fires etc.; (ii) unsustainable agricultural practices including inappropriate irrigation methods; (iii) altered flow patterns; (iv) gravel extraction along the Drin River and its tributaries etc. Damaging of the flood protection constructions (barriers) in the channels of Drin coupled with the steep gradient of their bed exacerbates erosion phenomena. Soil erosion leads to high sediment loads, in addition to normal inputs, in the Drin River. Significant loads of material transported into the lake of the Hydro-Power Station of Vau i Dejes may result in the increase of the rate of filling up of the artificial lake.

The balance among / combined effect of the accumulation of sediments, the water flows in the Shkoder/Skadar –Drin–Buna/Bojana system, the variability of the wave activity and sea level, short-term events (storm waves and tides) and long-term processes (sea transgressions), defines the morphology, the hydrography and the related parameters/characteristics of the whole Drin – Buna/Bojana deltaic complex.

Coastal erosion in the delta of the river Buna/Bojana is believed to be mainly the result of the altered physical characteristics of the Drin and the entrapment of sediment of the upper part of the watershed in Albania by the dams. The quantity of alluvium that results from erosion in the tributaries of Buna/Bojana and Drin as well as in the downstream part of the latter is not enough to invert the coastal erosion process. In addition, the reduction of the sediment transport capacity of the Drin in combination with the natural low gradient of the channel of Buna/Bojana River result in the accumulation of alluvium from erosion in the bed of Drin and Buna/Bojana preventing this from reaching the Buna/Bojana mouth at the Adriatic Sea. The progression of the sea along the Buna/Bojana mouth has been about 500 m since 1936 and about 50 m the past 20 years.

In comparison, the sea line has progressed by approximately 400 m during the same period along the Lezha seashore where the other branch of Drin flows into the Adriatic Sea.

The changes in the coastline affect drastically the ecosystems in the Buna/Bojana Delta. For example, nesting bird habitats are being lost progressively throughout the Buna/Bojana Delta due to the disappearance of islands.

- ***Water Quality***

Pollution from diffuse (e.g. agriculture) or point sources (e.g. industrial and urban wastewaters etc.) is a matter of concern throughout the "extended" Drin River basin. It results to impacts to the ecosystems of the Drin as well as of the Adriatic Sea and poses a risk to human health.

A considerable amount of nutrients ends up in the **Drin hydrologic system** and possibly to the **Adriatic Sea**; 95% of the nutrient load is attributed to anthropogenic sources (Borgvang S. et al., 2008). Whereas agriculture is the main source of nitrogen and phosphorus in the river system as a whole, the contribution of each source varies from site to site. While in the lower parts of the drainage system, in the Buna/Bojana River, most of the phosphorus load derives from agriculture, sewage is more important in the upper parts of the Black Drin. Unsustainable management of domestic liquid and solid waste exerts pressure in the water quality in other parts of the basin as well (Shkoder/Skadar and Buna/Bojana). The riparian countries are slowly taking measures to address urban wastewater pollution. For instance, in Albania waste water treatment plants have/are being constructed for major towns.

Inadequate wastewater collection and lack of treatment is an issue in the Albanian part of **Micro Prespa**; wastewater is discharged in surface waters or underground. The level of diffuse pollution cannot be estimated. Macroscopic observations (according to reports from local population in Albania, water transparency has decreased to only a few centimeters) and scientific evidence (e.g. the composition of the phytoplanktonic community) suggests that the Lake is currently heading towards eutrophication; however, there is not enough information available to the authors with regard to the causes. As an outcome there is major pressure exerted on fish population and there are impacts on the balance of the ecosystem which hosts many species including endangered ones.

According to current data the **Macro Prespa Lake** can be characterized as mesotrophic; although a final conclusion about its trophic state, as well as the related trends, cannot be reached due to lack of adequate systematic monitoring for neither the lake nor its tributaries, there are indications suggesting that it is in the process towards eutrophication. The composition of the diatom population community indicates the state of the lake today to be mesotrophic to eutrophic.

Nutrients input –mainly from the FYR Macedonian side that hosts the biggest share of the population and economic activities in the watershed – is considered to be the main cause. This input comes as a result of insufficient wastewater management and unsustainable agricultural activities e.g. improper use of fertilizers and irrigation techniques; in addition, erosion may also contribute to nutrient inputs due to the poor land management (agriculture). Organic pollution leads to depleted dissolved oxygen concentrations –particularly in summer months- contributing to degradation of water quality with a potential impact on aquatic life. The main source of organic pollution is believed to be the town of Resen and the industry in the same region. Furthermore, excessive apple production usually ends up in the streams entering the lake increasing their organic carbon loads. Insufficient wastewater management leads to bacterial pollution too in certain areas of the lake and its tributaries.

Diffuse pollution from agriculture in the Albanian part is minimal and where present it should be of local character. The use of chemical fertilizers is very limited. The nutrient and organic loads entering the lake due to insufficient wastewater management is a factor of pollution that may have –data are not available- an impact of local character; it should be of less importance if compared to transboundary pollution. In contrast, the impact of wastewater discharge is major in the Albanian part in terms of bacteriological pollution; the situation becomes critical at certain locations during particular periods of the year. The health risks are high for people who use untreated water abstracted from the lake for drinking purposes or when using the lake for recreation.

There is virtually no information available regarding the concentrations of hazardous and toxic substances in the local aquatic system (water column, sediment or biota). Nevertheless, the use of herbicides and pesticides at the FYR Macedonian side of the basin is substantial, mainly within the Golema River sub-watershed, affecting both the river and the northern end of the Lake. Use of inappropriate types of pesticides in FYR Macedonia –e.g. agrochemicals banned, by the law, are obtained and used in both Prespa and Ohrid sub-basins- may pose a threat to the ecosystem. As for the seriousness of the threat while only rough estimates can be made about the quantities or the types of pesticides and herbicides used, ecotoxicology studies of runoff from fruit orchards in the region indicate significant sub-lethal impacts of insecticides on fish larvae and potential for certain herbicides to have sub-lethal effect on endocrine function in wildlife and humans, affecting sex determination, growth rates, and fecundity. There are views suggesting that hazardous substances use has resulted already to the alterations of the ecosystem structure. In Albania the use of pesticides is restricted; farming is labor intensive.

Water quality deterioration is most intense at the littoral zone of **Ohrid Lake** especially:
- in FYR Macedonia in the: sections adjacent to the urban areas of Struga and Ohrid; shoreline to the south of Saint Naum; areas that the larger tributaries discharge into the lake, especially the Sateska, Daljan, Grasnica and Koselska Rivers;
- in Albania in the: sections adjacent to the urban areas of Pogradec and; in the shoreline where recreational activities take place i.e. Drilon, Pojska, and Lin.

Ohrid is an oligotrophic lake, however, there are indications of progressing eutrophication. Nutrient loading from both littoral countries exert pressure to the system causing acceleration of the “aging” process of the lake. Concentrations of phosphorus and nitrogen have been increasing over time. Considering the very large volume of water in the lake this increase represents a very significant change. Both the phytoplankton and zooplankton communities are shifting to a species composition more characteristic of a mesotrophic condition and so do the macrophytes and benthic fauna in the shallow-water zone.

Lake Ohrid is being “fertilized” from the FYR Macedonian side by sewage due to inefficient and in some cases insufficient infrastructure for wastewater collection and treatment and diffuse pollution due to uncontrolled and excessive use of fertilizers. There are plans for the expansion of the sewerage network as well as the treating capacity of the wastewater treatment plant serving the sub-watershed.

Urban wastewater discharge has been the main input of nutrients from the Albanian side leading also to organic and bacterial pollution –of local importance- at the littoral zone. Treatment of urban wastewaters of the Pogradec area, since 2009, has had a positive effect with regard to the

organic matter and phosphorous concentration trends as well as to the bacterial contamination of water. According to observations some improvement in the water quality in the adjacent part of the lake is evident.

According to some information phosphorous is transported via the karstic underground connection from the Prespa watershed.

Inappropriate disposal of solid wastes and non-compliance of the existing landfills to modern standards in both sides of the basin is another threat for surface and ground water.

There is some preliminary evidence in Ohrid Lake with regard to hazardous substance pollution. In FYR Macedonia pesticides used by farmers in the watershed may threaten fish in the lake; traces have been found in the tissues of some fish collected. In addition, there have been inflows of toxic wastes from industrial facilities in the area of Ohrid. Economic reasons have forced the closure of many industrial plants in the past two decades thus sources of pollution have been "de facto" greatly reduced. However, a recent study indicated an elevated level of PCB in edible fish.

Mining activities at the Albanian shoreline have been sources of heavy metals pollution (e.g., chromium, copper, cobalt, nickel as well as iron, etc.). The impacts to the ecosystem had been considerable. According to publications, flora and fauna (especially some fish species) of the lake had been seriously affected in the adjacent to Guri i Kuq lake area. Sediments in the littoral zone in adjacent to the mines areas are substantially polluted, presenting a potential toxic risk for the aquatic life and through the food chain also to humans. The closing down of mines and the removal and disposal of the site tailings in Guri i Kuq addressed to a certain extent these important pollution sources. Depositions of residual material left in open pits in abandoned mines constitute still a pollution source; the initiation of operation of some illegal mines may be an issue in this regard. A potentially significant risk to living organisms is still present.

The main sources of pollution in the **Black Drin River** in FYR Macedonia are considered to be: domestic sewage and solid waste; agriculture; mining activities throughout the watershed. There is no adequate information available to the authors with regard to water quality; according to some data, nutrient levels appear to be low if compared to the other sub-basins of the extended Drin River basin. According to the Spatial Plan of FYR Macedonia (2004) Black Drin is among the watercourses of the country that shows "permanent deterioration of its quality".

There is also no adequate information with regard to water quality in the part of the **Drin River** watershed extending to the Albanian side. The following are among the potential sources of pollution:

- Inappropriate disposal of solid waste throughout the watershed; deposits, including of hospital waste, are present on the river banks and lake shores in residential areas;
- Domestic sewage that is discharged untreated along the course of the river as well as in the artificial lakes;
- Waste from mining and industrial activities throughout the watershed and in particular in the Kukes region where mining industries are placed.

According to some publications concentrations of nitrates and DIN are rather high compared to the values observed in the Prespa and Ohrid Lakes. According to the Albanian Ministry of Environment, Forests and Water Administration the overall water quality in the Drin River is good.

Despite the fact that the **Shkoder/Skadar Lake** receives pollutant loads, the quality of water appears to be reasonably good, due to high renewal rate of 2-3 times per year.

Inappropriate wastewater management results in pollutants entering the Shkoder/Skadar Lake – **Buna/Bojana River** system. Improvement of related infrastructure in Podgorica and construction of infrastructure in Shkodra is underway.

In the Montenegrin side, untreated or poorly treated municipal wastewater and diffuse pollution from the Zeta Plain pollute surface water and groundwater. Pollution reaches the lake through tributaries and springs. Increased concentrations of nutrients (phosphates and nitrates) are monitored in the lake near the river mouths, in particular of Crnojenica and Moraca Rivers; concentration peaks are observed during summer season.

In the Albanian part the pollution contributed is due to absence of wastewater treatment, insufficient solid waste management and agricultural runoff results in the pollution of the Lake. Sewage from the Skhodra city is collected into a pool and then pumped into the Drin River at a short distance before its confluence with Buna/Bojana. Occasional failures of the sewerage system lead to spills posing a threat to the quality of the Lake. The discharged wastewater affects the Buna/Bojana River all the way down to its delta and in periods of high waters in Drin and floods, the Lake.

Bacterial pollution seems to be an issue of local importance during spring / summer in Moraca River downstream the Podgorica wastewater treatment plant; this is also true occasionally, during the summer period at the point that Moraca enters Shkoder/Skadar Lake.

The sources of toxic substances pollution lie mainly at the Montenegrin side:

- The Aluminum Plant in Podgorica (KAP: Kombinat Aluminijuma Podgorica); pollutants associated with the operation of the plant include fluoride, phenols, SO_2, NO_x (emitted in the atmosphere), PCBs that had been stored under poor conditions, phenolic compounds, PAHs and mercury-containing wastes. Pollution by PCBs is currently regarded as of low concern due to the export in 2006 of accumulated waste reserves and the proper storage of newly generated PCBs since the privatization of the company in the end of 2005.
- The Steelworks Niksic that is located near one of the tributaries of the Zeta River, is responsible for a range of pollutants, such as waste oils, heavy metals and toxic substances that reach the Zeta and Moraca rivers.

While hazardous substances (heavy metals, PAHs, PCBs, etc.) had been observed in the period prior to 2000 in the Shkoder/Skadar Lake, improvement of the water quality has been noticed in the last years. The pollutants that have reached the lake in the past seem to have been accumulated in the sediments. Moderate and, in few cases, high concentrations of heavy metals have been (monitored) identified at specific sites of the lake in the sediments. Concentrations of PAHs and PCBs in sediments were found to be higher at the entry points of the Moraca River than the pelagic zone, and exhibited a decreasing trend from 1993-1996 to 2005. Traces of pollution from the Steelwork factory in Shkoder/Skadar Lake are minor. Trace metals were found to be relatively higher in the Albanian side of the Lake.

According to some stakeholders (information is not confirmed) Drin contributes, to some extent, trace metal pollution to the Buna/Bojana River from mining activities upstream.

Inadequate solid waste management is of particular importance and constitutes a serious pressure. While in the Albanian part there is an almost complete absence of waste management, the situation is slightly different in Montenegro where the core of the problem is that waste collection system covers mainly the urban population. Currently, only Podgorica, Cetinje and Danilovgrad are served by a sanitary landfill. The rest of the wastes are dumped in a large number of uncontrolled disposal sites or even in the vicinity of watercourses that frequently wash the litter into larger streams and/ or the Buna/Bojana River and the sea, a situation exacerbated by floods.

Efforts to improve the solid waste management system in both countries, including construction of sanitary landfills, are ongoing.

There are insufficient data with regard to impacts due to pollution; nevertheless, the nature of pressures as well as their intensity in some cases, lead to the conclusion that water pollution is a threat to the ecosystem and potentially to the health of local population.

Compared to the Shkoder/Skadar Lake the nutrient levels in the Buna/Bojana River are elevated and reflect, most probably, the discharges of urban wastewater of the city of Shkodra as well as the nitrogen and phosphorus loads entering the system through agricultural runoff in Albania. Localized bacteriological contamination is also an issue. In periods of high waters in Drin and floods (see above "***Water Balance"***) the lake is affected as well.

- ***Other issues***

Unsustainable forestry management and deforestation

Illegal and abusive lodging –for commercial purposes as well as due to the socioeconomic conditions- extensive collection of firewood, uncontrolled grazing coupled with poor forest management in Albania, has resulted in the deterioration of forests in most parts of the Drin Basin including the Ohrid sub-basin.

In Prespa it is estimated that 50% of the forests are significantly degraded and at least 10% of these can only be restored by extensive reforestation – in some cases the natural regeneration capacity of the forest has been lost. The declining trend of livestock is a positive development with regard to pressures related to grazing. The sub-sequent erosion has been a contributing factor for the destruction of the wetlands in Micro Prespa Lake. Nowadays, the remaining high forest habitats and undisturbed grassland in the Prespa National Park are very limited. Important habitats of several animal species (e.g. *Lynx lynx*, *Rupicapra rupicapra*) have been fragmented and degraded.

In the Black Drin, damages are more severe in the Lura National Park and Luzni-Bullaci Reserve.

The Diber, Kukes, Puke and Malesia e Madhe Regions in the Drin watershed host the largest areas of forest in Albania; their role in water balance and prevention of erosion is crucial. The aforementioned reasons of degradation, coupled with poor management practices (forests have been managed with a view to production of timber and firewood with only limited attention to ecosystem management) have led to direct impacts on biodiversity depending in woodland habitats and increased erosion. Socio-economic reasons lead to over-harvesting of rare medicinal plants.

External pressures from alterations in land use also affect directly forests. For instance in Buna/Bojana the natural forests along the seashore are threatened or already damaged by constructions.

In FYR Macedonia forests have been managed more successfully; nevertheless, this has been done with a view to resource production, timber and firewood (see section 3.3.2 "Forestry"). Ecosystem values and watershed management considerations are not incorporated as major management objectives; there are on-going efforts to alter this approach e.g. in the Galicica Park in the Prespa sub-basin. The alteration of the structure of the forest ecosystem through the monoculture reforestation in the watershed of the Macro Prespa Lake has caused the simplification of the forest species composition and degraded forest habitats e.g. the loss of nesting trees for globally threatened species such as the imperial eagle. In Ohrid and the Black Drin cutting is regulated and reforestation is practiced; there has been some concern with regard to the species used in this regard. Reforestation has significantly reduced erosion; nevertheless, there are still areas that require attention, especially in the Sateska watershed (see above "Sediment Balance").

Unsustainable fishing practices and introduction of alien species

In addition to the water regime disturbances and water pollution mentioned above that lead to degradation of shoreline habitats and habitat alterations, there are additional pressures that result in the decline of the native fish stocks as well as biodiversity in the extended Drin watershed. The following factors are valid for all countries of focus; the significance of each one may vary among different areas of the Basin and different countries: lack or inadequate regulation and/or enforcement with regard to over-fishing, inappropriate means of fishing (inappropriate nets), poaching during spawning periods, introduction of non-native or exotic species.

In **Macro Prespa Lake** the aforementioned pressures has led to the decline of native fish stocks, changes in the structure of fish populations and species composition, loss of biodiversity while there is a risk of potential loss of revenue for fishermen. It should be taken into account that in Albania fishing is exercised by a part of the population to complement its income or for house consumption. The statistics on fish numbers and catches are limited in the Prespa Basin as a whole. A key conclusion of a recent detailed study on fish stocks of the basin (in the framework of the UNDP-GEF Prespa project) is that while the overall fish biomass may be constant (or even increasing) commercial fish stocks are under threat due to over-fishing; in particular carp and bleak. As an outcome of all three littoral countries having experimented with restocking native species and fish farming, nine (9) non-native fish species have been "introduced" to the Lake. The number of alien species mentioned during the National Consultation Meeting in Ohrid (2 November 2010) was twelve (12) against eleven (11) endemic species. The latter represent approximately the 70% of the fish stock in the lake.

In **Ohrid Lake** the native fish populations are also under pressure. Overfishing seems to be the major cause of the decline of commercial species such as the carp, bleak, belvica (*Salmo ohridana*) and in particular the endemic Ohrid trout (*Salmo letnica*). With regard to the latter, it is believed that conservation measures in the FYR Macedonian side are more efficient and that pressures exerted in the Albanian side has an impact at transboundary level; nevertheless, the ban on the fishing of trout currently in force in FYR Macedonia seems not to be always respected. There is no such ban on the Albanian side. There have been at least seven (7) exotic fish species

introduced during the last decades. One of these, the golden trout (*Oncorhynchus mykkis aquabonita*) represents a threat to the Ohrid trout. Fishing regulations in the two countries are not compatible.

In Albania in the **Drin River**, non-discriminatory and destructive fishing methods are being used exerting major pressures to the fish stocks and the ecosystem.

Fisheries in the hydrological system including the water reservoir of **Vau Dejes on Drin, the Buna/Bojana River, tributaries of both rivers, Shkoder/Skadar Lake and the marine area from the Buna/Bojana outlet until the town of Velipoja in Albania** are subject to the total of the pressures mentioned above; in addition non-discriminatory and destructive fishing methods include the use of explosives, high voltage electrical shock and poisons. The outcome is a considerable decline of fish stocks and reduction in the number of fish species; some non-commercial fish species are also under threat.

In the case of **Buna/Bojana River** and **Shkoder/Skadar Lake** additional pressures include: destruction of reproduction sites; potential toxic contamination and; manmade barriers (nets) for fishing purposes along the migration routes to the Adriatic Sea. With regard to the latter, placing barriers along the Buna/Bojana River hinders the migration of anadromous and katadromous fish species and the reproduction of several species of Shkoder/Skadar Lake. Furthermore, overfishing at the mouth of the lake threatens the existing fish population.

The commercially valuable fish populations in Shkoder/Skadar Lake have declined in favor of less valuable species and there was also a significant decline on migratory fish in the overall production; there have been significant shifts on the composition of fish catches from early 60's till today.

The introduction of non-native fish had negative impacts to the populations of the native fish species, such as cyprinids, and especially the wild carp (*Cyprinus carpio*). About 1/3 of the species and subspecies of the lake are alocthone.

Growing populations in littoral and coastal settlements as well as growing tourism contribute to additional pressure on the fresh water and marine biodiversity. Lack of coordination between the two riparian countries exacerbates the situation; as the borders on the Lake are not clearly marked, there are cases that Albanian fishermen perform their activities on the Montenegrin side and vice versa. Cooperation on scientific research should also be strengthened to make it possible to better assess the fish populations in the lake, especially the most important commercial species, such as eel, bleak and carp.

Urbanization and unsustainable tourism

Urbanization due to socioeconomic reasons as well as unsustainable tourism exert pressures in areas such as the immediate littoral zone of the water bodies and the coastal area. The resulting land occupancy -due to construction- lead to soil sealing hence, amplification of runoff processes into the lakes. Insufficient sanitation infrastructure, wastewater collection systems and treatment plants, exacerbates the pressures. The same is true for tourism related infrastructures such as hotels and weekend houses; in this case there is a periodically increased need for wastewater treatment, waste disposal and water supply.

The outcome of the above is fragmentation and loss and/or modification of habitats, while biodiversity is directly and indirectly, threatened.

Furthermore, in all countries of focus the urbanization development as well as tourism activities concentrate close to environmentally sensitive areas or biodiversity hotspots.

Characteristic examples of areas exposed to related pressures are:

- The littoral zone of Ohrid Lake, in particular close to Ohrid and Struga cities in FYR Macedonia where the number of permanent residents and weekend houses, hotels, campsites, resorts, tourist and sport facilities are increasing rapidly. Pristine coastal areas, which are highly sensitive and of great importance for local endemic species, are increasingly under pressure. Coastal habitats and reed belts have been destroyed; macrophyte communities have been altered and new associations have developed in some locations; fish spawning grounds in these regions may convert from salmonid into cyprinid spawning grounds (Kostoski et al., 2010 and references therein). In the Albanian part around Pogradec and Tushemisht village the reed zones have been severely affected by uncontrolled development.
- The Kukes city in the Drin basin in Albania, where mass movement of population from rural areas and growing demands for new constructions are reported; currently, there are 0.2 km^2 of illegal constructions.
- The littoral zone of Shkoder/Skadar Lake. In the Montenegrin part there are illegal constructions even within the National Park borders. In the Albanian side 32% of the population in the area lives in illegal settlements.
- The coastal zone of Buna/Bojana which is perhaps the most affected area in this regard. In Montenegro the Velika Plaza beach, in spite of its proclamation as a Natural Monument, is degraded due to illegal building, excavation of sand and hunting. In Albania, in Velipoja, immigration has led in an increase of constructions -including many illegal- at the expense of the pine forest; the forest area has been significantly reduced (presently about 19 ha remain). Uncontrolled tourism development poses a risk to the biodiversity in the area, for instance, the system of sand dunes in the coastal areas at the Buna/Bojana mouth in Albania is under threat.
- Unauthorized recreational activities take place at several protected areas of the extended Drin River basin, even at the zones of strict protection and pose significant threats to the biota. For example in Ohrid Lake there is pressure exerted at the ecosystem from boat traffic; at the Velika Plaza beach in Montenegro, off-road vehicles running on beaches and building of trails to reach remote parts of the dune landscape are recorded. Sand dunes are also under pressure in the Velika Plaza in Montenegro due to unsustainable tourism practices.

Hunting

Unsustainable legal as well as illegal hunting is an issue for the entire ecosystem of the Shkoder/Skadar Lake and the Buna/Bojana River and delta. There are violations with regard to the:

- Protection status of certain areas i.e. hunting ban areas, such as the Ulcinj salina that is a site of outmost importance for migrating species;
- Species allowed to hunt e.g. hunting of rare and endangered breeding birds like the oyestercatcher during the breeding season in the Buna/Bojana sub-basin, the pygmy cormorant, the common redshank, the avocet etc.;
- Hunting ban period.

The long hunting season established in Montenegro should be noted among the issues of concern.

Furthermore, the insufficient or even lack of control in some cases attracts foreigners to hunt in the area creating a phenomenon of "illegal hunting tourism". "Tourist hunters" have been reported to hunt, even endangered species, also during the breeding season and/or within protected areas; in particular in the salinas of the Buna/Bojana delta.

As a consequence the bird populations –including endangered species - and mammals have been decimated and the suitability of the Buna/Bojana delta for breeding of migrating birds has been impaired. The exact impacts cannot be assessed since data on the status of several fauna groups are limited due to the absence of a regular and coordinated monitoring at national and transboundary levels.

Sand and gravel extraction

As already mentioned, sand and gravel extraction is a matter of environmental concern throughout the extended Drin River Basin. In addition to the direct impact to the benthic communities there are also indirect effects to biodiversity; these are due to the altered water flow and sediment distribution patterns (which furthermore favors erosion).

Climate variability

Climate variability seems to be linked to the water balance and flow patterns of the Drin River in the last decades. There are already some related evidences. In **Prespa basin**, native species of trout living in the river ecosystems is reported to have changed the geographical boundaries of its habitat in Greece and Albania as it has moved higher in colder waters. In FYR Macedonia, parts of a Brajno River dry-up during summer months, affecting the migration for reproduction of the endemic trout and Prespa barbell.

Should scenarios indicating that climate variability/change will affect the SEE be proven to be true there will be several effects:

- Riverine flood risk will generally increase, amplifying the threats to the riparian habitats in Albania (MEFWA, 2009).
- In Lake Ohrid, (Matzinger et al., 2007), increase of temperature is expected to reduce vertical mixing of the water column increasing the density difference between the surface and deep layers resulting in a decrease of dissolved oxygen in the deep water. Under the scenario of predicted atmospheric warming of 0.04°C per year, current anthropogenic phosphorus load would have to be reduced by at least 50% to maintain sufficient oxygen conditions for the fauna at the bottom of the lake.
- The coastal area of the Buna/Bojana delta will be affected by sea-level rise; it is projected that about 1 km^2 of wetland area will be lost by 2100. The coastal floodplain is expected to increase, while the coastal forestland and the low, unvegetated wetlands are likely to decrease. Likely enlargement of lagoons is expected to increase their capacity to host migratory birds and change the composition of bird population. Changes in aquatic flora and fauna species in favor of species more tolerant to higher temperatures and salinities are likely to occur (MEFWA, 2009).

Furthermore, the horizontal and vertical distribution of plant and animal species will change, as migrations to higher elevations are likely to occur, affecting the relict plant and animal species. Under climate change scenarios, the composition of the forests in the **Drin Basin** is expected to

change: evergreen species and oak forests are expected to enlarge, while areas of beech forests, which are more important to produce wood, would reduce. Common spruce forest is expected to disappear, while the alpine pasture on high mountains is expected to reduce more than ten times by 2100.

B. The Way Forward

- **Proceed with the on-going reform process at national level that will provide the basis for integrated and sustainable management of the basins**

Reforms guided mainly by the EU accession prospect are on-going in the countries of focus.

To this end efforts are being made, at varying levels in each country in consistence with the socio-economic and administrative capacities and with varying results aiming for:

- More effective approach of legal frameworks with regard to the management of natural resources and, furthermore, the adoption of the needed regulations that will make the framework laws applicable;
- Better design and adoption of a combined nexus of CAC and economic instruments. In the medium term these should be integrated with the national developmental and economic policies and coupled with efficient monitoring and enforcement mechanisms that would ensure that access to the natural resources is allocated fairly and efficiently among competent uses;
- Establishment of appropriately-scaled management institutions with clear - not overlapping competences over natural resources management and continuous improvement of their capacities and coordination;
- Establishment of rational and operational decentralisation that will allow the efficient involvement of local communities;
- Establishment of clear and applicable procedures that will ensure public awareness and balanced participation in the decision making;
- Development of mechanisms that will facilitate the financing of the natural resources management in accordance with the "user" and "polluter pays" principle.

It is obviously a difficult and time consuming process. As for the management of the water bodies difficulties are more evident for sectors that need major capital investments as these of liquid and solid waste management.

- **Adopt and implement the legal instruments that transpose the EU WFD – proceed with the initial implementation steps such as the analysis of the characteristics of the basins.**

The aforementioned difficulties are also valid in the case of adoption and implementation of "demanding" legal instruments such as the EU WFD that require effective coordination across sectors and an overall enhanced administrative capacity.

Preparing and implementing basin management plans and establishing monitoring systems in consistence with the provisions of the EU WFD is a task that will need the commitment of substantial resources.

The countries need to proceed with the analysis of the characteristics of the basins (natural values in place, uses, pressures etc.) in accordance to the EU WFD being the basis for any future managerial actions at national and transboundary level. Analysis made in the framework of the GEF projects in Prespa, Ohrid, Shkoder/Skadar (State of the Environment reports, Transboundary Diagnostic Analysis, Socio-economic studies etc.) and in the framework of projects supported by the EU and the international community, provides valuable background information. Such work at the national level is on going for the Black Drin sub-basin in FYR Macedonia in the

framework of implementation of the new Law on Waters and is expected to be initiated soon in the part of Drin that extends in Albania as part of a World Bank supported project. The analysis of existing information will be initiated soon in the Buna/Bojana sub-basin (both in Albania and Montenegro) as means for the preparation of an integrated water and coastal management plan in the framework of the GEF MedPartnership project. A basin management plan for Prespa is on its way.

In the case of Black Drin in FYR Macedonia and Drin Basin in Albania it needs to be secured that there is coordination to assure that the same or compatible procedures and techniques are used for the characterization of the sub-basins so as the outcomes to be comparable and enable at a later stage the identification of measures in the framework of a river basin management plan.

- **Create the conditions for enhanced cooperation for the integrated management of shared basins.**

Reach science based consensus on transboundary issues of priority to address and environmental objectives to achieve.

The interlinks between the water bodies in the Drin sub-basins are obvious; however, what are not obvious are the hydrologic interaction patterns among the components of this complicated system and especially between surface waters and groundwater. These interactions govern the way the Drin system functions as a whole hence it is imperative to sufficiently understand them through systematic effort at the Drin Basin level. Central elements in this regard are: the connection of the Lake Ohrid and Lake Prespa watersheds through karst formations; the effects of the flow of Drin River in the Buna/Bojana River to the hydrological regime of the Shkoder/Skadar Lake, Buna/Bojana River, the linked karst and alluvial aquifers as well as the morphology and function of the Buna/Bojana Delta in the Adriatic Sea.

Such knowledge incorporating, to the extent possible, climate change and variability considerations will be the basis to understand the effect of the current water uses in the hydrology of the system hence, support the decision makers towards the sustainable management of the Drin Basin and its sub-basins.

This, combined with the information that will be acquired through the WFD implementation process could be used for a science based discussion and, hopefully, consensus among countries on (i) the transboundary implications of the shared nature of the Basin's water resources; (ii) key transboundary concerns to be addressed; (iii) environmental objectives to achieve and; (iv) common indicators to be used for the monitoring of the state of the environment.

Agree on commonly acceptable management standards - Harmonize rules and regulations for the management of shared basins

If, for the sake of the argument, assume that there is an "ideal" way for advancing in applied cooperation for transboundary basin management in the area, this would require countries to conclude first with the legal and institutional reforms at national /sub-national level (in order for all components for sustainable management of natural resources to be in place) and then move towards transboundary (international) cooperation activities. Reality suggests that an "alternative" path should be followed i.e. the two phases of the process to move in parallel. The

on-going reforms can benefit the cooperation between the countries for the management of the shared water bodies while international cooperation could speed up national reforms.

The approximation process to the EU acquis is gradually leading to *de facto* harmonized legal instruments for the management of natural resources. Countries could use the momentum and go a step further. Taking into consideration the different level of the approximation process in each country, commonly agreed standards for the management of the shared basins on the basis of WFD and international conventions may be used for the design of rules and regulations specifically for the management of the basins in a coordinated and consistent manner, taking of course into consideration the specific needs and realities in each case. The EIA and SEA related legislation and procedures could provide a framework of an initial harmonization exercise.

Establish harmonized monitoring approaches and data collection methods and eventually harmonized monitoring and information systems

Accurate and up-to date information on the status and trends of key elements in a basin system is essential for effective protection and management. For a transboundary water body/system of water bodies it is important that harmonized or, at least, similar monitoring approaches and data collection methods are used by each country, that a common database is established with open and efficient exchange of information, and that analysis is carried out based on priorities concerning the water body as a whole.

These would provide the basis for more efficient collaboration and further building of trust. This becomes particularly important when future basin wide management measures and/or development activities are planned in the Drin catchments area. They may also provide the necessary information to decision makers to reach to commonly agreed management objectives facilitating cooperative management.

In the case of Ohrid Lake and its tributaries, the two countries have succeeded the harmonization of procedures for water monitoring, establishing Joint Protocols for sampling analyzing and quality assurance. A Working Group consisting of Experts from all Drin Riparians could work towards the harmonization of relevant procedures across the extended Drin Basin.

The countries will come across challenges such as different types of equipment, standards, and analyzing methodology etc. and limited financing. Nevertheless, these are not restricted to this region; examples from other regions may guide the process. What is important is for the process to be initiated and gradually adjusted to the realities of the region. Ensuring more reliable data results through for instance laboratory inter-comparison exercises could be the first step at the extended Drin Basin level to lead towards more harmonised monitoring procedures. Work performed in the framework of international research projects such as DRIMPOL and DRIMON involving institutions from the three countries can provide useful background. The momentum created through the Drin Dialogue process should be used in this regard.

Involve local stakeholders and continue the dialogue for the management of the Drin Basin

The collaboration, compromise and consensus-building necessary for coordinative/cooperative and eventually joint decision making depends upon open dialogue, goodwill and trust among the key stakeholders. Local stakeholders should also be involved; there is no “golden rule” in terms

of when and how to involve these. It depends among others on the economic activities, socio-economic conditions, the way that the cooperative process has been initiated and evolved etc.

Experience from the region suggests that the involvement of stakeholders early in the process or the initiation of the process by the local stakeholders has facilitated transboundary cooperation. The Drin Dialogue Process involving the stakeholders in a process for the establishment of a strategic shared vision offers the same experience: it has facilitated the political commitment through the Ohrid Ministerial Declaration (April 2011) and the signing of the MoU for the management of the Drin Basin (Tirana, 25 November 2011).

The sustaining of the involvement of stakeholders will be a crucial factor for the implementation of the short, medium and long term objectives described in the MoU. A stakeholders analysis and the preparation of a public participation plan and a strategic communication plan would assist in grasping in their full extend the benefits of structured stakeholders participation.

Enable sustainable function of the existing institutions for the joint management of the Drin sub-basins

It is critical for the governments and international donors to assist sustaining and enhancing the functions of the existing joint commissions and committees in Prespa, Ohrid and Shkoder/Skadar lakes. Upgrading gradually their role and capacity to prepare and implement plans and become financially sustainable is of key importance for the future. Establishment of regional funding mechanisms, introduction of innovative financing tools (e.g. Inter-riparian financing, Trust funds, Levying Taxes etc), generation of new income from ecotourism and alternative activities are indicative instruments in this regard.

Such steps need substantial political commitment, funding and a great effort from all stakeholders. International and regional experience has shown though, that it is feasible –Sava and Danube River Basins are such examples providing lessons to follow.

Institutionalize cooperative/coordinative action at the extended Drin River Basin system level

The hydrologic interdependences between the different water bodies of the extended Drin Basin hydrological system are extending to interdependencies at the ecosystems and socio-economic levels. This fact advocates for strong cooperation among the riparian countries eventually institutionalized in the form of an official joint body that will eventually ensure joint management.

The ultimate goal will be to create the conditions to reach a point in the future where the scale of coordinative/cooperative management reach, in addition to this for single water bodies, to the hydrological interconnected system of the Drin Basin, eventually leading from the sharing of waters between countries and conflicting uses, to the sharing of benefits between stakeholders in an area that is physically, culturally and historically interconnected.

A multi-level process need to be followed to succeed such level of cooperation. International experience suggests that usually this process is time consuming, and the end goal difficult to obtain.

Nevertheless, in the case of the Drin Basin some pieces of the puzzle are already in place i.e. cooperation processes and activities initiated in some of the sub-basins.

The establishment of the Drin Core Group offers an initial basis for future joint management as it is a platform for coordination among the Riparians and the join management bodies in place. Its sustained function will be a factor that will determine the success of the cooperation process at the transboundary level.

The extended involvement of GEF in the area is an additional positive parameter. The fact that Albania and Greece are parties to the UNECE Water Convention and that FYR Macedonia is preparing to ratify it in combination to the relevant intention of Montenegro further improves the possibility for joint action.

The GEF involvement

The on-going support from the EU, international organizations and donor countries for revising legal frameworks, developing plans, building capacities, constructing infrastructures etc. has significantly contributed towards building the framework for the sustainable management of natural resources and enhancing the cooperation process between the littoral countries.

It is the involvement of GEF though, that has catalyzed transboundary cooperation in the area. GEF financing is targeted to provide catalytic support for the global and regional components that would not be otherwise funded by the national governments. GEF projects have catalyzed the initiation of a transboundary approach to basin management in the cases of Ohrid and Shkoder/Skadar or enhanced the existing cooperative procedure in the case of Prespa.

The GEF IW:LEARN project (2005 – 2008) has supported activities within the Petersberg Phase II / Athens Declaration Process and through this a regional dialogue in the Southeastern Europe on aspects of transboundary water resources management. The International Roundtable "Integrated Shared Lake Basin Management in Southeastern Europe", 12 - 14 October 2006, Ohrid, FYR Macedonia gave for the first time the chance to the stakeholders to discuss issues and aspirations for the management of the extended Drin Basin. Communication among stakeholders has been initiated and systematically facilitated ever since.

The tested approach of GEF could achieve outcomes in the case of the extended Drin. The projects financed by donors –including donor countries- aim mainly at addressing issues at the national level as a regional/cooperative approach is difficult to achieve outcomes because of the complex character of the Drin Basin. Support from GEF could catalyze cooperation by investing (i) in understanding the extremely complex hydrology in the Basin (ii) to facilitate the identification of priority transboundary issues through a Transboundary Diagnostic Analysis (iii) on the development of a Strategic Action Plan to address the causes of these issues through actions at the national and transboundary levels (iv) on activities such as capacity building, information acquisition and management, monitoring procedures, meaningful stakeholders involvement etc. that will secure the sustaining of the outcomes.

The UNECE involvement

The implementation of the Water Convention –the UNECE offers the necessary assistance- can greatly assist in the creation the aforementioned conditions for enhanced cooperation for the integrated management of shared basins. Parties to the Convention are obliged to conclude specific bilateral or multilateral agreements providing for the establishment of joint bodies

(institutional arrangements such as river basin commissions). These joint bodies must agree on a common action plan to reduce pollution, in addition to agreeing on water quality objectives and waste-water emission limits. They are also required to cooperate on information exchange and monitoring and assessment. Early warning systems must be established to warn neighbouring countries of any critical situation such as flooding or accidental pollution that may have a transboundary impact. Parties to the Convention are also required to inform the general public of the state of transboundary waters and any prevailing or future measures.

Furthermore, the UNECE documents i.e. “Guidance on Water and Adaptation to Climate Change”, “Strategies for monitoring and assessment of transboundary rivers, lakes and groundwater” and, “Recommendations on Payments for Ecosystem Services in Integrated Water Resources Management” can provide valuable guidance for the implementation of related activities.