Study and Analysis of Innovative Financing for Sustainable Forest Management in the Southwest Balkan

Cross Cutting Issues and Summary of the Ulza Watershed Case

Date prepared: October 2014

Financed by: WB – PROFOR
Contract number: 7165252

Connecting Natural Values & People Foundation

a legacy organisation of SNV in the Balkans

Study and Analysis of Innovative Financing for Sustainable Forest Management in the Southwest Balkan

About PROFOR

PROFOR is a multi-donor trust fund program housed at the World Bank within the Environmentally and Socially Sustainable Development (ESSD) Forests Team. PROFOR is funded by the Department for International Development (DFID) of the United Kingdom, the Finnish Department for International Development Cooperation, the Japanese International Forestry Cooperation Office and Swiss Development Cooperation (SDC). The German Government is an in-kind contributor. Initially established in 1997 at the United Nations Development Programme (UNDP), PROFOR relocated to the World Bank in 2002. PROFOR's objectives are consistent with those of the World Bank's Forest Strategy and Policy (approved in October 2002), and PROFOR collaborates closely with the Bank in implementing the Strategy, which is built on three pillars: harnessing the potential of forests to reduce poverty; integrating forests in sustainable economic development; and protecting global forest values. A Management Board comprised of representatives from donor agencies, client countries, international organizations, NGOs and the private sector provides strategic guidance to PROFOR and determines what activities are included in the PROFOR portfolio. The Management Board holds one formal meeting each year, maintaining an active role through correspondence and informal meetings in the interim. (*www.profor.info*)

This project is financed by: WB - PROFOR

About the project

CNVP in cooperation with the Faculty of Forestry of Skopje, Macedonia and the Regional Federation of Communal Forests and Pastures in Diber, Albania is implementing the WB-PROFOR project on '*Further Study and Analysis of Innovative Financing for Sustainable Forest Management in the Southwest Balkans*'. The first phase of the study is implemented through two cases; in Albania on SFM and watershed management in the Ulza watershed, and in Kosovo on SFM and wood biomass production and use. The first phase of the project was implemented by CNVP in cooperation with NRS Kosovo, REGEA Croatia, Diava Consulting, Albania, Faculty of Forestry, Macedonia and Wageningen University, The Netherlands. The first two-year phase ended in October 2013. The second phase continues with the Albania case on erosion, run off and sedimentation monitoring in the Ulza watershed.

The Albania case on the Ulza Watershed is focused on erosion monitoring and sedimentation in the Ulza reservoir and will continue until October 2014. The research continues with the field measurements on erosion and runoff on different land use types. Based on the initial results, some adjustments were made on the erosion plots. A higher focus is given to different forest types with different covers and structures; also, further attention is given to gully erosion.

In addition to the land use effects on erosion, this phase will carry out another bathymetry measurement of the Ulza Lake. This was also performed in 2013 and even though the interval was short, a new bathymetry measurement was made in spring 2014 when the lake is at full capacity. This will allow comparison and indicate the level of current sedimentation.

To be able to better connect the effects on different land use types and the sedimentation in the reservoir, a watershed erosion risk assessment and overall land cover assessment will be performed. This will give insights into the areas most prone to erosion in the watershed and the process of sediment transportation from fields, into streams, rivers and the lake.

Currently, the WB and the Government of Albania are in the process of finalization of the expected new ESP (Environmental Services Project). The ESP will, among other things, focus on specific environmental services and pilot for Payment for Environmental Services. This current study on watershed management demonstrates through sound scientific methodologies how payments for environmental services (PES) could benefit rural land owners and private dam operators while improving environmental sustainability. The baseline data generated will form the basis for a local PES scheme.

The results and lessons learned from the study are disseminated locally, regionally and internationally to promote broader adoption of similarly innovative financing mechanisms. One can find all results on the project website: www.cnvp-wbprofor.org. This website includes also the project results of the first phase.

This document

This report provides the summary and cross cutting issues from the Ulza Watershed Case of this study. It presents the overall results of the influence of forests and other land uses on erosion and sedimentation. It also provides the results of comparative analyses between the two phases of the study, 2011 through 2014. All results are based on the underlying technical documents for the Erosion Case, presented in detail within this study.

CNVP – Connecting Natural Value for People Foundation
CNVP Albania Office
7th floor Zayed Business Centre, Rr. Sulejman Delvina, Tirana, Albania
Tel: +355-4-222 9642
E-mail: info@cnvp-eu.org, Website: www.cnvp-eu.org

Acknowledgements

This report was prepared by:

Prof. Dr. Ivan Blinkov, Ss. Cyril and Methodius University, Faculty of forestry in Skopje, Department for Land and Water
Peter Kampen MSc Forestry, Executive Director CNVP

The report made use of the studies and results from the project for the Watershed Case on erosion in Ulza. These underlying studies were only made possible with the contribution of the whole project team engaged in the study.

Content

List of figures

List of tables

Abbreviations

asl	above sea level
CNVP	Connecting Natural Values & People Foundation
DEM	Digital Elevation Map
EPM	Erosion Potential Method
PES	Payment for Environmental Services
PROFOR	Programme for Forests
SFM	Sustainable Forest Management
UHPP	Ulza Hydro Power Plant
WB	World Bank

1. Introduction

The WB-PROFOR project on 'Study and Analysis of Innovative Financing for Sustainable Forest Management in the Southwest Balkans' is implemented through two cases; in Albania on SFM (Sustainable Forest Management) and watershed management in the Ulza watershed, and in Kosovo on SFM and wood biomass production and utilisation. The first phase lasted two years and was completed in October 2013. The second phase was a continuation of the study on the Ulza Watershed in Albania. It started in November 2013 and was completed in October 2014. The study has been implemented by CNVP in cooperation with experts from the Forestry Faculty of the Skopje University of Macedonia and the Federation of Communal Forests and Pastures Diber in Albania in the second phase.

This report provides a summary and some cross cutting issues of the Ulza Watershed Management case in Albania. Figure 1 gives some images of the Ulza watershed. There are many documents and specific results obtained from this study. All these documents are provided at the project website; www.cnvp-wbprofor.org. A list of all publications is provided in Annex 1 of this report, including the publications of the wood biomass case.

Figure 1: The Ulza Watershed

In the first phase, in addition to the social aspects on downstream and upstream stakeholders, a specific study was made through field research for erosion at different land uses and using bathymetry analysis to assess the level of sedimentation in the Ulza reservoir. In the second phase the study concentrated on a continuation of the erosion monitoring under different land use types in which further attention was given to levels of erosion at different forest types and erosion in gullies. A second bathymetry was carried out to further quantify the sedimentation in the reservoir. Additionally, an erosion risk mapping and analysis of sediment transportation in the watershed was made.

The results of this are presented below, after a short introduction of the Ulza watershed. Chapter 3 presents the bathymetry results, followed by the erosion risk mapping and sediment transportation. The erosion monitoring results for different land uses are provided in Chapter 6. A short comparison is made with a similar watershed in the region in Chapter 7, followed by conclusions and recommendations.

2. The Ulza Watershed

The Ulza watershed is located in (and is a sub-watershed of) the Mati river basin about 70 km from Tirana, covering almost the entire Mat district of the Diber region (refer figure 2). The main towns in the watershed are Burrel and Klos, while the watershed further comprises 13 Communes (2 of which are partially located in the watershed).

Figure 2: Mati River and Study area

The total area of the Ulza watershed is 122,435 ha (1,224.34 km^2). The Ulza Lake, which is used as reservoir for the Ulza Hydro Power Plant (UHPP), forms the central part of the watershed together with the valley of the Mati River. The area slopes gently to the Mati river valley from approximately 500 m asl to approximately 80-120 m asl. The surrounding mountains forming the watershed reach to over 2000 m asl, with the highest peak at 2245 m asl. The elevation map of the watershed is presented in figure 3.

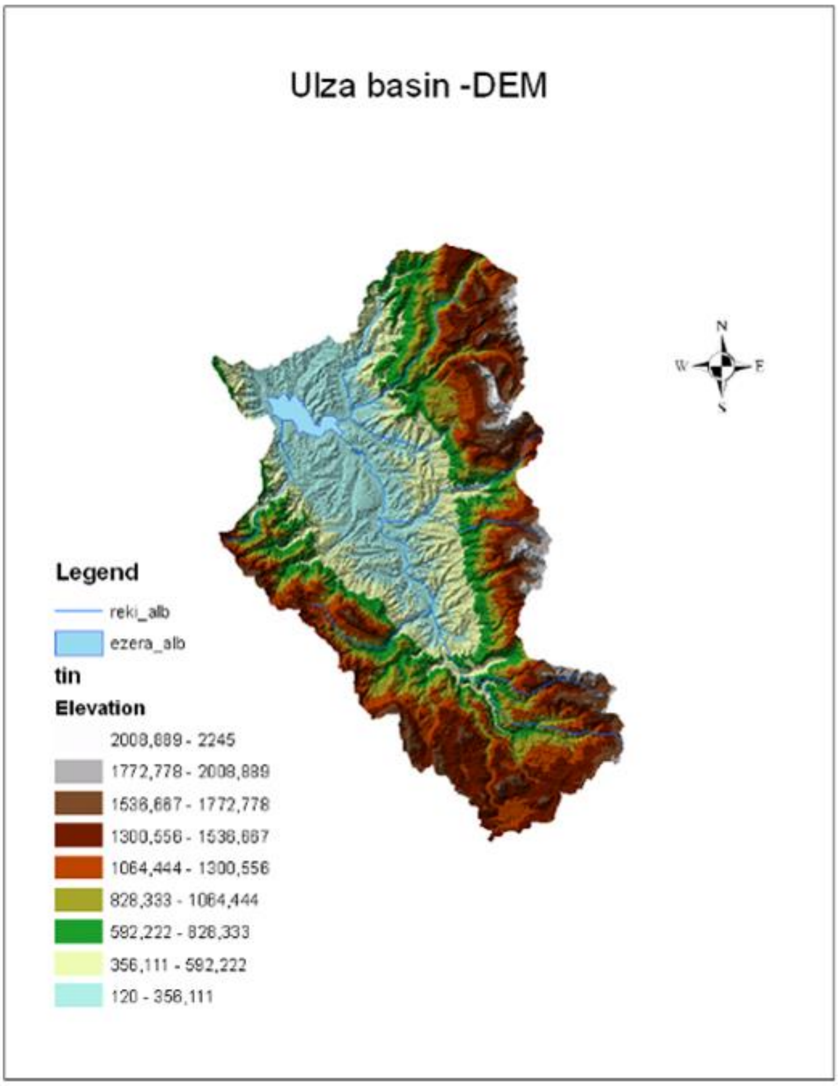


Figure 3: Ulza Watershed Digital Elevation Map (DEM)[1]

The Ulza watershed area feeds the UHPP, which is located on the Mati River upstream from the mouth of the Fani River and near the villages of Ulza and Baze. The UHPP has a 64 m high concrete gravity dam with a straight axis and an impounded volume of 240 million m^3. The formed hydro lake (water reservoir), constructed in 1958, serves as a head source for the Mati River flow. The UHPP was recently privatized, in 2013, and is now under the management of Kurum Group from Turkey[2].

2.1 Erosion problem in the watershed

Erosion is a widespread phenomenon in Albania and is a cause for many problems leading to land degradation on the eroded sites, but also causes downstream problems due to siltation, sedimentation and flooding. The Ulza watershed is a typical example in Albania of an area with high to extremely high erosion (figure 4). This is causing direct land degradation, but in the Ulza case also leads to high sedimentation of the Ulza reservoir with a negative impact on the UHPP. It also creates damages

[1] '*Watershed Topography map*' under the WB-PROFOR SFM PES project, November 2012

[2] '*Description of Ulza watershed boundary*', Blinkov, I., Faculty of Forestry, Skopje, Republic of Macedonia, September 2013, PUB_06 under the WB-PROFOR SFM PES project

and costs for other stakeholders and water users in the watershed. It leads to damages of road and irrigation infrastructures and increased flooding.[3]

Figure 4: Erosion in the Ulza Watershed

Generally, it is understood that sustainable and improved land management upstream in a watershed has a positive effect on reducing erosion and leads to increased soil stability and reduces the negative impact downstream. It is expected that SFM and sustainable grassland (range land) management are land use systems that contribute well to erosion control. These land use types provide an ecosystem service that leads to benefits both for the actual land owners and users, and downstream water users. However, the efforts and costs for reversing the land degradation and/or maintaining these areas lie with the land owners and users. Payments for Environmental Services (PES) are a way in which beneficiaries can contribute to or pay for the services obtained from others.[4]

Although the PES scheme is a logical and simple concept in its principles, complications arise when trying to implement it in practice. To be able to implement a PES scheme related to soil stability and erosion control in the case of the Ulza watershed it is necessary to fully understand the relationships between upstream land management and downstream benefits. It is necessary to qualify and quantify the different aspects of erosion and sedimentation. The WB PROFOR study has focussed on these aspects to understand, show and quantify the environmental service from different land uses, especially forest to erosion control and downstream benefits.

2.2 Ulza Watershed stakeholders and their perception

The stakeholders, both downstream and upstream, related to environmental services in the watershed were identified. Their understanding and perception were assessed according to; (i) land use practices and the influence and the levels of erosion effects, and (ii) their willingness to pay for ecosystem services. The study involved 100 questionnaires for downstream stakeholders and 110 questionnaires for upstream stakeholders. See figure 5 below for the location of the down and upstream actors.

[3] PUB_05-Occurrence of Landslides and Flooding, '*Occurrence of Landslides and Flooding, past and current*', Diava and CNVP, July 2013, PUB_05 under the WB-PROFOR SFM PES project
[4] '*Payment for Environmental Services: Characteristics and Examples, an Overview*' prepared by Iskra Konevska, Wageningen University, August 2013, PUB_08 under the WB-PROFOR SFM PES project

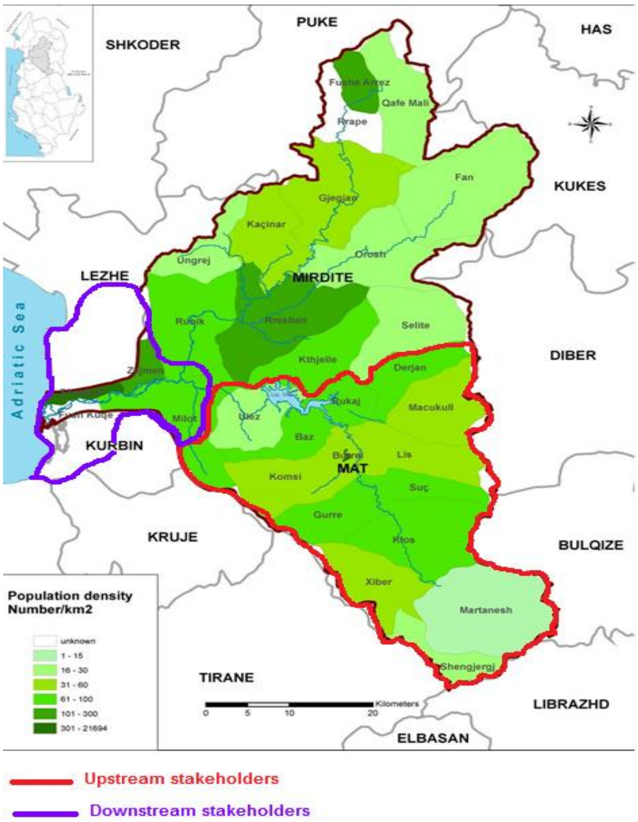


Figure 5: Location of the upstream and downstream stakeholders interviewed (area in green is the entire river Fan/Mat basin; area circled in red forms the Ulza watershed)

The main uses of the water downstream are: 1) consumption and irrigation by farmers, 2) hydropower generation by UHPP and 3) washing gravel and sand by extraction and processing companies of raw materials in the Mati river bed.

More than 85% of the downstream stakeholders regard variations in water flow, reduced seasonal flows and sedimentation as main problems. Downstream stakeholders believe that deforestation, forest fires, gravel extraction activities in the watershed and river bed, and grazing of livestock in forests are the main causes for undermining hydro regimes and accelerating erosion. Around 98% of the people interviewed downstream stated that there is a connection between the erosion in Ulza's upstream watershed and the water problems happening downstream; while 88% of the people interviewed upstream believe there is a correlation between natural resources management upstream and (negative or positive) impacts downstream. Furthermore, 60% of the upstream respondents believe that private communal forests are in very good condition, 68% think that common use communal forests are in average condition, while 60% believe the state forests are in poor or degraded conditions. Almost all stakeholders think that a PES scheme for Ulza watershed would be essential to maintain, safeguard or improve the environmental services, such as erosion control. They generally feel that in order to be able to set up such a PES scheme the Government needs to be a main contributor to the PES scheme. Only around 12% of interviewed stakeholders are willing to pay for environmental services such as reduced erosion and reduced sedimentation.

In general it appears that all stakeholders are aware of the relationship between upstream land management and downstream benefits or problems related to erosion. On one hand they value the provision of environmental services, but on the other hand are reserved in their willingness to directly contribute to a PES. Much of this is coming from unfamiliarity with PES schemes and limited understanding of a functional PES scheme. At the moment such is not, yet, existing in Albania. They are, however, often well able to qualify the negative effects of erosion, while they are less able to do so for the environmental services. Further understanding and qualification of the environmental services will contribute to the PES system.[5]

[5] '*Ulza Downstream and Upstream Stakeholder Analysis*', Diava, CNVP, 2013, PUB_16 under the WB-PROFOR SFM PES project

3. Sedimentation in the Ulza reservoir

To understand the magnitude of erosion it is important to know the amount of sedimentation in the watershed. How much sedimentation is present in the lake? To what extend has the lake filled during its existence since 1958 (refer figure 6)?

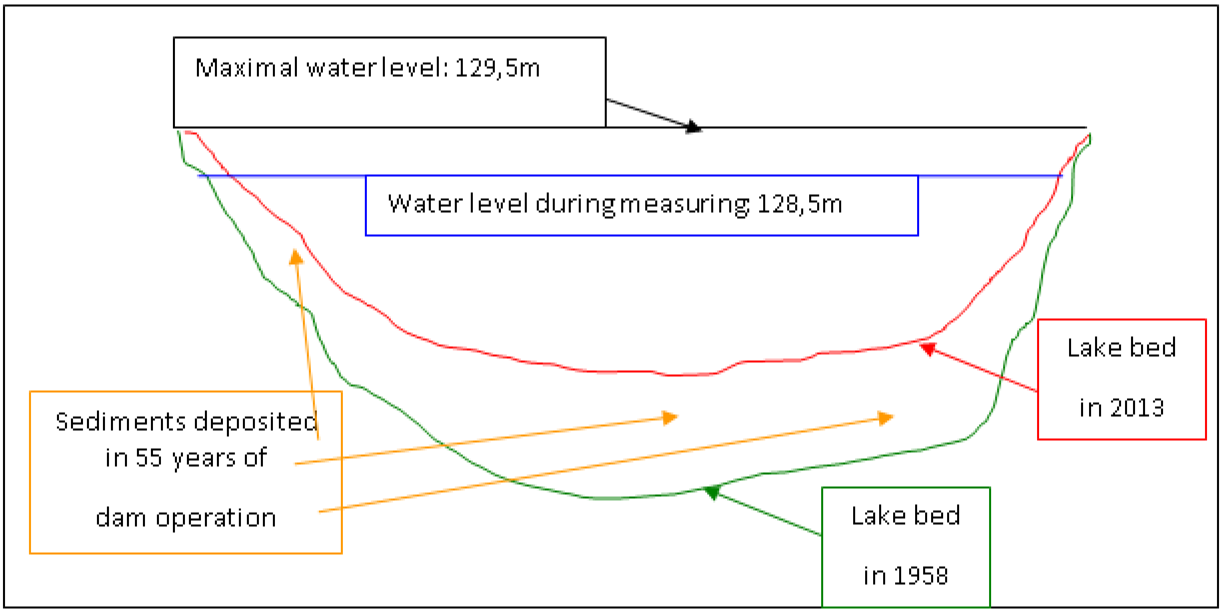


Figure 6: Schematic view of sedimentation in the Ulza reservoir

The reservoir and the dam are shown in the picture below.

Figure 7: The UHPP dam and its lake

One way of assessing this is through bathymetry measurements of the Ulza reservoir measuring the deposited sediment and calculating the quantity of accumulated sediment. The bathymetry used echo-sounding in which 6 points per second were measured. In total this resulted in 360,000 measured points and 355,000 points after correction.[6] The importance of reducing erosion and, therefore, sedimentation

[6] '*Ulza Reservoir Bathymetry and Lifespan Analysis*', Trendafilov A. and Mincev I., Faculty of Forestry, Skopje, Republic of Macedonia, August 2013, PUB_07 under the WB-PROFOR SFM PES project

became very apparent through the bathymetry measurements of the hydropower reservoir.

The 2013 bathymetry measurement showed significant sedimentation, with at least 31.5% of the total reservoir storage filled with sediment (figure 8). More importantly, sedimentation has reduced the operational capacity because 23.3% of the sedimentation is already in the "operational storage" of the reservoir, decreasing its volume and functioning (figure 8). Especially the reduction of the operation capacity is a concern since this has a direct economic effect on the UHPP. It increases the urgency to reduce erosion and sedimentation in the Ulza watershed.

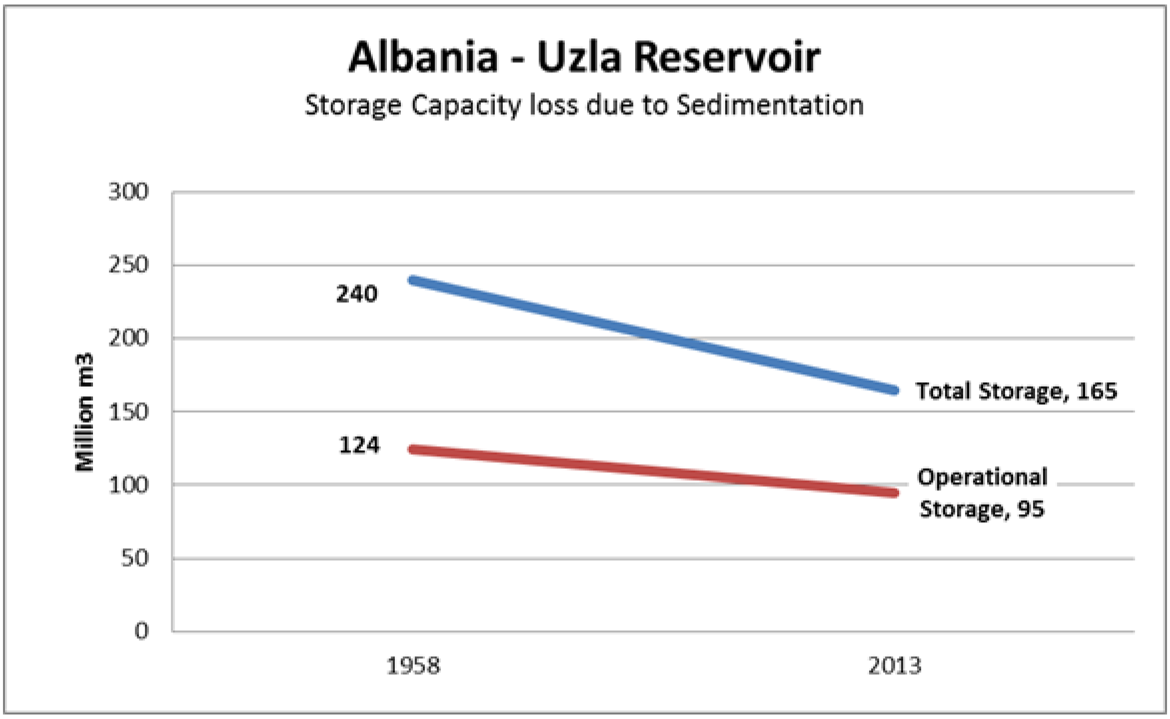


Figure 8: Level of reduced operation and total storage of the Ulza reservoir

Significant sedimentation of the operational storage starts about 4 km upstream from the dam, while the larger part of the "dead storage" is already filled with sediment. The average annual quantity of deposited sediment (1,331,741 m^3/year for the whole watershed and 1,113 m^3/km^2/year) is at least three times the average in the region. Future sediments will deposit additionally in the operational storage because a significant part of the non-operational storage has been filled (see figure below).[7]

[7] '*Ulza Reservoir Bathymetry and Lifespan Analysis*', Trendafilov A. and Mincev I., Faculty of Forestry, Skopje, Republic of Macedonia, August 2013, PUB_07 under the WB-PROFOR SFM PES project

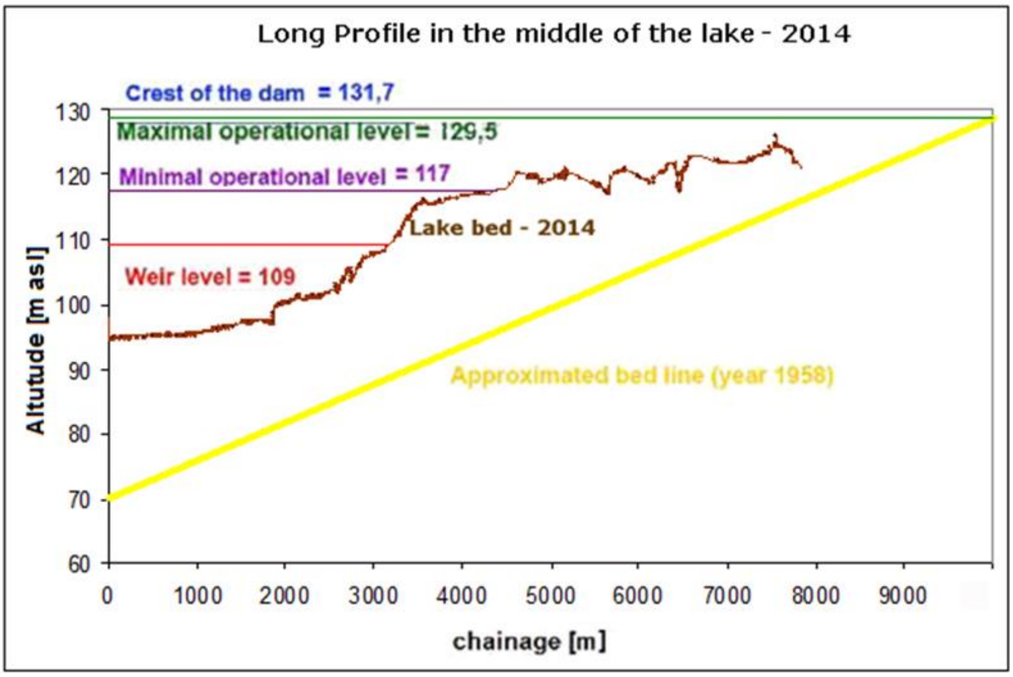


Figure 9: Long profile in the middle of the lake

In 2014 a further bathymetry measurement was made confirming the results (table 1). Unfortunately there is no zero bathymetry available this reduces to certain extend the exact measurements. The two measurements confirm each other and correspond well with the produced and transported sedimentation measured according the Gavrilovic method (table 2 in chapter 4).

Table 1: Bathymetry results 2013 and 2014

Bathymetry results	2013	2014
Total storage [m^3]	152,979,989	153,322,492
Total volume of sediment [m^3]	74,920,011	74,577,508
Percentage reservoir filled [%]	31.2%	31.1%
Average Annual Sedimentation [m^3/y]	1,362,182	1,331,741

There is an unexpected difference between the two measurements. The 2014 shows a slightly lower level of sedimentation, whereas it would be expected that it would be higher. There are three possible reasons:

- Different and longer route of measuring in 2014. In 2013 the water level was lower and therefore some of the peripheral parts (very shallow parts) of the lake could not be measured. It was estimated under the assumption that most of it was filled with sediments. In 2014 the water level was higher and these parts could be measured and some parts had less sediment than earlier assumed.
- Consolidation processes of sediments. In 2013 there were extreme rainfalls in March causing high erosion events and fresh sedimentation in the reservoir. The bathymetry was carried out in May. Quite a large portion of these fresh sediments were not yet consolidated at the time of the measurement in May 2013 and it is assumed that this contributed to the higher level of bathymetry measured in comparison to the measurement of 2014.
- Use of different echo-sounders might have contributed to the difference. This is, however very limited and regarded as not relevant.

However, the two measurements confirm the total level of sedimentation and the high value of average annual sedimentation in the Ulza Lake (more than three times in the region).[8] Future bathymetry measurements with a longer interval period will provide insight into the sediment progress and current annual sedimentation.

---

[8] '*Ulza reservoir, Second Bathymetry and Lifespan Analysis*', CNVP, Trendafilov, A., Mincev, I., and Blinkov, I, September 2014, PUB_20 under WB-PROFOR SFM PES project

4. Erosion risk mapping and sediment transportation

The amounts of sedimentation in the reservoir are known. The next step is to know where these sediments come from and how they are transported. Erosion mapping and modelling was carried out in order to assess this. The EPM method, Erosion Potential Method of Gavrilovic, was used as the most appropriate method in the case of watershed resource management.[9] The EPM method uses an erosion coefficient which assess for each area the risk for erosion, taking several criteria in consideration – soil, slope, land use and occurrence of erosion phenomena's.

The erosion risk maps (figure 10 and 11) of the watershed indicate the different erosion levels and erosion sensitivity in the watershed. The map shows the areas with high erosion risks. This can be used to identify areas which would need specific measures for erosion control.

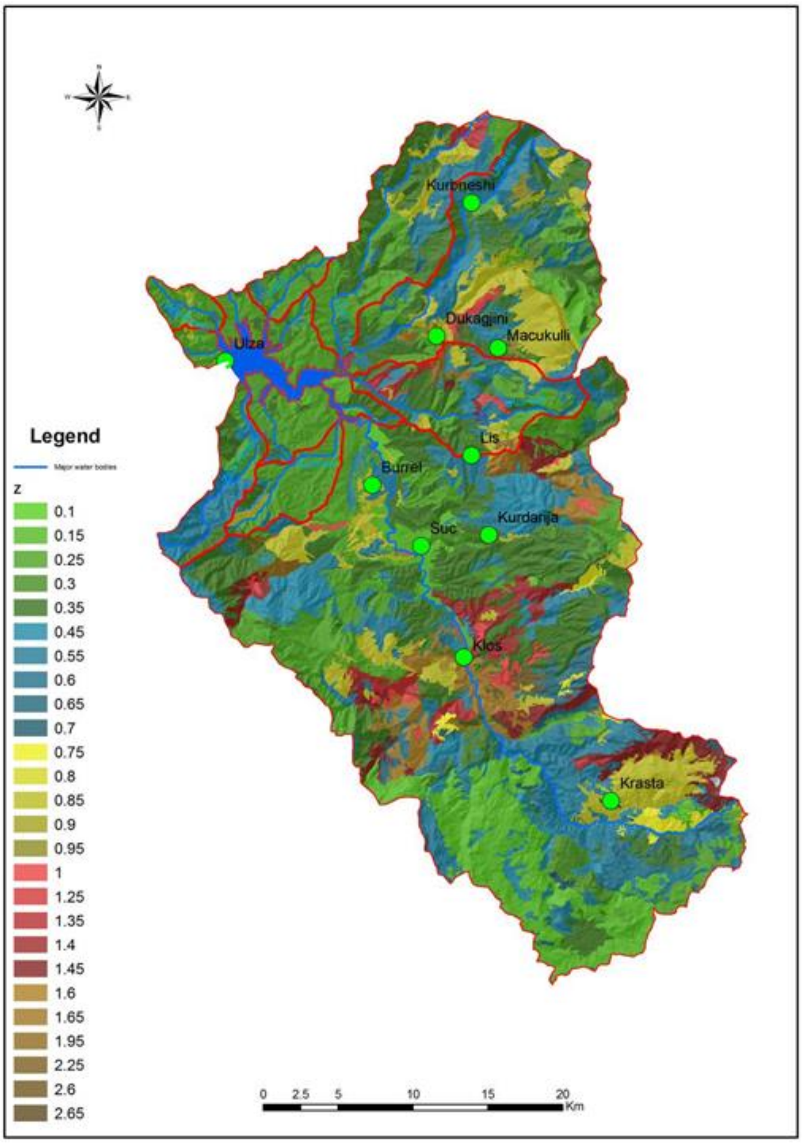


Figure 10: Prepared Erosion map of Ulza Watershed - detailed classification, based on the erosion coefficient: Z (0 = very low and > 2 is extreme erosion)

[9] Gavrilovic Z. Stefanovic M., Milojevic M., Cotric J., 2008, Erosion Potential Method, An Important Support For Integrated Water Resource Management, BALWOIS 2008

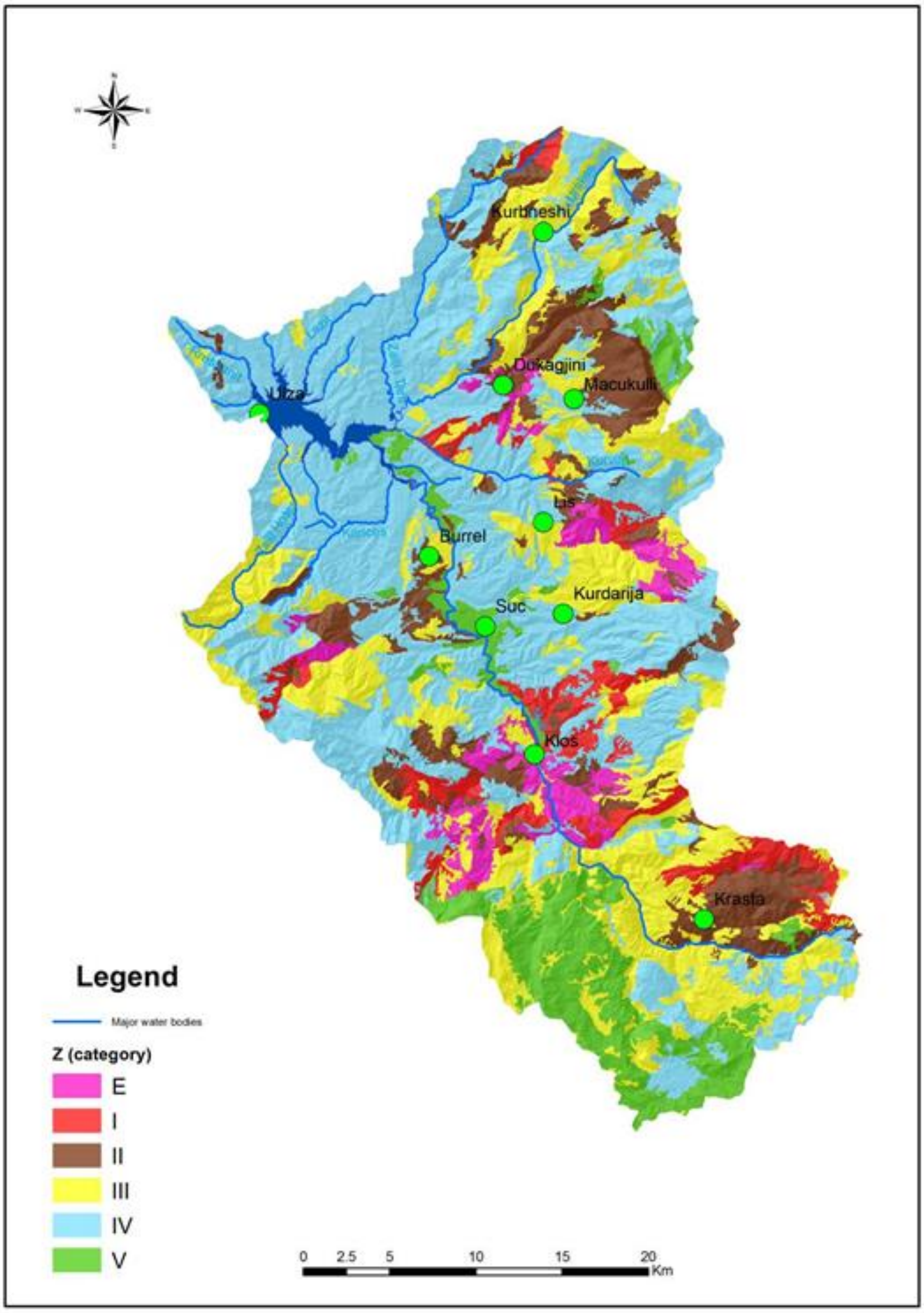


Figure 11: Prepared Erosion map of Ulza Watershed - grouped classes, with V categories of erosion risk (according to EPM) and E (the most extreme level of erosion)

The whole watershed was assessed using these classes.

The highest erosion occurs on 9.67% of the category I and E area (117 km^2), and is designated as territory where urgent erosion control works are necessary. Additionally, stronger erosion processes (II and III category) are spread on 36.35% or 440 km^2 (figure 12).

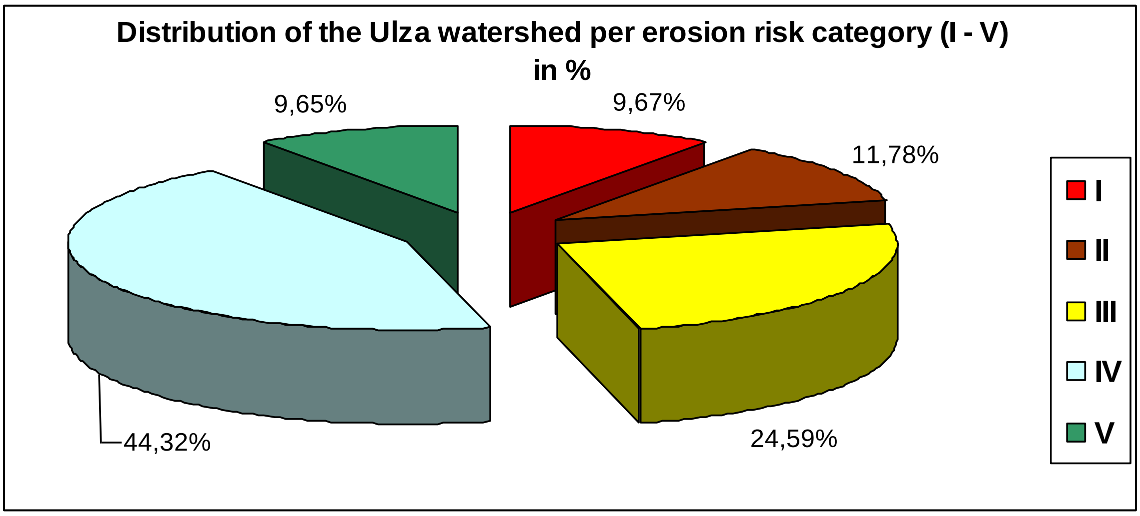


Figure 12: Distribution of the erosion risk category in percentage in Ulza watershed area

The erosion map is made using the land uses in the watershed and through on-field observation by assigning an erosion co-efficient to each area (see figure 13 for examples). The coefficient is a measure of erosion and is valuable in comparing areas on erosion levels and risks.

Figure 13: Examples of erosion (sheet and gully) classified with the erosion coefficient

The average erosion coefficient for the watershed is 0.54, which is very high since it is an average value for the whole watershed. The most erosive sub-catchments in the Ulza watershed are Kurwait (erosion coefficient 0.60) and Mat (0.58).

Using the erosion coefficient the total mean annual quantity of produced erosive material on the catchment is calculated as 1,826,140 m^3/year or 1,507 m^3/km^2/year. Not all sediment produced reaches the reservoir. Certain sedimentations are deposited within the watershed. The actual sedimentation into the lake is calculated, based on distance, steepness and kinetic power in the streams. The mean annual quantity of transported sediment to the reservoir storage is 1,343,467 m^3/year or 1108 m^3/km^2 annually, which comes as a result of the significant transportation energy in the catchment. The Mat sub-catchment causes the highest threat for the reservoir, because circa 67% of the total sediment into the reservoir origins from this sub-catchment.[10] Therefore, investments for erosion reduction could be concentrated in this sub-catchment to reduce sedimentation in the lake.

[10] *'Mapping and Modelling Erosion Intensity and Calculating Transported Sediments in the Ulza Watershed'*, CNVP, Blinkov I., and Trendafilov, A, September 2014, PUB_21 under the WB-PROFOR SFM PES project

When comparing the value of specific transported material into the Ulza reservoir with values for similar reservoirs in the region, the values in Ulza are much higher; in Macedonia (Kalimanci – 368 m^3/km^2/year; Spilje – 195 m^3/km^2/year, Tikves – 237 m^3/km^2/year), while in Albania, the Ulza watershed has a value of 1,108 m^3/km^2/year.

The results from bathymetry and the calculation for erosion and sediments using EPM are similar (table 2).

Table 2: Comparison sedimentation results between Bathymetry and EPM

	Bathymetry	**EPM**
Average annual sedimentation (m^3/year)	1,331,741	1,343,467
Specific annual sedimentation (m^3/km^2/year)	1,088	1,108

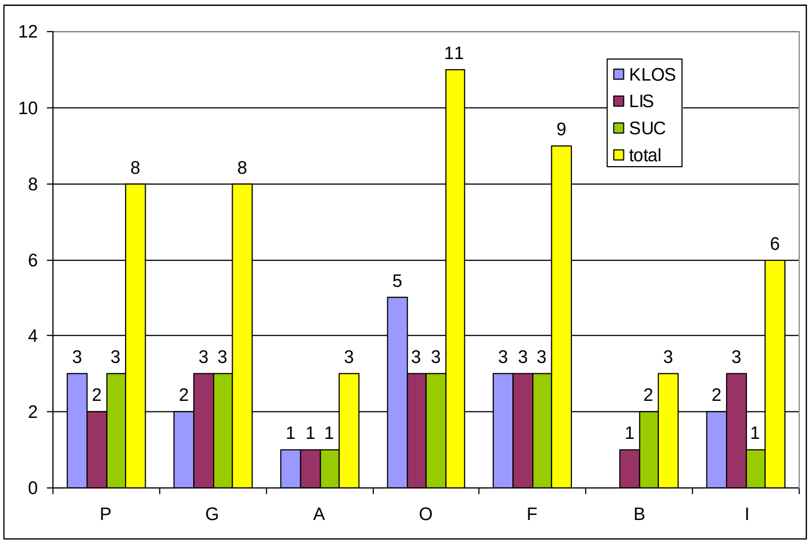
The values correspond very well and the difference is not significant. Two different methods were used; one focused on the produced and transported sediment (viewing from up to down in the watershed) and the other focused on the amount of sediment received in the lake (viewing from the bottom up). This increases the reliability of the results and provides further certainty when using the outcomes for conclusions and as a base for future measures.

5. Erosion under different land uses

Knowing the amount of sedimentation and the locations in which the sediment is produced, the next question needs to be addressed. How is this erosion taking place? Which land use is contributing to this sedimentation and which land use types and practices are reducing the erosion and sediment produced?

Figure 14: Erosion monitoring plots

Field monitoring for erosion and run-off for different land uses were made in the study (figure 14). It is possible to slow down the sedimentation in the hydropower reservoir by reducing erosion and run-off. The study gave insights into good practices and land uses on the correlation between precipitation, run-off and sedimentation in different land uses and slope categories. 48 erosion plots (figure 15) with different land uses and slope conditions were regularly measured in this study.[11] The first phase was from 1 October 2012 to 31 Aug 2014. The second phase was from March – August 2014.



P = Plantation (on meadow and young plantation), G = Grass land, A = Arable land, O = Overgrazed grassland, F = Forest, B = Bare land, I = Irregular/Bare land

Figure 15: Distribution of plots by land cover/use (# of plot/land use type)

---

[11] '*Experts Report on methodology of establishment erosion control plots and social aspects of farmer selection and coaching*', Todorov V, Petrovski S and Kampen P., CNVP and Blinkov I., Forestry Faculty Skopje University, January 2013, PUB_04 under the WB-PROFOR SFM PES project

The included land uses represent the main land uses in the watershed (table 3 and figure 15).

Table 3: Land uses assessed with erosion monitoring

Sign	Type
I	Irregular on grassland/scrubland degraded
A	Arable land
Py	Plantation (orchard) young
G	Grassland
G-T	Grassland/scrubland transition
Pm	Plantation (orchard) on meadow
TW	Transitional woodland-forest
FP	Plantation (fruit trees) in forest
F	Forest

Descriptions and examples of these land uses in plots are provided in Annex 1.

Based on the results from the first phase (2013) the study showed that erosion and sediment load are correlated to land uses. Land uses with the highest to the lowest erosion and sediment load are: Bare land/degraded area > Arable land > Young plantation on bare land > Overgrazed land > Plantation on meadow > Planation with non-grazed meadow > Forest (see the figure below). Bare land has 3 times higher sediment load than forests (figure 16).

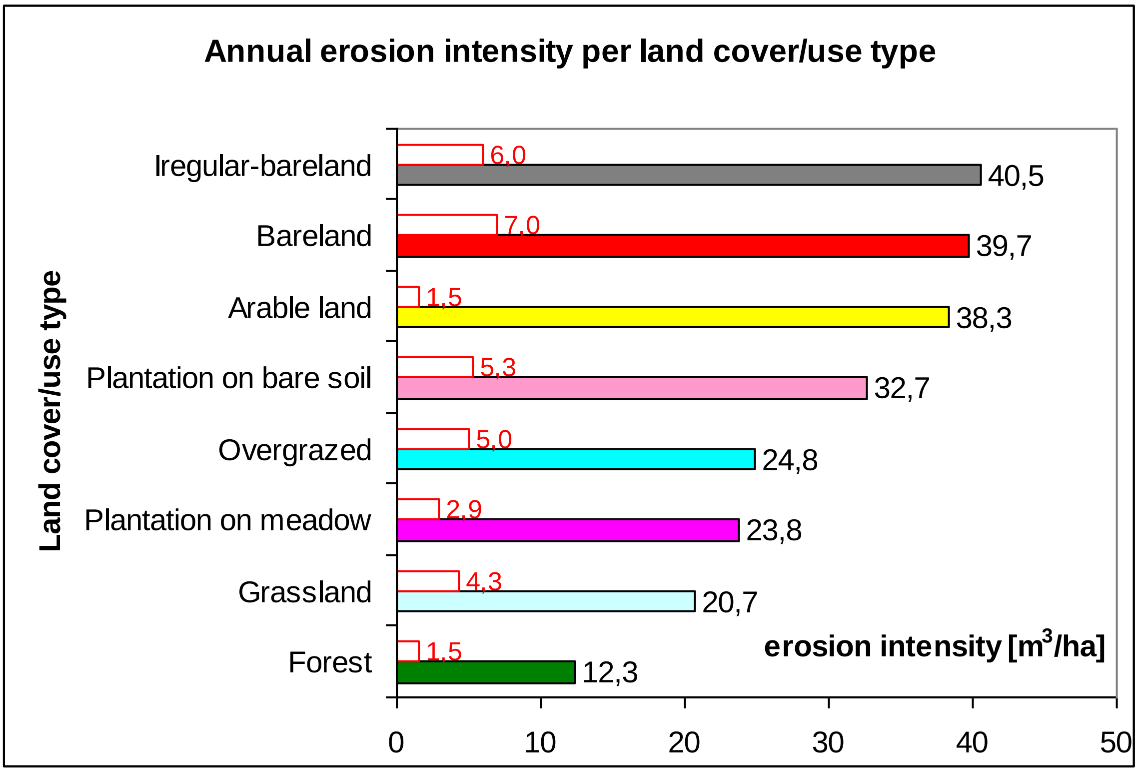


Figure 16: Annual intensity of erosion (sediment production) per land use type and mean error

Furthermore, slope is a very important parameter influencing runoff and especially sediment yield on so called "open land". Arable land, bare land and young plantation show increased erosion and run off with increased slopes. Slope is also an important factor in case of grasslands/meadow but less than in "open land" while in forest areas slope is not the crucial factor for run-off/sedimentation. Here, forest characteristics such as: crown cover, surface florae and cover, uneven surface, litter etc. have a higher influence and reduce the influence of slope.[12]

Table 4: Annual level of erosion per land use type including slope and error

Land Cover	# of plots	Slope of Plots [%]				Sediment load [m³/ha/year]			
		from	to	mean	Error	from	to	mean	Error
Bare land gully	5	26	60	40	8.32	30.2	48.3	40.5	6.0
Bare land	3	15	28	23	5.11	30.1	46.6	39.7	7.0
Arable land	3	20	75	12	14.49	30.9	46.2	38.3	1.5
Planation young	3	16	32	23	6.22	24.8	38.2	32.7	5.3
Grassland overgrazed	9	10	40	22	9.49	7.3	33.9	24.8	5.0
Plantation on meadow	5	10	60	37	13.28	21.2	30.1	23.8	2.9
Grassland	9	10	38	21	9.49	11.7	35.6	20.7	4.3
Forest	9	10	33	39	6.44	8.4	15.5	12.3	1.5

Based on the first result, continued erosion monitoring was conducted in the second phase in 2014. In the continued erosion monitoring further attention was given to different forest types and to gully erosion (table 4). With forests, a land use that contributes well to erosion control and soil stability, it is important to see the influence of differences in forest types and practices. This will give guidance to which SFM practice to promote.

Gully erosion is limited as a land cover, but is very important on the total sediment production due to its severity. Understanding this emphasizes the importance of taking specific erosion control measures for gullies. The results of the 2014 monitoring confirm the high level of erosion production by gullies (see figure below).

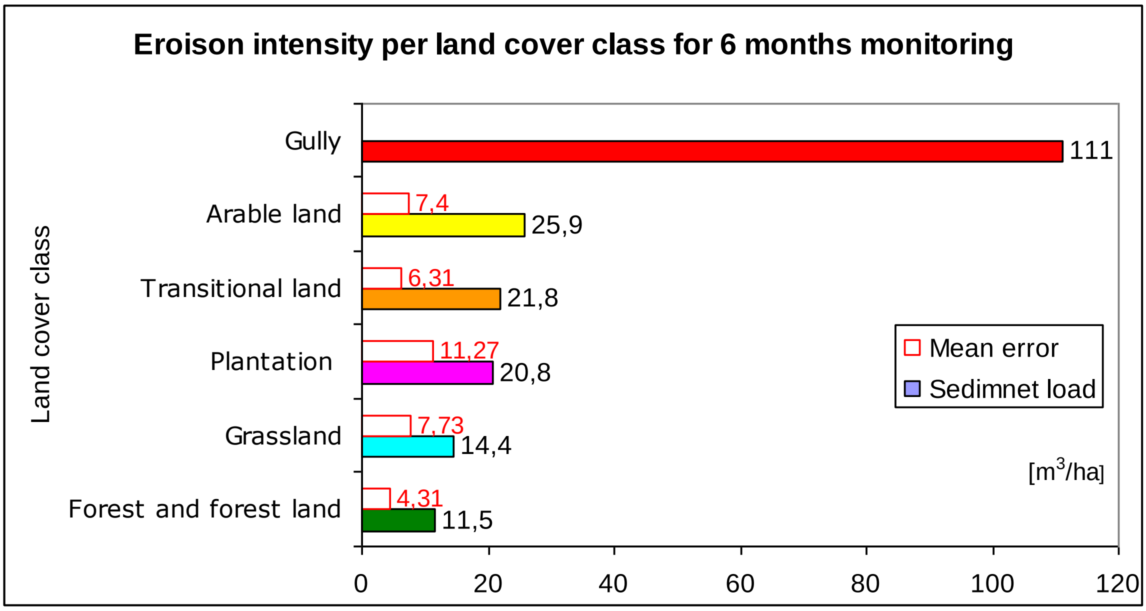


Figure 17: Sediment load per land cover type and gully in m³/ha (during monitoring period)

[12] '*Monitoring and modelling erosion and runoff in the Ulza sub-watershed*', Blinkov, I., Faculty of Forestry, Skopje, Republic of Macedonia, September 2013, PUB_11 under the WB-PROFOR SFM PES project

The sediment results from the 2014 monitoring show the influence of forest crown cover and ground cover. The transitional woodland plots with a low crown and ground cover show higher erosion levels compared to grassland and plantation with ground cover. Regular forests again provide the lowest sedimentation results.

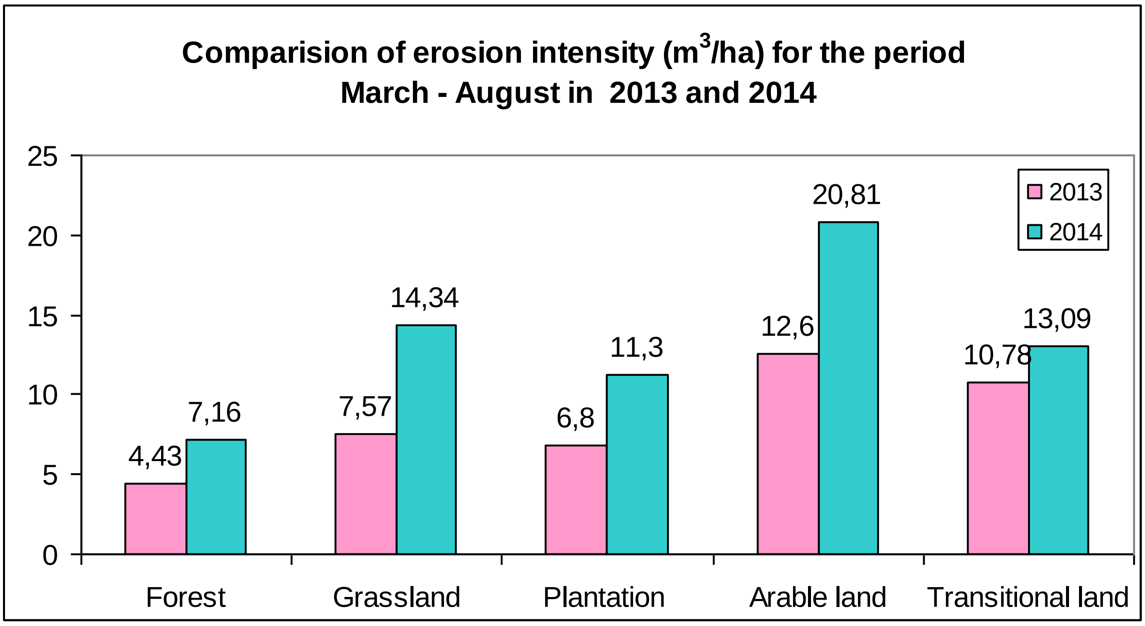


Figure 18: Comparison of erosion intensity for the period March-August in 2013 and 2014, per land cover class [m^3/ha]

There is also a difference in the sediment production between the two years (figure 18). In 2014 the precipitation was high with high rainfall intensities, resulting in higher erosion levels compared to 2013.

The relation between land use type, slope and erosion intensity is clearly visible in the diagram below. With an increased slope the erosion rate is increasing dramatically for arable land and plantation. On the other hand, slope has hardly any influence on forests.

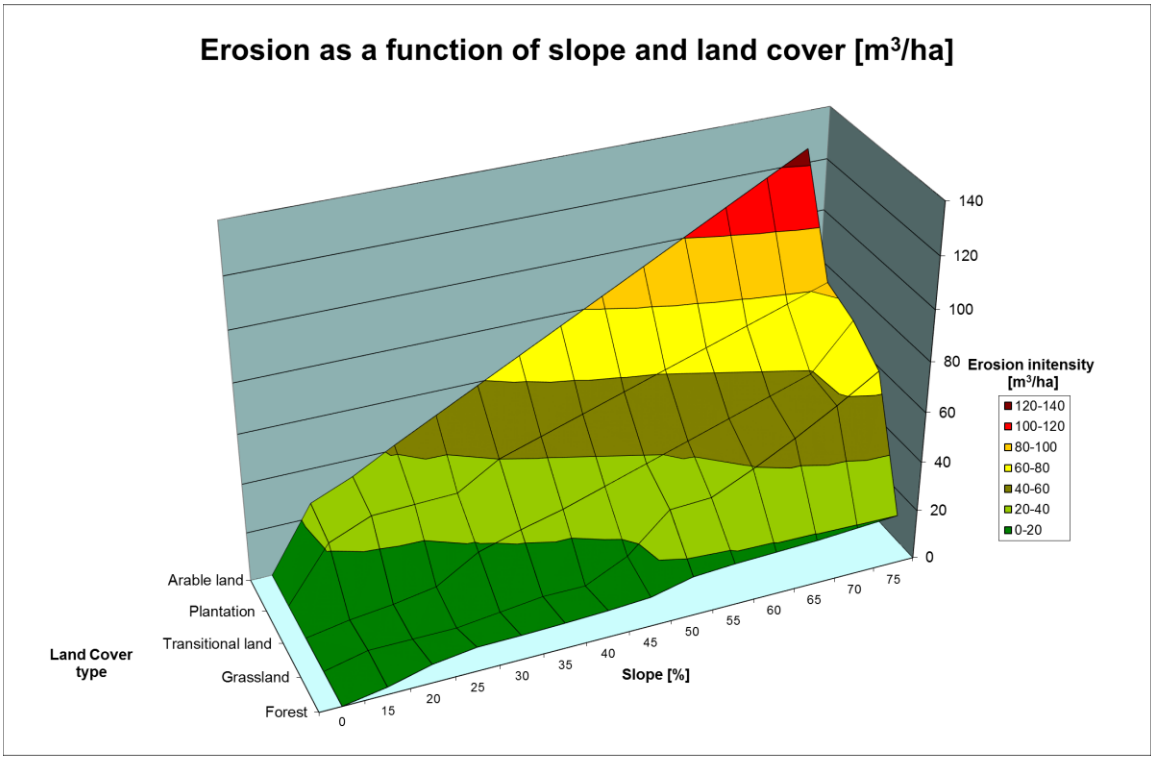


Figure 19: Relation of land use type and slope on erosion intensity

It must be noted that the used data are based on the erosion monitoring during 2014. Therefore the absolute values of erosion intensity are an indication of erosion in that period, with an above average rainfall. The erosion intensity is very high and does not reflect an average value. It can be used as comparative data showing the relation between land use, slope and erosion intensity.

As shown, the slope is not the main factor influencing erosion intensity of forests. Crown cover and forest structure are more important factors for erosion. The influence of crown cover is also visible when comparing the results between plots of forest with different crown covers and structure; regular forest (with a closed canopy) and forest plots with tree lopping and pruning (with an open structure). The influence of crown cover is limited regarding runoff (figure 20), but there is a high reduction of erosion with increased crown cover (figure 21).

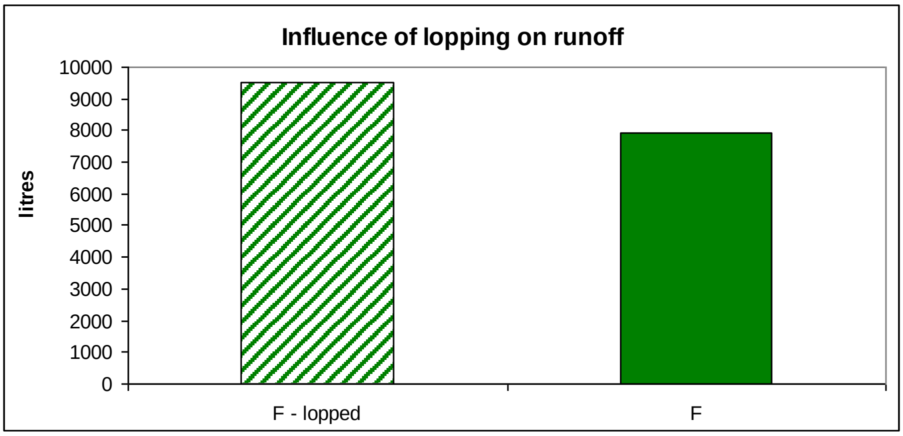


Figure 20: Influence of forest lopping on run off

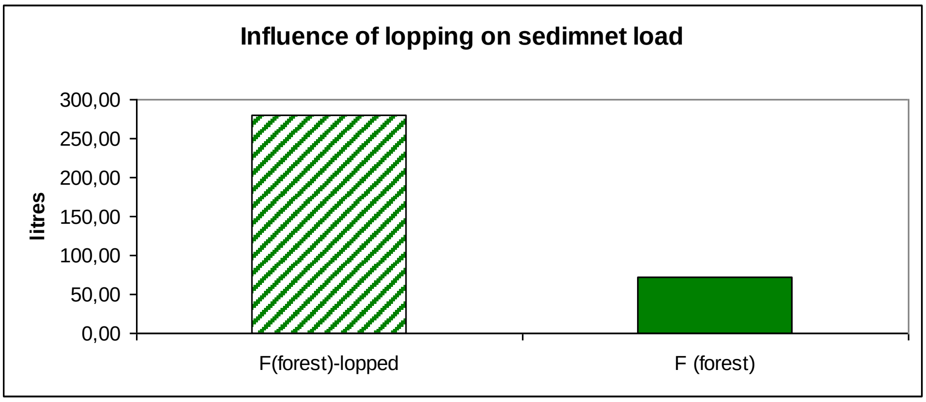


Figure 21: Influence of forest lopping on sediment load

In general, land cover by forests is important in reducing erosion[13]. It is important to have a good crown cover and undergrowth/ground cover in forests on high slopes >20%. This provides guidance for the SFM practices that can be applied under such circumstance. It is recommended to have a continuous forest cover on such land areas and to apply a forest management practice that creates a multi-layer structure with ground cover and only limited inferences in crown cover reduction when thinning.

Grasslands and plantations (orchards) with grass cover show good results up to slopes of 30%. With increased slopes the grass cover cannot provide sufficient protection.[14] Therefore, grasslands are a recommended land use practice up to 30% slopes, above which forest land use is recommended.

Arable land practices are most susceptible to erosion and are therefore not recommended on slopes above 15%. Good agricultural practices can reduce erosion. Ploughing along contour lines reduces run-off compared to ploughing cross contour lines. If agriculture is practiced on slopes above 15% terracing is highly recommended. The results of the erosion monitoring can be used to provide recommendations on specific land use and land use practices in the watershed.

Based on the total erosion production and the land use distribution in the watershed a calculation can be made of the contribution of the different land use types to the total erosion in the watershed. The land use distribution in the watershed is presented in figure 22 and the erosion per land use type in figure 23.

[13] 'Continued Modelling Erosion and Runoff, in the Ulza sub-watershed', CNVP, Blinkov, A., September 2014, PUB_22 under WB-PROFOR SFM PES project

[14] '*Forest Practices in the Ulza Watershed*', Trendafilov, A, Blinkov, I., Mincev, I., Faculty of Forestry, Skopje, Republic of Macedonia and Omuri, I, CNVP, August 2013, PUB_14 under the WB-PROFOR SFM PES project

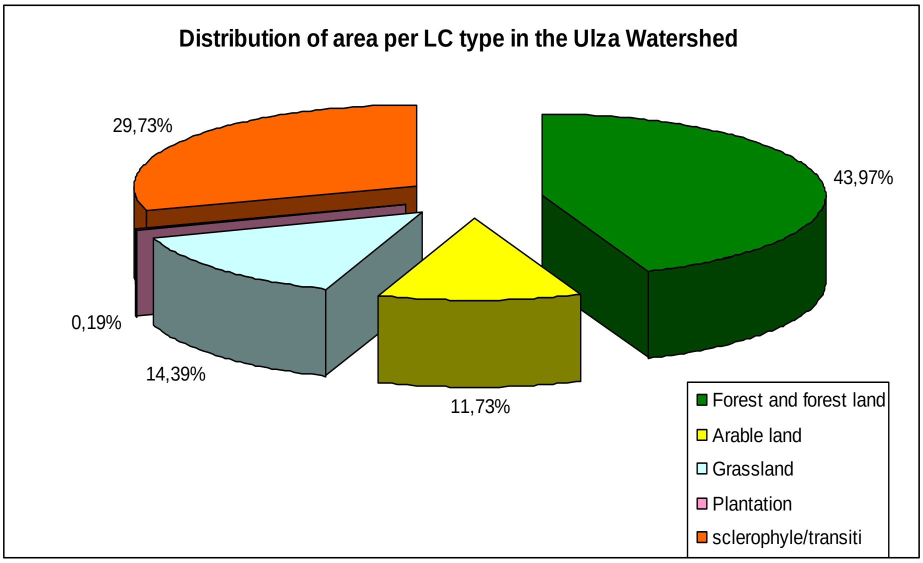


Figure 22: Distribution of areas per LC types in Ulza Watershed

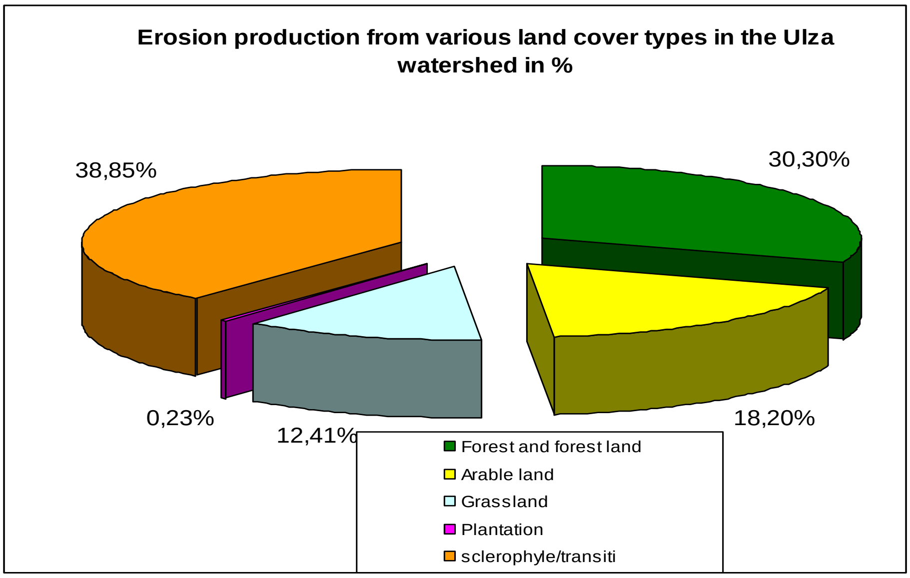


Figure 23: Erosion production from various land cover types in the Ulza Watershed

Table 5: Comparison of % of land use type VS erosion intensity

	Area		Erosion intensity	
	ha	%	m^3	%
Forest and forest land	52,997	43.3	609,461	30.3
Arable land	14,133	11.5	366,038	18.2
Grassland	17,339	14.2	249,677	12.4
Plantation	225	0.2	4,631	0.2
Sclerophyle/transitional wood	35,839	29.3	781,291	38.9
Other	1,870	1.5	0	0.0
	122,400	100.0	2,011,098	100.0

It is important to point out that the data in the chart above (table 5) are obtained for the period of 6 months of measurement (March-August 2014) and rainfall intensity for this period was 2.1 times higher than the average. Despite the high levels of rainfall and erosion during this period, the comparative results of area distribution and erosion per land cover type are relevant.

From the results presented above it is easy to see that forest and forest land as land use type is dominant in the Ulza watershed with 43% of the total surface. This land use type is usually disposed at higher slopes. An interesting point is that forests are producing only 30.3% of the erosion in the Ulza watershed. It is important to point out that most of the forests in the Ulza watershed are in resurrection phase. The age is not more than 30 years and most of them are one layer forest stands. With ongoing regeneration and forest restoration, especially in the communal forest, a further reduction of erosion can be expected from the forest lands.

On the other side, even though arable land is only 11.5% and basically on lower slopes, it contributes with 18.2% of erosion production in the Ulza watershed. Another important figure is that transitional woodlands are significant part of the Ulza watershed with 29.3% of total surface. These lands are usually covered with degraded wood vegetation or shrubs where wood and shrubs cover is less than 50% and usually there is no grass cover on the site. Very often there are gullies appearing at the spot. These areas are usually on slopes higher than 30%. This land use type is producing the largest quantity of erosion in to Ulza watershed with 38.9% of total erosion intensity. The grasslands are basically providing proper protection from erosion as land use type.

Investments to reduce erosion should therefore be concentrated on arable land and improved agricultural practices, on transitional woodlands, to restore them to sustainable forest areas, and on gully control measures.

6. Comparison Ulza vs. Kalimanci

In the qualification and quantification of erosion in the Ulza Watershed it is relevant to assess how it relates to similar situations in the region. Detailed data of other watersheds in Albania is not available, but a comparison is made with a watershed in Macedonia.

The Kalimanci reservoir basin is one of the most eroded areas in Macedonia. The reservoir basin is similar to Ulza 1,224 vs. 1,135 km^2. Erosion processes are similar (figure 24); the main difference is in their extent.

Figure 24: Extreme erosion process in Kalimanci basin

Similar data is available of Kalimanci, but over a longer period of time. Data is available from 1981 and 2014 which allows for comparison over time (table 6).

Table 6: Erosion level in Ulza and Kalimanci

	ULZA 2014	KALIM 1981	KALIM 2014
Erosion coefficient	0.54	0.58	0.29
Specific annual sedimentation produced in the watershed [$m^3/km^2/yr$]	1,507	1,502	
Specific annual sedimentation transported in the reservoir [$m^3/km^2/yr$]	1,108	368	301
Average annual sedimentation [m^3/y]	1,331,741	418,731	330,000

First of all, it is interesting to notice that the erosion risk coefficient was similar between Ulza and Kalimanci, and was even higher for Kalimanci in 1981. The amounts of erosion and annual sedimentation levels per square kilometre are much higher in Ulza because of configuration of the terrain. This indicates the severity of erosion in Ulza. It is interesting that the erosion has been reduced greatly over the years in Kalimanci, with an erosion coefficient of 0.29 in 2014. Why is there a decrease of sediment income in Kalimanci?

- Dry period 1987-2000 (lower precipitation, lower discharge)
- Migration and self-restoration of forests reducing erosion
- Erosion control measures (permanent decrease over the years based on measuring)
- Consolidation of erosion (less effective sedimentation in the reservoir)

One of the erosion control measures is forestation (figures 25 and 26).

Figure 25: Mass afforestation of erosive terrains in Kalimanci (left before afforestation, right after afforestation)

As a result of erosion control programmes 6,505 ha of previously high erosive terrains of I or II erosion risk category were afforested up to 2000.

Figure 26: Afforested terrains

The soil is highly prone to erosion and in cases of a small open areas without forest cover gullies appear (see figure above right). Therefore forests are needed with a good structure and close crown canopy. There were a lot of construction works in the stream beds in addition to afforestation. These structures are made of wood, rocks, gabions, concrete and have different height and form. In Albania good practice and experience also exist (figure 27), which can be applied on high erosion risk areas such as in Ulza.

Figure 27: Application of double fence dams and plantation in Diber, Albania for erosion control

Check dams (see figure 28 and 29) were constructed in Kalimanci in the Kamenicka River to control the water flow, reducing the kinetic energy. A lot of torrents are regulated totally or partially due to these works in the Kamenicka River in the Kalimanci Watershed. These check dams retain significant quantity of already produced erosive material. Measurements in Kamenicka River show that at least 2 million m^3 are retained behind 51 check dams.

Figure 28: Check dams in the Kamenicka river bed (system of check dams in the river bed)

Figure 29: Various check dams in the tributaries of Kamenicka River

7. Conclusions and Recommendations

The Ulza Watershed has very high erosion levels that have a direct impact on downstream water users and land areas. With this specific study it was feasible to quantify and qualify the relationships of the environmental service for erosion control.

- The final results of erosion monitoring show and prove the crucial role of forest for runoff regime, erosion protection and reduced sediment yield defined in other previous research by various scientists in the world.

- Taking in consideration that gullies are highly present in the Ulza watershed, gully erosion is a large source of erosive material that is subject of downstream transport.

- The erosion levels in the watershed are very high, the erosion mapping indicates a more than three times level of sediment compared to similar situations in the region. High risks spots are identified in the watershed and call for direct interventions to control erosion.

- The erosion and sedimentation is causing many problems in the water regime. Sedimentation has already filled 1/3 of the Ulza reservoir and reduces the lifespan of the UHPP, but, more importantly, it is already reducing the operational capacity of the reservoir and therefore limiting the amounts of energy production.

- Reduction of the operation capacity is a real concern since it is having a direct impact on the economic result of the UHPP. This is justifying direct investments in controlling erosion and sedimentation in the Ulza watershed.

- The relationships and quantification of the environmental service on erosion control, and water regime are given in the study. This should be used in improving the watershed management and potentially in a PES scheme, involving the stakeholders.

- Stakeholders in the watershed (upstream and downstream) understand the importance of upstream watershed management, but are not aware of PES schemes and do not indicate a high willingness to pay. Qualification and quantification of environmental services can be used to create understanding, awareness, acceptance and participation in a potential PES scheme.

- Supporting SFM practices and sustainable grassland practices should be practiced and promoted. This could be done among others in a PES scheme.

- The land use recommendations are of a technical practice nature. These should however be embedded within the social-economic context. Supporting and stimulating technical practices might fail if not socially accepted and economically sound. Communal forest management was seen by all stakeholders in the Ulza water as leading to improved upland forest management. The communities and their land are in the lower range of the watershed. It is recommended to make use of good SFM within communal forestry.

Recommendations have been derived in lieu of all the results from the measurement and conclusions above. With appropriate human activities, runoff, erosion and sediment yield can be reduced significantly.

Practice level

- Slope is one of the crucial factors for runoff and sediments yield. The proportion of runoff and sediments yield increases with the slope. Using the results of the influence on land use and land cover on runoff and sedimentation provides criteria for practicing different land uses and land practices with increased slope level. Specific land use recommendations can be provided based on slope level and soil condition.

- Regarding arable land uses, indicators should be produced for agriculture practice, recommending different ploughing techniques on slopes - ploughing along the contour lines. A good example of this can be seen in the plot under young plantation (orchard) where rows and ploughing are set along the contours and show lower sediment results. Terraces on agricultural land is recommended to reduce slopes >15% on the ploughed parts. This is visible with the plot set on a terraced land where runoff and sediment are very low.

- Green cover of soil in orchards significantly reduce runoff, minimizes erosion and sediment yield. It is fully recommended and in accordance with recommendations by other experts to establish green cover in orchards even on flat areas also in order to minimize pollution originating from pesticides and fertilizers.

- Grasslands can be used well on slopes up to 30%. This can be a grasslands or combined with plantation (orchards). Slopes above 30% are recommended to have forests with SFM practices.

- In erosion sensitive areas, with slopes >35%, forest cover is a recommended land use. It is important to maintain a close forest cover and stimulate the ground floor cover. Forest management needs to avoid a clear cut system and keep a continuous forest cover on higher slopes (>35%) to reduce erosion. The forest practices should stimulate a diversified forest structure with undergrowth. In cases of coppice forests and when clear cut is needed it can only be considered under good forest circumstances. In such cases, the coppice can be in belts along the contours, to always have a forest belt on the field that serves as retention of water and soil. However, in areas with high erosion sensitivity, erosion classes I and II, like in the Ulza watershed, it is recommended to support continuous forest coverage management.

- Support afforestation programs on lands that are not suitable for agricultural purposes, having in mind and balancing it with the needs of the community for pasture land. Afforestation is recommended on the erosion sensitive areas and especially around gullies (class I and extreme areas).

- Specific attention is needed for gully control. Supportive measures are needed within gullies, such as seeding with grass seeds, tree planting and erosion control measures (single and double fences, dry stone wall and gabion boxes).

- It is recommended to combine forest belts on edges of agriculture land at steep slopes as protection from erosion.

- Preparation and implementation of strategic erosion control projects and documents are necessary to prolong the reservoir lifespan, viability and sustainability and efficiency of the UHPP. The focus should be on the erosion risk areas in the sub-catchments contributing most to the sedimentation in the lake (Kurwajt and Mat), as well in the torrent control in the river.

- Preparation of erosion control plans and preliminary and final designs for torrent control, for the construction of cross structures (made by wood, rock, gabions, concrete etc.) in the stream bed is necessary to retain produced erosive material and avoid sedimentation in the basin with the final aim to extend lifespan of the reservoir.

- Areas that have high erosion sensitivity are identified in the erosion mapping. It is recommended to make specific investments on erosion control in the erosion risk areas identified.

Policy level

- Overall watershed management is needed to address the current very high level of erosion in the watershed. An institutional structure is needed in which all land owners and users are involved. There is a need for integrated natural resource management where agriculture, livestock, forestry and water management will be balanced and practiced based on criteria for erosion control.

- It is not necessary to have one manager of the whole area, ownership and management should be respected, but overall support and coordination is needed, with sustainable planning, criteria and indicators to monitor.

- Every stakeholder in the watershed has the responsibility to respect certain limitations on land use. The overall watershed management should be combined with supportive instruments for implementing good practices in agriculture, livestock and forest management. It is recommended to start piloting this and support via IPARD like measures can be used in it to obtain experience and opportunity for development of supportive instruments.

- It is recommended to use the acquired understanding and insights into the erosion, its relationships and effects of the watershed to raise the awareness and interest of the stakeholders for cooperation in a PES scheme.

- The exact nature of such a scheme should be developed in a participatory manner. Facilitation by the government is recommended.

- Capacity development on farmer and forest users and other land managers' level will be a reasonable step to increase the level of understanding how activities influence erosion and how this can be addressed.

- Instruments for supporting good land use practices need to be promoted. Extension service and vocational training combined with field practice examples are recommended to stimulate this. Cooperation with farmer groups, forest users associations and federations can be considered to provide this extension service, in combination with State services.

- Regular bathymetry measurements are needed to monitor the erosion and sedimentation in the reservoir. This could be done in intervals of 3-4 years. The next bathymetry could be done in 2017 in the spring, when water levels are high in the reservoir.

- Through the field erosion monitoring in the Ulza situation we now have an understanding of the erosion under different land use systems. It is not necessary to continue this kind of erosion monitoring on a large scale. It could be considered to continue limited erosion monitoring in selected land use types. The erosion monitoring was done for two seasons only, already showing seasonal differences. Longer term erosion monitoring will increase the understanding, validation and reliability of erosion levels.

- It is recommended to use the practices applied in Ulza in other watersheds in Albania. It would not be necessary to carry out full erosion monitoring as was done in Ulza since the results from the Ulza erosion monitoring can be used. It is recommended to consider small scale erosion monitoring on selected land uses to confirm the erosion levels, carry out erosion risk mapping to identify risk areas in the watershed and bathymetry measurements in case of lakes.

Annex 1: List of Publications

The following publications are available at the project website: www.cnvp-wbprofor.org.

Documents
PUB_01-Inception part I final, 'Inception phase report *General Project Albania and Kosovo'*, under WB-PROFOR SFM PES project, April 2012 *
PUB_02-Inception part II final; '*Inception phase report part II Albania Ulza Watershed case*' under WB-PROFOR SFM PES project, April 2012 *
PUB_03-Inception part III final; '*Inception phase report part III Wood biomass case*' under WB-PROFOR SFM PES project, April 2012
PUB_04-Report on Plots Establishment, '*Experts Report on methodology of establishment erosion control plots and social aspects of farmer selection and coaching*', Todorov V, Petrovski S and Kampen P., CNVP and Blinkov I., Forestry Faculty Skopje University, under the WB-PROFOR SFM PES project, January 2013 *
PUB_05-Occorrence of Landslides and Flooding, '*Occurrence of Landslides and Flooding, past and current*', Diava and CNVP, under WB-PROFOR SFM PES project, July 2013 *
PUB_06-Description of Ulza Watershed Boundary, '*Description of Ulza watershed boundary*', Blinkov, I., Faculty of Forestry, Skopje, Republic of Macedonia under the WB-PROFOR SFM PES project *
PUB_07-Bathymetry and Lifespan Analysis, '*Ulza Reservoir Bathymetry and Lifespan Analysis*', Trendafilov A. and Mincev I., Faculty of Forestry, Skopje, Republic of Macedonia under the WB-PROFOR SFM PES project, August 2013 *
PUB_08-PES Characteristics and Examples; '*Payment for Environmental Services: Characteristics and Examples, an Overview*' prepared by Iskra Konevska, Wageningen University under the WB-PROFOR SFM PES project, August 2013 *
PUB_09-PES Scheme in Ulza, '*Designing Potential Payment for Environmental Services (PES) schemes for watershed protection in Ulza, Albania*', Marianne Meijboom and Peter Kampen, CNVP under the WB-PROFOR SFM PES project, August 2013 *
PUB_10-Energy Efficiency Building Cases, '*Feasibility Study for Energy Efficiency of Buildings in three selected cases*', Julije Domac, Tina Opalic and Hrvoje Maras, Mihaela Mihadzic and Adam Babic, REGEA, under the WB-PROFOR SFM PES project, July 2013
PUB_11-Erosion Monitoring Ulza, '*Monitoring and modelling erosion and runoff in the Ulza sub-watershed*', Blinkov, I., Faculty of Forestry, Skopje, Republic of Macedonia under the WB-PROFOR SFM PES project, August, September 2013 *
PUB_12-Wood Biomass Value Chain, 'Analysis of biomass supply chain, production and utilisation of wood biomass for Energy Production, Julije Domac, REGEA and Sasho Petrovski, CNVP, under the WB-PROFOR SFM PES project, April-September 2013
PUB_13-Wood biomass Consumption Household survey, '*Study on firewood and other wood biomass use by population, Household Survey*', Tina Opalic and Luka Safar, REGEA, Sasho Petrovski, Haki Kola and Peter Kampen, CNVP, under the WB-PROFOR SFM PES project, summer 2013
PUB_14-Forest Practices, '*Forest Practices in the Ulza Watershed*', Trendafilov, A, Blinkov, I., Mincev, I., Faculty of Forestry, Skopje, Republic of Macedonia and Omuri, I, CNVP under the WB-PROFOR SFM PES project, August 2013 *
PUB_15-Forest practices Kosovo, '*Forest Management Practices, supporting wood biomass production*', Haki Kola, CNVP, under the WB-PROFOR SFM PES project, 2013
PUB_16-Stakeholder analysis, '*Ulza Downstream and Upstream Stakeholder Analysis*', Diava, CNVP, under the WB-PROFOR SFM PES project, 2013 *

PUB_17-Wood biomass potential, '*Analysis on production, current and potential for wood biomass, from public and private forests and agricultural land in Kosovo*', Ergin Hajridini, NRS and Peter Kampen, CNVP, under the WB-PROFOR SFM PES project, 2013
PUB_18-PES options Kosovo, '*Potential PES for carbon and other supportive scheme for wood biomass production and consumption*', NRS, CNVP, under the WB-PROFOR SFM PES project, September 2013
PUB_19-Innovative Financing for Sustainable Forest Management, Completion Report, CNVP, under the WB-PROFOR SFM PES project, September 2013 *
MAP-'*Ulza Watershed topography map*', under the WB-PROFOR SFM PES project, November 2012 *
MAP-'*Ulza Watershed land cover map*', under the WB-PROFOR SFM PES project, November 2012 *
PUB_20-Second Bathymetry; '*Ulza reservoir, Second Bathymetry and Lifespan Analysis*', CNVP, Trendafilov, A., Mincev, I., and Blinkov, I, under WB-PROFOR SFM PES project, September 2014 *
PUB_21-Erosion Risk Mapping, '*Mapping and Modelling Erosion Intensity and Calculating Transported Sediments in the Ulza Watershed'*, CNVP, Blinkov I., and Trendafilov, A, under the WB-PROFOR SFM PES project, September 2014 *
PUB_22-Continued Erosion Monitoring, 'Continued Modelling Erosion and Runoff, in the Ulza sub-watershed', CNVP, Blinkov, A., under WB-PROFOR SFM PES project, September 2014 *
PUB_23-Ulza Watershed Cross Cutting, 'Cross Cutting Issues and Summary of the *Ulza Watershed Case*, CNVP, Blinkov, I., and Kampen, P., under the WB-PROFOR SFM PES project, October 2014 *

Note: all documents with a * relate to the Ulza watershed case

Annex 2: Land use type descriptions under erosion monitoring plots

The following land use types were used for erosion monitoring.

F – Forest - these plots represent Oak forest with relatively good ground cover. Within the basin there are some other forest types - beech forests and pine forests, but they are located at higher elevations.

Figure 30: Example of forest plot

G – Grassland – field cover with grass, not threaded by the owner, no grazing. These are areas used for hay production. Although farmers indicated that these areas were not grazed, practice showed that during the field measurements there was some grazing.

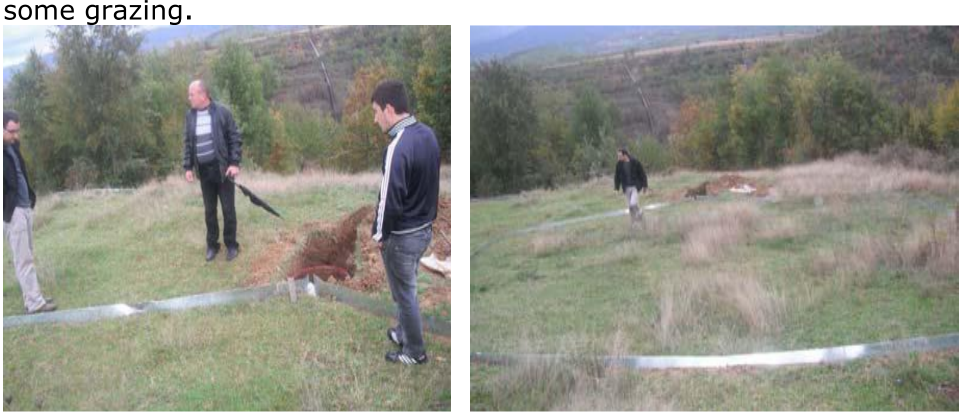


Figure 31: Example of grassland plot

O – Overgrazed – grassland where grazing is allowed. This is the predominantly form of range land in the area. Most of the grazing is free grazing and herding with cows, sheep and goats. Grazing is whole year round at lower altitudes, while the high pastures are used for grazing in the summer.

Figure 32: Example of overgrazed grassland plot

Pm – Plantation mature – Orchard plantation where there is green ground cover. In the Ulza watershed farmers are increasingly involved in horticulture with a variety of fruit trees. In general these land uses have a good ground cover with grassland use for grazing or hay production.

Figure 33: Example of mature plantation plot (plantation on meadow)

Py – Plantation young – Young 2-3 year plantation on former bare land (trees are almost unnoticeable). These are located in general plantations made with support of investments from projects with the aim of reforestation and erosion control.

Figure 34: Example of young plantation plot (on bare soil)

A – Arable land – classical arable land. Used for farming of agricultural crops such as maize, beans, potatoes etc.

Figure 35: Example of arable land plot

I-B – irregular shape plot/bare land – These are based in gullies with high erosion. Some having low ground cover, others transitional woodland cover.

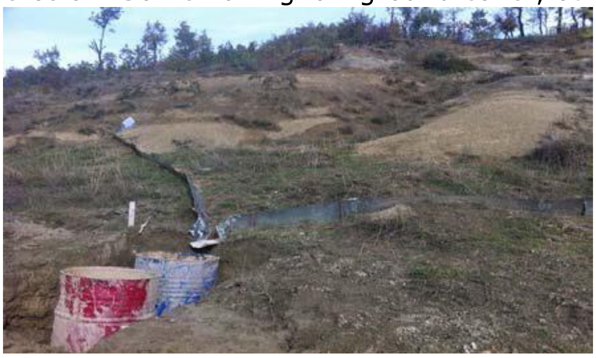


Figure 36: Example of irregular shaped plots, bare land

Figure 37 - Example of plot for measuring gully erosion intensity using pins

CONNECTING
NATURAL
VALUES &
PEOPLE

Working together to grow a canopy of trees providing home, shelter, food, a livelihood as well as a place to wander

CNVP is a legacy organisation of SNV in the Balkans. Established through a legal demerger, CNVP will continue the SNV forestry and rural development programme in the Balkans and beyond.

CNVP envisions:

- Local communities achieving their own development goals;
- Maximising the production and service potential of forests through Sustainable Forest Management and locally controlled Natural Resource Management;
- Forests contributing to equitable local economic development supporting rural livelihoods;
- Forests contributing to wider societal interests and values including biodiversity conservation and wellbeing;
- Connecting natural values and people!

Connecting Natural Values & People
7th Floor Zayed Business Centre
Rr. Sulejman Delvina, Tirana e Re
Tirana, Albania
PO Box 8303
T +355 4 222 9642, +355 4 222 9551
www.cnvp-eu.org