Development scenarios of the coastal area in western Albania

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Abstract

Coastal Area in Albania stretches along the Western part of the country. The development of water resources comprises an analytical interpretation of both the problems and opportunities that the Coastal Area contains. Therefore, this paper aims to identify the approach implemented in this study, followed by a feasible conclusion with the environmental and social parameters attained. The Coastal Area in Western Albania is seen as a potential resource of environmental, economical and social development. The study developed focuses and sets all the development criteria in accordance with the EU legislations regarding to environment and water policies. Social and economical benefits are the driving factors to have an overall feasible layout of this study. This study identifies the potential resources and indicates for each of them the threats and opportunities. Different measures, methods of implementation, and the data required are proposed for all objectives and categorized in three alternatives as a) economical, b) environmental and c) mixed, to give a clear option for the perspective development of the integrated coastal zone and water resources that affect in extent the Western Albania.

The understanding of the system and public involvement are important in the solution to the integrated water management in the Coastal Area. In the research are simulated three development strategies based on different criteria. In each strategy, various studies are undertaken. Data collection, analysis, system understanding, modeling, interpretation, economic analysis, risk analysis, environmental impact studies are accomplished before the final suggestion of measures in each alternative. The research is made such as an approach to integrate the spatial and temporal effects of measures. Development of the study areas will be important not only for the existing situation, but a long-term strategy is developed to distribute reliably the resources in space and time.

Introduction

The Albanian Western part has an important role in development of the water resources potential and reducing water related risks in the region. The region is seen as a potential resource of environmental, economical and social development. This paper focuses and sets all the development criteria in accordance with the EU legislations regarding to environment and water policies. Social and economical benefits are the driving factors to have an overall feasible layout of the master plan.

This study identifies the potential resources and indicates for each of them the threats and opportunities. Objectives sets are defined for the upstream and downstream areas in an integrated manner. Different measures, methods of implementation, and the data required are

proposed for all objectives and categorized in three alternatives as a) economical, b) environmental and c) mixed, to give an option for the client.

The research study has made an approach to integrate the spatial and temporal effects of measures. Development of the study areas will be important not only for the existing situation, but a long-term strategy is developed to distribute reliably the resources in space and time.

1 Description of the water resources system

A water resources system (WRS) can be considered to consist of:

- The natural resources system (NRS)
- The socio-economic system (SES)
- The administrative and institutional system (AIS)

The master plan studies are carried out in two different pilot areas "upstream area" and "downstream area". The upstream area is located within the catchment of the Koman which is a tributary of Drini, and Drini is a tributary of River Buna. The downstream area is located at the southern end of the River Buna and borders the Adriatic coast. The area is a well-developed area with lots of natural beauty, especially in Karavasta area.

1.1 Natural resources system (NRS)

The components (Elements) involved in the natural resources system (NRS) are:

Upstream:

- Blue water: Drini and tributaries, groundwater aquifers.
- Green water: Water from rainfall used by vegetation.
- Infrastructure subsystem: irrigation canals, dam in the Koman Reservoir just upstream of the confluence with the Drin River, waste water treatment plant, hydropower scheme (currently not in use), bridges, and wells.
- 'ABC' components of the water (physical, biological and chemical characteristics).

Downstream:

- Blue water: Buna and tributaries, groundwater aquifers, Adriatic coast, reservoirs.
- Green water: Soil water.
- Infrastructure subsystem: irrigation canals, existing dams, bridges, wells, dikes, port of Durrës, Vlora and Shëngjin, coastal defence.
- 'ABC' components of the water (physical, biological and chemical characteristics): Karavasta wetland.

1.2 Socio-economic system (SES)

The components involved in the socio-economic system (SES) are:

- Agricultural production.
- Water supply and irrigation management system.
- Tourism and recreation (such as world famous hot water springs).
- Salt production (downstream only).
- Navigation and Port (downstream only).

1.3 Administrative and Institutional System (AIS)

The components involved in the administrative and institutional system (AIS) are:

- Western Albanian Regional Council
- Ministry of Environment, Forestry and Water Administration

- Coordinating body of agriculture, irrigation, environment, navigation and port, economy, communication issues.
- Stakeholders associations and NGO's.

2 Problems and opportunities

2.1 Problem analysis

This section presents a description of the problems and opportunities identified in the pilot areas under study. The identification of these problems is based in the long-term analysis of:

1) Floods

Excessive sediment loaded flow of the Drini and its tributaries have resulted in flooding threats to the low lying areas. The city of Shkodër in the upstream area has continually been threatened in the past due to the low capacity and sedimentation blocking of the sewerage system. Expansive urbanization in this upstream area is also aggravating the urban flooding by reducing infiltration of surface runoff in the location. The downstream area is also exposed to serious flooding problem due, in addition to the high gradient nature of the location, and the increasing urbanization, to the bottleneck in the Buna River. Snow melting due to the ever increasing climate change is also highly aggravating the flooding downstream.

2) Erosions and landslide

Landslides in the black marls just east of Shkodër form a risk for the inhabitants and the infrastructures. These sediment produced through eroding marls and through landslides, finds its way to the river, resulted in the flooding of low lying areas.

There are two sources for the sediments. The gravels and pebbles (which are mainly made up of limestone) are originated from the higher rocky mountainous parts in the catchments and, for a large part, were transported to their current position along the rivers and in higher elevated terraces, during the past ice ages. Another source of sediment is the black marls in the area. When the marls become water-loaded during heavy rain, substantial parts of the rock may collapse and find its way to Drini. These black marls belonging to the limas formations are rather soft and after heavy rains, blackish sediments are produced which are finally taken up by the river water.

3) Decline in agricultural production

Agricultural production is faced with a general decline in production as a result of inefficient cultivation and irrigation methods, ill-maintained infrastructural works, unavailability of labour and falling prices. Crop production seems to be low (upstream), especially in the case of rice, wheat and grapes as compared to fruits, vegetables and flowers while the cultivation of rice crops in the delta is booming upstream. These factors which are caused by human actors have a significant impact on both the increasing tourist population and the country as a whole.

4) Threat to the ecosystem

The main threats to the ecosystem are the excessive use of water resource, inadequate sewerage systems and treatment plants in the upstream area. In the downstream area, the varying nature of salinity concentration in the lagoons and the Karavasta due to inadequate drainage systems in the expanding irrigation fields as well as the exploitation of the salt pans poses a great threat to flora and fauna.

5) Water quality

Inadequate capacity of the sewerage system for the peak flows and treatment plants in the City of Shkodër are the major causes of degraded water quality which releases half treated water to the water system in the Buna. During these high discharges, the ammonia concentration in the river increases which leads to the high mortality of the fish. Polluted water in Buna also comes from large area of agriculture land in Buna watershed. During the high discharge the water in the Buna River changes to black due to sediment coming from marls.

6) Salinity

There is increasing threat on the level of surface and ground water salinities due to expanding irrigated area and the exploitation of the salt pans endangering the quality of life in Karavasta. The level of ground water salinities in some parts of Seman Delta and Karavasta is so high that the water cannot be used for any type of human need and agriculture production.

7) Coastal retreat and dune erosion

Along the Seman delta coast, erosion leads to a higher risk of coastal retreat and dune erosion. On the Karavasta Lagoon, erosion has separated the groins from the beach and is threatening the farms and salt pans.

The low sediment input from Seman resulted in the fast retreat of this zone around the old mouth.

The coastline shows erosion and accretion in different places, with different trends in erosion and sedimentation as a function of time over the last 60 years. The Seman mouth is an accretion zone (2.0 m^3/years since the beginning of 20^{th} century) that does not appear to supply the coastline. The global transport rate is in deficit (2.4 $M.m^3$/year). The sedimentary losses are directed towards the deeper part of the near-shore zone, as well as towards the dune system by Aeolian transport on the spits.

The localization of the major erosion zones is correlated with the spatial distribution of wave energy and the long shore gradient in sediment transport, which seems to be the primary cause of erosion. The long term sea-level rise probably causes 10 % of the shoreline retreat.

Lastly, transport by winds from the land (Mistral, Tramontane) also causes a deflation of the dunes, which are being eroded on E-W trending sections of the beaches.

8) Siltation in the Durrës Port

The central part of the spit is the continuous retreat of and the occurrence of many breaches has endangered the sustainability of the spit bar. Apart from the spit extends further to the North-East direction and it is starting to cause a serious sedimentation problem in the navigation channel. Ongoing sediment transport towards the Gulf of Durrës is expected, thus threatening the entrance channel of the deep-sea port of Durrës. More analysis about coastal morphological processes should be carried out to quantity this thread.

2.2 Categorizing problems

The problems discussed so far are categorized into three based on the skill and expertise of the research criteria due to shortcomings the individual problems. Thus,

- Category 1: the research study has had enough expertise and skill to alleviate the problem.
- Category 2: the research study has had incomplete expertise and skills, but will fill the knowledge gap.
- Category 3: the research study has had limited expertise and skill to solve the problem with the given data.

Table 1 presents a list of the problems identified, their causes and the category of expertise of the research study with respect to these problems.

Table 1 List of problems, causes and their category

Problem	Causes	Where	To Whom	Category
Flooding River	Excessive Sediment loaded flow	Up/ Downstream	Ecosystem City Population	1
	River bottleneck	Downstream		
	High gradients	Downstream		
	Decrease in dune heights	Downstream		
	Climate change	Up/ Downstream		
	Deforestation	Up/ Downstream		
Urban	Urbanization	Up/ Downstream		
	Capacity and Sediment blocking of the sewerage systems	Upstream		
Erosion and Landslide	Deforestation	Upstream	Ecosystem City Population	1
	Geology			
	High gradient			
	Snow load/high rain fall			
Decline in agricultural production	Lack of Market/failing prices	Up/ Downstream	Farmers Population	3
	Irrigation practices			
	Decreasing labour			
Threat to Ecosystem	Excessive use of water resources	Up/ Downstream	Ecosystem Flora/Fauna Farmers	2
	Inadequate/low capacity sewerage system	Up/ Downstream		
	Exploitation of the salt pans			
Water Quality	Fertilizers in fields	Up/ Downstream	Population Ecosystem	1
	Capacity of sewerage system.	Upstream		
	Sewerage related problems	Up/ Downstream		
Coastal Retreat	Lack of sediment supply from upstream	Downstream	Population Ecosystem	1
	Long shore transport			
	Sea level rise			
Salinity	Insufficient drainage system in agriculture land	Downstream	Agriculture Ecosystem	1
	Salt industries			
	Low ground water replenishment			
	Sea water intrusion			
Navigation problem	Sedimentation	Downstream	Population	1
	Low depth of the river during dry season			

2.3 Opportunities

In addition to the problems identified, the research study has pointed out below lists of opportunities that can be exploited in the catchment under consideration.

For Upstream:

- Hydropower Production
- Assess groundwater for water supply
- Tourism/recreation

For Downstream:

- Tourism/recreation.
- Salt production.
- Inland navigation (cargo transport).
- Port/terminal expansion (Inland/Coast).

- Agriculture (Diversify crops).
- Employment

3 Objectives and criteria

3.1 General objectives

The general objective of this research study is to develop and improve the water management in the region focusing on the development of water resources potential, and decreasing water related risks with the aim to improve socio-economic conditions in an efficient, environmental friendly and sustainable way.

3.2 Specific objectives and criteria

The specific objectives, location of these objectives and criteria adopted are presented in the following table.

Table 2 Specific objectives, location and criteria

Specific Objectives		Criteria
Control, mitigate floods and improve flood protection	Upstream and downstream	flooding area (ha) flood depth (m) casualty (no. of people) frequency of flood (/year) loss of property (€) evacuation time (hr)
Reduce Erosion/Landslide in the area and risks	Upstream	erosion area (ha) casualty (no. of people) resettlement
Increase Agricultural land and production	Upstream and downstream	production value (€) irrigation area (ha) cropping intensity (%)
Conserve (improve) Natural resources	Upstream	Water chemistry
Promote efficient use of water resources	Upstream	hydropower production (MW) groundwater table water availability for water supply (m^3) water availability for irrigation (m^3)
Promote tourism in the area	Upstream and downstream	number of tourist employment (no. of people) income (€) infrastructure (€)
Improve the quality of water and soil (salinity control)	Downstream	salinity concentration (mg/L) pollutant concentration (mg/L)
Reduce threats and conserve ecosystems	Upstream and downstream	wetland area (ha) species diversity
Reduce coastal retreat and stabilize spit	Downstream	erosion rate (m/year) coastline protection length (km) dune erosion (m/year)

Specific Objectives		Criteria
Reduce siltation in the Port of Durrës	Downstream	navigational depth (m) rate of siltation (m^3/year)
Improve navigation in the river	Downstream	navigational depth (m) sedimentation (m/year) dredging materials (m^3)
Development coastal port and inland harbours	Downstream	employment (no. of people) income (€) infrastructure (€) port area (ha) channel depth (m)
Diversification on Agriculture	Downstream	production value (€) fish production (tons) aquaculture area (acre) fish diversity

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