The effect of Climate Change on the water sector with a case study of Albania: An economic perspective

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1. Introduction

In January and February 2010, Albania experienced several flooding event, which causes depend partly on climate change. The aim of this paper is to discuss their financial costs and their effects on the state budget and on macroeconomic indicators. In addition, we have analyzed possible financing solution to natural disasters caused partly from climate change factors. Finally, we have proposed some adaptation measures on this matter. The paper concludes with recommendations regarding financial preparedness for natural disasters due to climate change in Albania, based on the experience of developed countries.

2. Literature review: Global policy responses to climate change

> *"The climate has been anything but uneventful in the recent years. The inundation of New Orleans, the European heat wave of 2003 and the accelerating melting of polar ice sheets are widely seen as examples of how climate change is a growing threat to the planet. It is not just the scale of these events, but also the sense of inadequacy of our preparedness for managing adverse events and how this requires us to think in a multidisciplinary way in our preparedness"* (Burroughs, 2007)

Warming of the global climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level (Cromwell, 2010). It has been concluded that many natural systems are affected by regional climate changes, particularly temperature increases. Anthropogenic warming has had a discernable influence on many physical and biological systems (Annex 1 shows the impact of climate change and variability on health).

Societies have always depended on the climate but are only now coming to grips with the fact that the climate depends on their actions. The steep increase in green-house gases since the Industrial Revolution has transformed the relationship between people and the environment. In other words, not only does climate affect development but development affects the climate (The International Bank for Recontruction and Development , 2010).

These changes are already having major impacts on the economic performance of developing countries and on the livelihoods of millions of poor people around the world. Thus, the necessity to take measures and prevent the impacts of climate change on environmental resources is compelling. Modifying public policies, changing individual behavior, implementing adaptation measures and reducing carbon emissions are now considered the great challenges of our society.

Studies on climate change have shown that one of the major impacts will be the increase of weather extreme events, which might to lead to natural disasters. Different regions on the world suffer from different symptoms of climate change. USA is threatened by hurricanes, Japan by typhoons and Europe from floods. Some effects of climate change on water resources are presented in Annex 2 of this paper. Dealing with the consequences requires a multidimensional approach.

Contemporary thinking on climate change management defines two distinct kinds of activities for climate change management: mitigation activities and adaption activities. Many authors insist that for the next 10-15 years it will be essential to put a major emphasis on mitigation, because the more mitigation is done, the less adaptation will be necessary. However, the effects of climate change will be felt with increasing force in years to come, even under the most optimistic scenario for mitigation efforts (Goodwin, 2008).

Therefore, agencies involved in this issue sustain that adaptation to climate change should be addressed through a climate risk management approach—that is, an ongoing process that starts with coping strategies for current climate variability, tries to anticipate changes in climate change, and seeks to evolve new coping strategies as necessary (World Bank Group, 2006). Some examples of supply-side and demand-side adaption options for various water-use sectors are shown in Annex 3.

Adapting to climate change will require tremendous financial investments. Therefore, one of the most important problems to deal with is finding and implementing financing sources for different countries. With economic development and growing investment (especially in coastal regions and agriculture), along with growing risk of extreme weather events, disaster and insurance costs are projected to increase rapidly over the decades[1.] Insurance will become much more expensive, or simply unavailable, for people living in areas increasingly prone to fire, flooding, or high winds; and decisions will need to be made about building expensive dikes, or abandoning airports and other coastal infrastructure. Estimates of the price vary widely, in part because few climate-specific adaption projects have actually been completed.

An appropriate evaluation of the costs of natural disaster is necessary to guide the decision-making process. Models for disaster losses estimation have already been developed, which might be used for evaluation purposes. A widely used model is the Disaster Deficit Index, constructed by Cardona et al (2008). This index measures the economic loss that a particular country could suffer when a catastrophic event takes place, and the implications in terms of resources needed to address the situation. Construction of the DDI requires undertaking a forecast based on historical and scientific evidence, as well as measuring the value of infrastructure and other goods and services that are likely to be affected. Objective modeling must take into account existing information and knowledge gaps and restrictions. The DDI captures the relationship between the demand for contingent resources to cover the losses caused by the Maximum Considered Event and the public sector's economic resilience (that is, the availability of internal and external funds for restoring affected inventories). A complete explanation of the DDI model is given in Annex 4.

Clearly, climate change is not just an environmental issue but one with severe socioeconomic implications, particularly in developing countries. If climate risk management is consistently integrated in domestic policies, it will affect many different sectors within the government, including infrastructure, health, natural resources, agriculture, and water management. The way to address these concerns is not to separate climate change adaptation from other priorities but to integrate comprehensive climate risk management into development planning, programs, and projects. As a result, climate change has catapulted to the top of the agenda for many policymakers (World Bank, 2006). The effects of natural disasters and their relationship and impact with macroeconomic indicators are summarized in Figure 1.

Notwithstanding the importance of theoretical models, public risk perceptions strongly influence the way governments respond to hazards. What the public perceives as a risk, why they perceive it this way and how they will behave are vital questions for policymakers attempting to address climate change. Public support or opposition to proposed climate change policies is greatly influenced by risk perceptions, in the following dimensions:

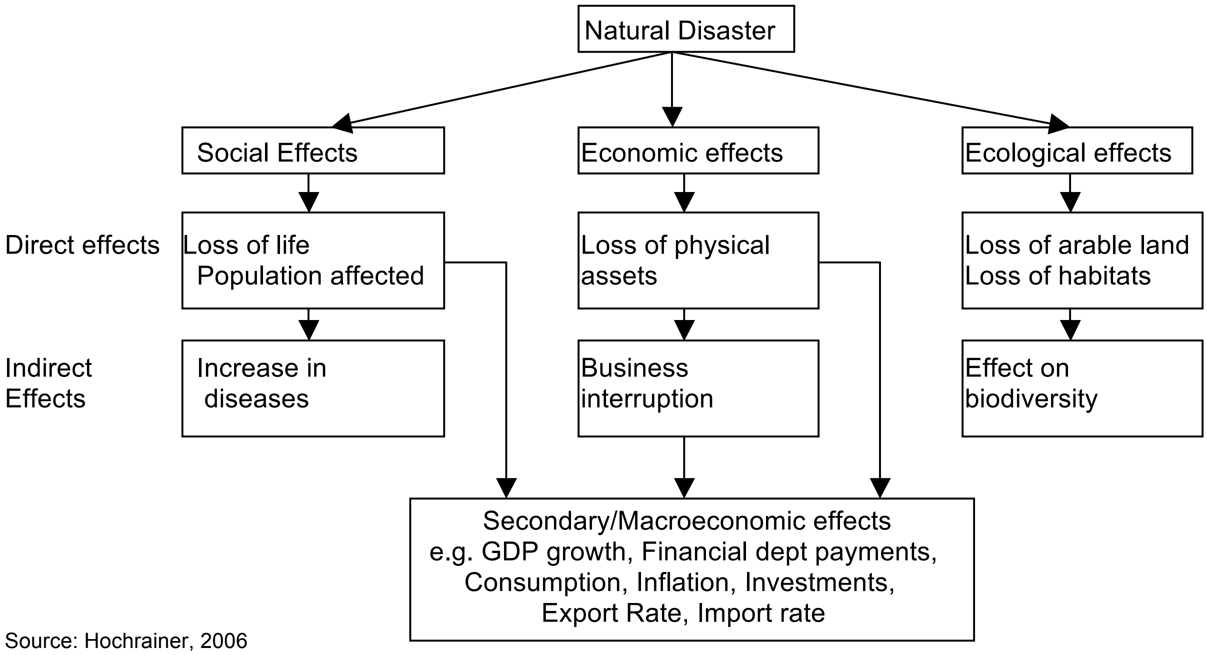
1. *Awareness of Global Warming* - the lack of basic awareness has many important implications ranging from the lack of political pressure on local and national governments to act, to potentially ling term vulnerability as individuals and communities make decision.
2. *Seriousness of Global Warming* - Risk perception of public that affect public and social responses to hazard Awareness is necessary but insufficient to motivate individual or collective response. Nevertheless, seriousness does not mean urgent and climate change remains relatively low priority globally
3. *How could Climate Change pose a threat to me and my family* -Developing countries tend to be more convinced that CC would be a direct threat because they are likely to suffer greater impact of climate change because in part they lack adaptive capacities of developed countries For developed countries which perceive global warming as distant, this remains as a low public priority
4. *How much do we worry about GW* - Varies between countries as climate change affects them in different ways, geographically. Nevertheless polls conducted by GALLUP and Pew, show

[1] Association of British Insurers Report 2005 estimates these costs are going to double every decade that goes on if no adaptation measures are implemented.

relatively low levels of worry which explain why there is still no massive public action to reconfigure current environment policies and lower CO_2 emission in the atmosphere.

5. *Do we understand GW* – High percentages of people both in believe that global warming is a result of the damage of the ozone layer. Still there is little understanding of human activity effect in climate change.

Figure 1: Relationship between the effects of the flood and macroeconomic indicators



Source: Hochrainer, 2006

3. Climate challenges in the water sector in Albania

3.1. Characteristics of water resources in Albania

Surface Water

The area surrounding Albania has relatively abundant fresh water resources. Seven main rivers run from east to west in Albania. Most of the rivers discharge into the Adriatic (95 %), while only 5% discharge into Ionian Sea (5 %). The total volume of water flow is 39,220 x 106 m3/year.

Ground Water

The most important factor, on which groundwater levels depend, is precipitation. The drinking water supply is provided by using underground resources extracted by forced flow. The networks of drinking water provide water not only for domestic use but also for industrial activities.

Marine Water

The Albanian coast consists of the Adriatic and Ionian sea coasts. Monthly variation in sea level is caused by non uniform influences on the hydro-meteorological factors. The highest levels are observed during November – December because strong southern winds at this time push the water mass to the north and increase the sea level. The lowest levels are observed during July – August which is the quietest period of the year. Of great impact to sea level, are the extremes caused by strong winds blowing from sea to land and vice versa, especially when the strong southern winds are active.

3.2. Land Use, Land Use Change and Forestry

During the last years, socio-economic changes, along with massive demographic movement, deeply affected land use policy and land use management. The lack of a sound land use policies has resulted in widespread land degradation and chaotic development causing the loss of the best quality farmland to non-agriculture, urban use. Multi-storey buildings have been built in areas previously considered uninhabitable.

Furthermore, the exploitation of river beds (to extract construction materials) and the natural phenomenon of erosion have broken natural equilibriums. To reverse these trends, the MEFWA has already set up programs for the rehabilitation of forestry and breeding areas.[2]

3.3. Climate challenges and disaster risk in Albania

Climate change symptoms are beginning to affect Albania. During the last years, many weather phenomena have made it clear that including climate adaptation measures in environmental policies is becoming a necessity. Likely changes in climatic parameters in Albania are shown in Table 1:

Table 1: Climate change effects on environmental resources in Albania

Climate parameter	Climate change effect	Consequences
Frost days (temperatures ≤ –5 °C) in high altitudes	Expected decrease: 4–5 days, 9 days and 15 days by 2025, 2050 and 2100 respectively.	
Temperatures during summer [3]	Likely increase up to 5.6°C	Increased probabilities of extreme events (heat waves and droughts) and a higher intra-annual variability of minimum temperatures. Higher increase of daily minimum than maximum temperatures is likely to occur. More frequent and severe droughts with greater fire risk are likely.
Precipitation during summer	Reduction by 41%	
Temperatures during winter	Higher temperatures	more precipitation is likely to fall in the form of rain rather than snow will cause: increase both soil moisture, floods and erosion. The floods will still occurred during spring time, but will shift toward the winter.
Heavy precipitation during winter	Is likely to increase by 1–2 days by 2025, 2–3 days by 2050, and 3–5 days by 2100 compared to 1951–2000 average	Although total precipitation is expected to decrease, an increase of intensive rain episodes is likely. The maximum reduction accounts for 30% and 66% respectively by 2050 and 2100. It must be taken into consideration by the Hydropower industry
Sea level	Will rise	Will cause several direct impacts, including inundation and displacement of wetlands and lowlands, coastal erosion, increased storm flooding and damage, increased salinity in estuaries and coastal aquifers, and rising coastal water tables.
Ground water supply	Will be reduced	In combination with increased salinity of the ground water supply can cause shortage of drinking water of adequate quality.

Source: Adapted from data on "Albania's Second National Communication to the Conference of Parties under the United Nations Framework Convention on Climate Change"

According to the above mentioned figures, Albania is affected by a relevant number of natural disasters, whose effects, in many occasions, are exacerbated by human activity. The frequency of these disasters has risen during the last century. Many specialists explain this phenomenon in relation to climate change. Floods, mudslides of soil, fires in forests are some of the most frequent phenomena in Albania. In developing countries, the possibility to rapidly react to these disasters is lower, since the economic possibilities to respond to the event are limited.

[2] Ministry of Environment, Forestry and Water Administration Report 2005-2007

[3] Climate change scenarios regarding projections about level of temperatures in long rung are presented in Annex 5

In general, the natural disasters are unpredictable events. But, they occur according to a specific frequency and are located in specific areas. However, in many occasions, especially in the case of floods, the statistics regarding the possibility of occurring of the event have failed. Table 2 shows some predictions regarding the frequency of occurrence of different disaster events.

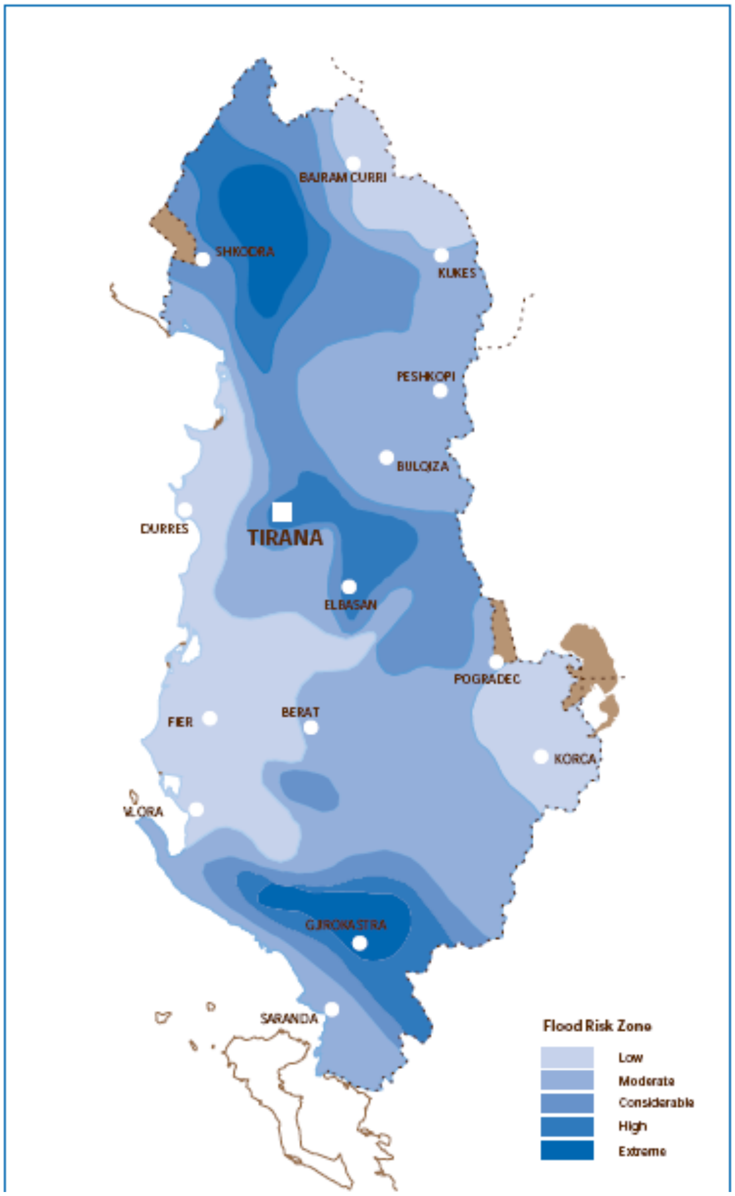
Table 2: Predictions regarding natural disasters occurrence in Albania

Nr.	High possibility	Medium possibility	Low possibility	Variable possibility
1.	Fog	Erosion	Earthquake	Avalanche
2.	Hail	Drought	Lightning	Infection of crops
3.	Slide of soil	Flood		Snow storm
4.	Fire in Forest	Ice storm		Wind storm
5.		Intensive rain storm		
6.		Sinking		

Source: Ministry of Interior

Albania has a long flooding record. The floods generally derive from rivers and occur during September-March. In this period also occur 80-85% of annual precipitations. Some data regarding the level of damages and other impacts of the major flood events in the last 50 years are summarized in Annex 6. Figure 2 shows the expected floods with a chance of repetition one time in 100 years. The flood with repetition chance one time in 100 years is forecasted to affect 20 districts, 110 municipalities, 341 villages, 85500 buildings of a total construction surface of 7900000 m2 and 565000 inhabitants (United Nation Development Programme, 2003).

Figure 2: 100 years return period of the maximum flood potential map



Source: Disaster risk Assessment in Albania, UNDP, 2003

Even with these predictions, few direct climate change adaptation measures have been implemented so far in Albania. Following the flood of 1962/1963 Albania undertook considerable investments in prevention measures. They were mainly engineering like: reconstruction of dike systems damaged or destroyed by the flood, construction of new dikes, construction of water retention reservoirs on Drin and Mat rivers. Some other actions taken during the second half of the 20th century for other purposes have indirectly contributed (and will contribute) to adaptation to climate change. The most important measures are the construction of flood protection systems in the lower part of the main rivers. In recent years more infrastructural investments have been made. They are shown in Table 3 along with their approximate costs and period of occurrence.

Table 3: Infrastructure investments for flood prevention

Period	Type of investment	Cost Approx.
1998-2005	Investments for irrigation systems, drainage, and flood prevention	20 billion ALL
2006-2009	- Investments for irrigation systems, drainage, and flood prevention	9 billion ALL
	- In the framework of the "Management of water resources" project were undertaken investments on:	
	- Embankment of Gjader (Shkoder)	18.6 million ALL
	- Embankment of Narac-Vau Dejes	28.7 million ALL
	- Protection from Drin River, Berdice (Shkoder)	18.2 million ALL

Source: Ministry of Agriculture, Food and Consumer Protection

The maintenance of flooding infrastructure is crucial for ensuring its stability. If the dams grow old, their security is put under question. This is a crucial issue which requires proper administration, including inspections, evaluation, modifications and improvement of existing systems. Also, the migration trend of the population has given their impacts to the dams system in Albania. Especially the construction of infrastructure near the existing dams structure, and, also, other human activities have affected the general stability of dams and their security.

The cost of disasters in Albania causes severe consequences for the economy. The financial cost of preventing an emergency is ten times as low as the financial cost for responding to the disaster and return to the initial conditions[4]. The human losses are not considered in this calculation. The cost of a disaster is conditioned not only to the level of vulnerability, but also to the capability of the economy to restore from the disaster damages. Thus, the developing and poor countries are going to face much higher costs in case of disasters. The consequences often include increase of poverty, economic variation and undefined time for recuperation. The disasters cost will affect both public budget and private budget of the economies affected by the disaster. The floods are an annual event in Albania. Thus, adopting a clear strategy to respond to these events is becoming a necessity, not only for economic issues, but also for social and human concerns.

3.4. Case Study – Consequences of the January 2010 Flood in North Albania

3.4.1. Overview of the events

During the period 25.12.2009-10.01.2010, the country experienced weather with continuous precipitation accompanied with relatively high temperatures, which caused fast melting of snow in mountainous areas, mainly in the reservoir of Drin River. From January 1 until January 6 140 mm rain was registered in Shkora and 70 mm rain in Lezha. The precipitations and snow melting caused the fast increase of feeds in Drin cascade. Consequently the discharges in Vau i Dejes plant increased reaching the level of 2500m3/second. Along with the massive feeds of Drin River, heavy feeds of rivers Gjader and Kir discharged in Buna River. All these events caused Buna River to overflow and the raising of Shkodra lake level, which initiated the flooding of villages located in both sides of Buna. These levels of precipitations were very high and lasted for several days, while the level of temperatures in those days was uncommon for this period of the year.

In the meanwhile, during the period 25 December 2009 -6 January 2010, the coastal areas around Lezha were flooded as result of 170mm precipitation and rising of sea level due to an abnormal tide accompanied with strong winds and high waves. Even though the situation was serious, the level of Drin River of Lezha, the main collector that discharges drainage water in the sea, never reached the critical levels.

Following these events, the Albanian Government declared "The Status of Civil Emergency" and established an Inter-ministerial Committee. In the mean time, emergency staff in Shkodra Prefecture drew up and implemented evacuation plans for each Local Government Unit. The emergency plan consisted in: evacuation of the population and livestock threatened by the flood, repair of embankment, distribution of aid and provision of road crossing by Armed Forces.[5]

[4] Ministry on Interior

[5] Ministry of Interior

The factors that caused the flood have been strongly debated. This discussion is not at focus in this article since there is no scientific evidence and official and reliable data to support any of the hypotheses. It is likely that a combination of factors caused this disaster.
The climacteric factors that contributed to the event are: the change in the patterns of rain and snow and the abnormal temperatures, which failed to be predicted. These caused heavy snowmelt, which normally should occur during spring. In the mean time, there was heavy rain falls, which combined with snow melting, caused the increase of river feeds and thus increase of flood size. Even though some efforts to conceive forecast techniques of weather in a changing climate were made, only some scenario predictions are realized. Regarding Lezha flood, the main reason is related to the critical tide, which is explained through the rising level of the sea from river feeds.
Secondly, the change of land management and use and the change of land destination are other factors that influenced the flood size. As it was mentioned, there are several problems, related especially to the transition period, caused by these factors. Among them are considered: the transformation of agricultural land in construction land, erosion problems from bad management of forests, constructions in forbidden areas on both sides of rivers, dikes, dams and reservoirs, the inappropriate exploitation of river beds, construction in marshy land (areas below the sea level), inappropriate functioning of hydro systems and problems with their management.
Moreover, Buna is the river where many other river discharge. One of these rivers is Drin River, where three of the most important hydro plants of the country are built. During the flooding days, the precipitations caused the level of the plant to exceed the permitted levels of Fierza Lake. The risk that these levels of water might cause a disaster much bigger that the one that occurred, induced the state structures to manage the situation as described.

3.4.2. Evaluation of damages

Complete data about the damages of the flood, especially for those regarding financial aspects, are still in process of evaluation. The economic effects need a more thorough analysis due to the complexity of the topic and the importance for the risk management and modeling approach. It is clear though that the state budged will be considerably affected. Some data regarding the surface of flooded land, evacuated persons, damaged buildings, agricultural assets and businesses are given in Annex 7.
Direct costs are related to direct damages caused by the flood. They comprise all the damages to immovable assets and on stock (including final goods, goods in process, raw materials and spare parts)[6]. The direct costs of the flood include: 1.- The reparations for flooded families and businesses, the evaluation of which is still uncompleted; 2.- Costs related to the total or partial destruction of physical infrastructure, buildings, installations, machinery equipment, means of transport and storage, furniture, damage to farmland, irrigation works and reservoirs. On the other side, indirect costs are to be evaluated. They derive from indirect damages which occur as a consequence of the direct stock losses: 1.- Other invisible or non-material costs related to the loss of potential agricultural production from the flooded agricultural areas and the loss of potential production of businesses damaged by the flood; 2.- Costs related to the time needed for the recuperation and regeneration of flooded lands. Also, invaluable in financial terms but not less important, social consequences like loss of life, increase of diseases, trauma, stress, uncertainty of all those who were in the frontline of the events are to be taken into consideration.
In Shkodra region, during the last years, many investments in infrastructure were undertaken. The total investments in the country for flood protection were shown in table 3, while in Table 4 are shown the infrastructure investments, which represent mitigation measures undertaken in Shkodra region since 2006.

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6 In the essence direct damages occur right at the time of the actual disaster itself or by aftermath physical destruction (Hochrainer, 2006).

Table 4: Infrastructure investments in Shkodra region since 2006

Period	Type of investment	Cost
2006	Construction of embankment of Kir River in Shkodra	70 million ALL
2007	- Main drainage System in Zadrime (Shkoder) and in Down Shkodra area - Construction of embankment of Kir (Shkodra) - Protection measures from Buna River	15.5 million ALL 40 million ALL 40 million ALL
2008	- Main drainage systems in Down Shkodra - Construction of embankment of Kir (Shkodra) - Protection measures from Buna River in Shirgj-Dajc villages (Shkodra)	11 million ALL 20 million ALL 13 million ALL
2009	- Protection measures from Buna River in Shirgj-Dajc villages (Shkodra) - Construction of embankment of Kir (Shkodra) - Main drainage systems in Down Shkodra-Mertemze-Ana e Malit	8.5 million ALL 21.5 million ALL 12 million ALL

Source: Ministry of Agriculture, Food and Consumer Protection

During the emergency phase many response measures were undertaken. They include: cleaning of some main areas of water discharge, repair of Ças embankment, removal of water from Ças hydrovor and other investments in the damaged hydrovor of Ças, installation of four moto-pumps in Ças hydrovor, etc. The approximate cost of these interventions is 30 million ALL. In table 5 are presented the intervention needed to be considered in infrastructure in a post emergency phase and in table 6 are evaluated the investments that should be considered in long run.

Table 5: Investments in post-emergency phase

Type of Investment	Evaluated Cost
Full rehabilitation of Ças embankment	130 million ALL
Full rehabilitation of drainage systems (main and secondary canals) in Down Shkodra area and municipalities of Ana e Malit and Velipoja; rehabilitation of the segment that allows waters of Down Shkodra area to be deposited in the sea	100 million ALL
Buna River embankment	1.3 billion ALL
Other research and projections	20 million ALL

Source: Ministry of Agriculture, Food and Consumer Protection

Table 6: Investments to be considered in long-run

Type of Investment	Evaluated Cost
Full construction of Kir River embankment	90 million ALL
Construction of embankment in Kuq village, for protection from Kir River	100 million ALL
Protection measures from Buna River, in the left side of Oblike village	112 million ALL
Construction of drainage systems (canals) in Shkodra area	55 million ALL

Source: Ministry of Agriculture, Food and Consumer Protection

It is obvious that many of the consequences of this flood, but also of other disaster events, will be transmitted to the future generations. The disaster will affect different sectors in varying degrees and thus will be reflected in the macroeconomic performance of the country's economy. In Table 7 are illustrated some potential impacts of a disaster event and its possible timeframe.

Table 7: Potential impacts of a disaster event to macroeconomic indicators

Macroeconomic Indicator	Expected change
GDP	Immediate drop in GDP growth in the year of the event Rise in GDP growth in the year after the event Slow down in second and/or third year
Agricultural sector	Significant fall in production
Manufacture Sector	Decrease in activity due to disruption of transportation, reduced production capacities
Service Sector	Decrease in activity due to disruption of transportation and payment system
Exports of goods	Reduction in the rate of growth in the year of the event In the year after return to the previous levels In subsequent years continuation of the year after
Imports of Goods	Considerable increase in the rate of growth in the event year A return of pre-disaster level a year after In subsequent years a further drop, possibly caused by reduced incomes
Gross Formation of Fixed Capital	Sharp increase in the year following the disaster
Inflation rate	Short increase caused by the disruption of production and distribution and increasing transportation costs
Public financing	Worsening of deficit due to a shortfall in tax revenues and increase of public expenditures
Trade balance	Deficit due to decrease in exports and increase in imports, associated with the decline in production capacities and strong public and private investments for reconstruction

Source: Adapted from Hochrainer, 2006

After this year's floods, it became clear that policy makers in Albania should consider climate impacts while drafting government programs and policies. In fact, climate change is gaining importance in Albania, although so far few studies have been conducted on its consequences. United Nation Developing Program in Albania in collaboration with the Ministry of Environment, Forestry and Water Administration has prepared a study on the possible effects of climate change on environment and especially water resources and proposed some adaptation measures. The National Environment Reports, Integrated Plan on Ministry of Environment, Forestry and Water Administration (MEFWA), and the National Civil Emergency Plan of Ministry of Interior include several adaptation measures in case of floods.

3.5. Financing issues

How can losses and other disaster consequences be financed? We focus on Albania's potential to implement different finance options. Also, we analyze how climate consequences, especially extreme ones, are considered in financial terms in the EU budged, and how this behavior has changed in the last years.

In addition, we discuss how climate change is affecting social behavior.. Most of the actual climate risk management is carried out by individuals, communities, and businesses in their day-to-day decisions and regular investments. Social capital, although not specifically designed for the purpose, can also play an important role in coping with environmental stresses and can be encouraged through appropriate interventions (Pretty and Ward, 2001).

Traditionally, in case of an extreme event in Albania the first resource to be used is the civil emergency fund[7] accorded to the Ministry of Interior[8,] second is the Council of Ministers Special Fund. This funding is not earmarked for a special purpose, but becomes available whenever such an event occurs. In fact, part of this fund was used to relief the damages of the 7 grade Richter earthquake that hit Gjorica in September 7, 2009. When flood events occurred in January 2010, the state budget was put in a difficult position. First it was very difficult to evaluate the damages. Second, funding was difficult to obtain since it

7 Low nr.8756, date 26.03.2001 "For Civil Emergency"

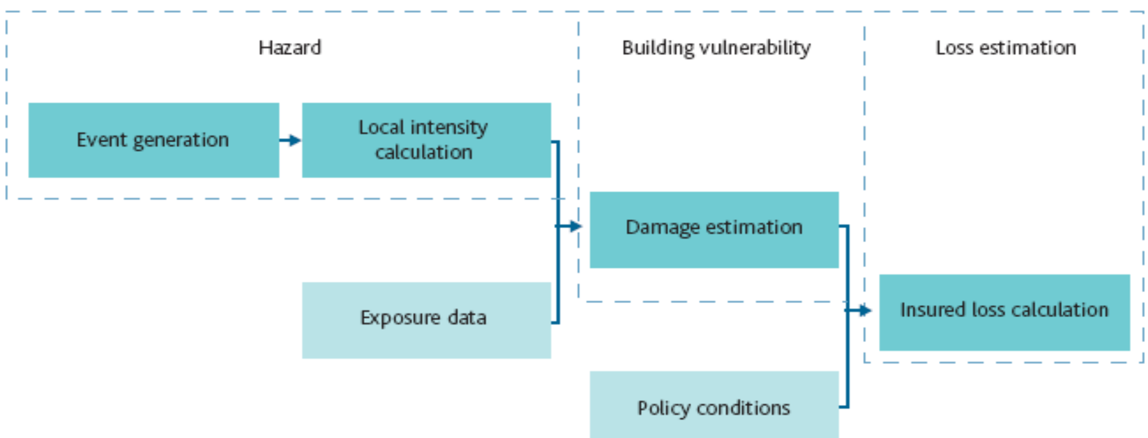
8 2009 Civic Emergency Fund was 607 million ALL, Council of Ministers Special Fund 800 million ALL

was previously used for damage relief in the 2009 Earthquake event. Financial contribution was collected by local units (municipalities, districts and county)[9], different government institutions, non-profit organizations and other societies, businesses, and individuals. However, the Funding sources for damages in case of future extreme weather events remain uncertain. Based on international experience, the following options can be considered:

Insurance and reinsurance payments. Insurance companies can provide new products to insure individuals/businesses against extreme weather events. Individuals bearing greater risk will pay bigger policy prices; those bearing lower risk will pay lower prices. In case of the event, risk will be distributed equitably between the portions of policy holders. But, in some cases, the damages inflicted can be of such magnitude that it may be costly for insurance companies to pay. In this case, insurance companies can transfer part of the risk though reinsurance payments.

Locally it looks like an appropriate solution but, climate change is a global problem. In the long run, with increased climate change risk, under high CO_2 emission scenarios, Insurance market finance capacity is not enough to finance damages of extreme weather events[10]. In this matter, we are referring to the AIR model. A simulation was undertaken by the natural catastrophe modeling team at AIR-Worldwide. It estimated the incremental impact on property of moving from a baseline set of storms within each of their models to one in which the climate-stress tests and limited sensitivity tests were included (Figure 3 shows key components of AIR model). Estimations regarding insured loss in Europe from the impacts of climate change are given in Table 8. All exposure information (location and density of population and property, physical characteristics of the property, asset values) according to this model was kept constant at today's values.

Figure 3: Components of AIR model



Source: AIR Worldwide

Table 8: Impacts of changing windspeeds in natural catastrophe models on additional costs of storms ($ bn in 2004 prices)

Scenario	Frequency increase in top 5% of Storms	Annual average insured loss	Insured loss with chance of occurring once every 100 years	Insurance loss with chance of occurring once every 250 years
Potential impact of climate change	20%	+0.5%	+2.0	+2.5

Source: AIR Worldwide

[9] For example the total contributions of Local Government Units of Tirana District are projected 44850000 ALL (Source Prefecture of Tirana District)

[10] With economic development and higher investment in coastal area and agriculture, the value of the assets increases along time past.

The problem in Albania is the low level of private insurance. This is due to the mentality inherited from the past, that the public sector should be responsible for protection and reimbursement of damages in these occasions. In fact, no policy or obligation exists for insuring property in these risky areas. On the other hand, voluntary insurance is rarely adopted in Albania. Another problem may be the low income per capita in Shkoder region Families exposed the most to flood risk have small income, and policy prime can be a burden. A plausible solution may be that part of this prime can be subsidized by the government.

Financial Markets[11]- If insurance market fails to meet the financial needs in case of Extreme Weather Events because of it size, we can occur to financial markets where funding opportunities are far too big, by introducing weather related financial products. Table 9 summarizes features, advantages and disadvantages of these instruments.

Table 9: Financial market mechanism for Extreme Weather Event financing

Financial mechanism	Description	Seller/buyer	Advantages	Disadvantages
Catastrophe Bonds	Financial contracts which pay out on fulfillment of a trigger condition. They are usually triggered by a loss from a particular pre-defined catastrophe	Sellers are insurance companies Buyers are major investors such as mutual and pension funds	Simple to administer Yield is high Risk is uncorrelated with other asset classes	Diversify funding for catastrophic risk by accessing capital which under normal conditions is not available to insurance Help to increase capacity in the market
Weather derivatives	Pay out on a specific trigger but covering a period of time	Sellers energy companies Byers: mutual funds, insurance companies, pension funds	Difficult to insure risks is covered. Payout is determined by index of objective measurements Eliminates catastrophe software error	Requires accurate prediction of information Expensive to set up Damage can exceed the indemnity covered

This is a very valuable tool insurance company and governments can rely on. The problem with Albanian insurance companies is that because of their size, such financial instruments may be very expensive to purchase. Another issue to be considered is the current financial crisis. Financial markets are contracted for the moment, and trading such large value instruments may be rather difficult. How will this contract be regulated and other related issues may pose some barriers to this finance opportunity.

Aid and Donations – This financial source is not always predictable in size, so it is better to be careful while calculating its portion of it in the DDI. However, it has played an important role in past disaster events.

New Taxes – This is a very sensitive measure. The whole tax system must be analyzed and the effect of this new tax can be measured by the Laffer curve, which defines the relationship between government revenue raised by taxation and all possible rates of taxation.

Budgetary relocations - This may be the most difficult issue. This possibility of financing poses a very delicate concern. Different governments, based on the importance and awareness on such problems, allocate differently the state budget to different sectors. For example, in EU budget figures for preservation and management of natural resources represented 42% of the total budget. In this element are included expenditures for the environment, agricultural expenditures and direct aids, rural development and fisheries. The percentage of this element has slightly increased since 2008. These figures for the year 2010 are predicted to rise to 59.5 billion EUR (or 5.4% more compared to 2009). During 2008-2010 there is a rise in the level of expenditures addressed to environment protection. This is partly due to the

[11] Albania has underdeveloped financial market. In this case, in the short-run perspective, we are referring to international financial markets.

increased representation of the Green Party in the European parliament. Nevertheless the level of these expenditures for climate change adaption is still low, and some reasons of such situation are related to government priorities, which does not fully consider adaption measures to CC, and social awareness about CC consequences. In the USA dealing with global warming ranks at the bottom of the list of public priorities; just 28% of the population considers this a top priority, the lowest measure for any issue tested in the survey.
Regarding Albania, the budgetary allocations and figures regarding civil emergencies[12] are shown in Table 10, and regarding environment protection in Table 11.

Table 10: Budgetary allocations and figures regarding civil emergencies

Budget figures	Expenditures (in ALL)	Budgetary allocations	Expenditures (in ALL)	% to total budget and MOI budget
Total budget	243851019	For civil emergencies	614.000	0,2518
Total budget for MOI	16.577.005	For civil emergencies	614.000	3,7039

Source: Ministry of Finances

Table 11: Budgetary allocations and figures regarding environment protection

Budget figures	Expenditures (in ALL)	Budgetary allocations	Expenditures (in ALL)	% to total budget and MEFWA budget
Total budget	243851019	For Environment protection	338.000	0,1386
Total budget for MEFWA	2.044.900	For Environment protection	338.000	16,5289

Source: Ministry of Finances

The figures show that environment protection is not still listed to top priorities of Albania government. This is caused because many other concerns as education, health protection, and other social problems for the moment are considered as priorities. Also, there is not a distinct element regarding climate change prevention and management. This is partly due to the fact that in Albania climate change is not a concern among the population. In Albania there is no official survey to measure what knowledge Albanians have on GW. Moreover, environmental education is very poor and also there is no direct policy to address approach to the public. Thus there is no public pressure to government regarding this problem.

External Credit /Internal Credit – alternative financial recourses on which we can rely in case of disaster event.

4. Conclusions and recommendations

The effects of climate change are affecting Albania. More likely the country will experience: variability of temperatures, change of patters of precipitation, change in sea level, serious impacts in biodiversity, etc. the most concerning consequences of CC are the increasing of extreme weather events (natural disasters). Flooding events were at focus in this article, since Albania has experienced tree major floods January and February 2010. Even though the causes of disasters in Albania are complex, and include land use control, deforestation, uncontrolled urbanization, infrastructure inefficiencies, water management, human activity, etc., it is believed that CC would increase the frequency of these events.
Financing these events is becoming a major public policy concern. The evaluation of costs and prediction of future events and costs related to them is a very difficult problem, because of complexity of costs related to the event and the impossibility to include in evaluation every element (like social costs, potential cost, etc.). We suggest DDI model to asses and evaluate the macroeconomic financial costs of EWE, and the finance capacity of Albania.
On the other hand, the financing issue remains unsolved. Until now, the cost of a natural disaster was borne by central and local budget units and, occasionally, from voluntary donations and contributions. The insurance system and culture in Albania is very undeveloped, especially in terms of voluntary insurance.

[12] This element of the budget is used for any civil emergency that may affect the country.

Other financing options (financial instruments) have not been implemented yet in Albania. Moreover, the social awareness regarding these problems is very low. Under these circumstances, what is certain is that the cost will be transmitted to future generations, partly through the tax system.
Our recommendations are presented in the following paragraphs:
1. Consideration of climate change consequences in government programs and policies.
2. Restructuring of the present legal systems and institutions responsible for land use and management policies.
3. Implementing adaptation measures and preparing a strategy to assess and manage the risk of more frequent extreme weather events in the future.
4. Designing a national finance strategy of natural disasters, where insurance policy modifications are involved.
5. Making property insurance obligatorily in areas more at risk from extreme weather events.
6. Encouraging environment and climate education among the population.

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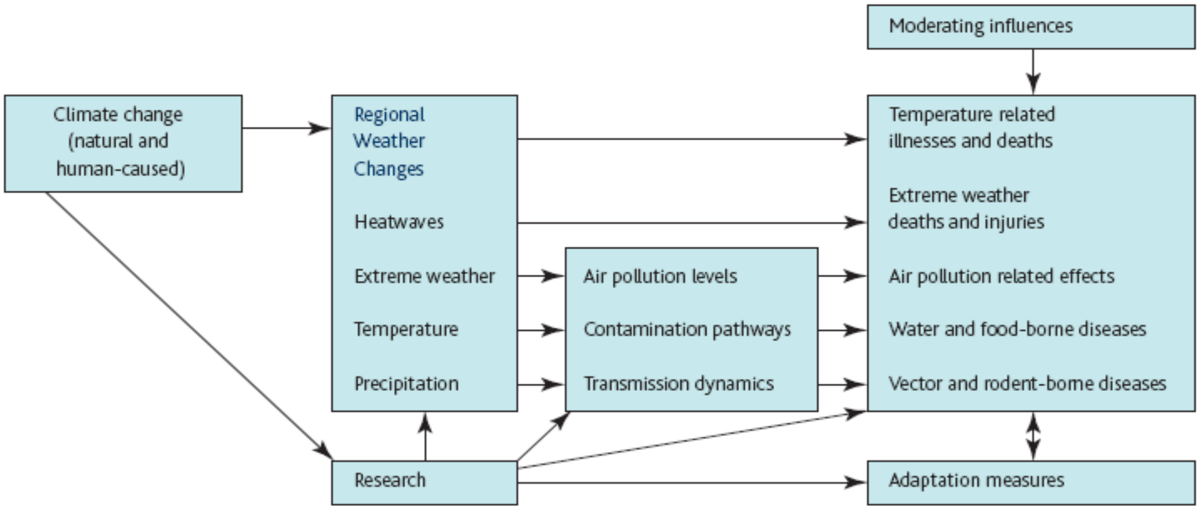
Annex 1: Potential health effects of climate variability and change



Source: Patz and others (2000), The potential health impacts of climate variability and change for the United States, Environmental Health Perspectives v108, April 2000.

Annex 2: Effects of climate change on water resources

System	Characteristics	Impact of the change in the system	Water resources potential impacts
Overland flow	Surface flow which is the main volume in the floods and affects soil erosion together with diffusive pollution	Due to increase in the rainfall intensity there are flood risks in small basins; more soil erosion with loss of fertile soil and increasing diffusive pollution	• Increase the flood frequency for the same risk; • Increase the soil erosion and loss of fertile soil; • Increase the pollution load in rivers
Groundwater	Important reservoir of water (mainly in dry areas), is vulnerable to changes in rechargeable water from rainfall. This is the flow component which allow the perennial conditions of the rivers	• High rainfall in short period and increasing dry days may decrease the amount of water recharge for groundwater. • Decreasing the water recharge, increases overland flow and decreases low flow in rivers and its capacity for natural flow regulation.	• Increase the frequency of droughts • Increase the need for artificial flow regulation by reservoirs • Water quality deterioration because of the decreasing capacity for pollution dilution.
Lakes and Reservoirs	This system regulate the flow of the basin; it has large surface water for evaporation; temperature regulates its water quality.	• Decreasing low flow can affect the lake and reservoir regulation, decreasing its levels; • Rainfall-evaporation balance is important for the change conditions of the lake overtime; • Increasing temperature can affect water environment (fauna and flora).	• Decrease in the reservoir regulation capacity can affect: water supply, irrigation, navigation and hydropower at different stages. • Change in lake levels along time affect population on the border of the lakes and its environment.
Coastal areas	River basin which drains to the sea has an important environment. It brings sediments with nutrients and flow energy which creates an equilibrium at the coast.	Decreasing the river flow together with the sea level rise allow the sea water to enter upstream in the system, affecting the salinity, change the sediment deposition areas and increase the coastal erosion.	• Vulnerability to population in the coast due to erosion; • Decreasing nutrients and fishing productivity; • Salinity intrusion affecting water supply; • Change navigation conditions.

Source: Flood management in a changing climate, 2009

Annex 3: Examples of supply-side and Demand-side Adaption Options for various water-use sectors

Water use sector	Supply side measure	Demand-side measure
Municipal water supply	Increase reservoir capacity Extract more water from rivers or groundwater Alter system operating rules Inter-basin water transfer Capture more rain water Desalination Seasonal forecasting	Incentives to use less (e.g. through pricing or rebates) Legally enforceable water use standards (e.g. for appliances) Increase use of grey water Reduce leakage Increase use of recycled water Development of non-water based sanitation system
Irrigation	Increase irrigation source capacity	Increase irrigation-use efficiency Increase use of drought-tolerant plants Alter cropping patterns
Industrial and power station cooling	Increase source capacity Use of low-grade water	Increase water use efficiency and water recycling
Hydropower generation	Increase reservoir capacity	Increase efficiency of turbines; encourage energy efficiency
Navigation	Build weirs and locks	Alter ship size frequency
Pollution control	Enhance treatment works	Reduce volume of effluents to treat (e.g. by charging for discharges Catchment management to reduce polluting runoff
Flood management	Increase flood protection (levees, reservoirs) Catchment source control to reduce peak discharges	Improve flood warning and dissemination Curb floodplain development

Source: Adapted from Compagnucci et al. 2001 and Kundzewicz et al. 2007

Annex 4. The DDI model – An approach disaster risk assessment and Public economic resilience

A model of Estimation of Probabilistic Losses from a disaster event, developed by Cardona et al. (2008) is presented in the following paragraph. This model might be fully implemented while conceiving national and regional policies of disaster evaluation, since disaster risk often involves more than a country. Financing strategies in case of disaster events might be based on this model.

Disaster risk management requires measuring risk to take into account not only the expected physical damage, victims, and economic equivalent loss, but also social, organizational, and institutional factors. The difficulty in achieving effective disaster risk management has been, in part, the result of the lack of a comprehensive conceptual framework of disaster risk to facilitate a multidisciplinary evaluation and intervention.

1. Disaster Deficit Index (DDI)

This index measures the economic loss that a particular country could suffer when a catastrophic event takes place, and the implications in terms of resources needed to address the situation. Construction of the DDI requires undertaking a forecast based on historic and scientific evidence, as well as measuring the value of infrastructure and other goods and services that are likely to be affected. The DDI captures the relationship between the demand for contingent resources to cover the losses, L^P_R, caused by the Maximum Considered Event (MCE), and the public sector's economic resilience, R^P_E, that is, the availability of internal and external funds for restoring affected inventories.

$$DDI = \frac{L^P_R}{R^P_E}$$

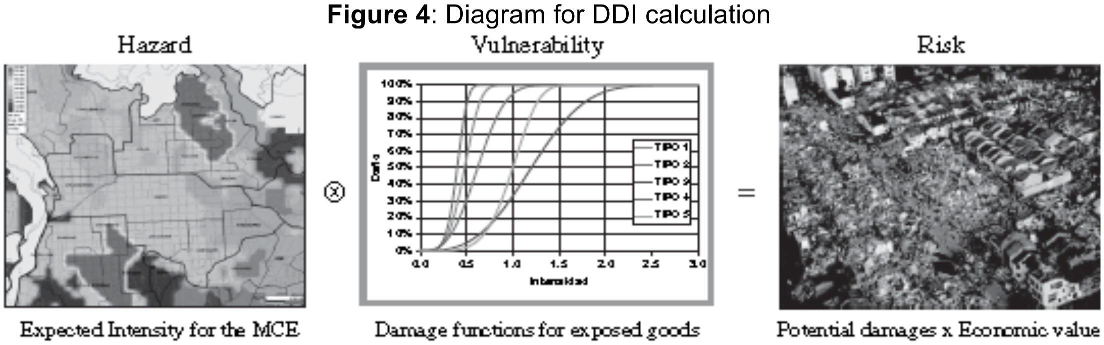
Where $L^P_R = \varphi L_R$ represents the maximum direct economic impact in probabilistic terms on public and private stocks that are governments' responsibility. The value of public sector capital inventory losses is a fraction of the loss of all affected goods, L_R, which is associated with an MCE of intensity I_R, and whose annual exceedance rate (or return period, R) is defined in the same way for all countries (i.e., return periods of 50, 100 and 500 years, whose probability during any 10 years exposure period is 18%, 10%, and 2%, respectively). This total loss L_R can be estimated:

$$L_R = EV\left(I_R C_S\right)K$$

Where: E - Is the economic value of the total property exposed; V ( )- Is the vulnerability function, which relates the intensity of the event with the fraction of the value that is lost if an event of such intensity takes place; I_R - Is the intensity associated to the selected return period; C_S - is a coefficient that corrects intensities to account for local site effects; and K is a factor that corrects for uncertainty in the vulnerability function.

The economic resilience, defined as $R_E^P = \sum_{i=1}^{n} F_i^P$, where F_i^P - represents the possible internal and external resources available to the government when the evaluation was undertaken. Access to these resources has limitations and costs that must be taken into account as feasible values according to the macroeconomic and financial conditions of the country. In this evaluation the following aspects have been taken into account: the insurance and reinsurance payments that the country would approximately receive for goods and infrastructure insured by government; the reserve funds for disasters that the country has available during the evaluation year; the funds that may be received as aid and donations, public or private, national or international; the possible value of new taxes that the country could collect in case of disasters; the margin for budgetary reallocations of the country, which usually corresponds to the margin of discretional expenses available to government; the feasible value of external credit that the country could obtain from multilateral organisms and in the external capital market; and the internal credit the country may obtain from commercial and, at times, the Central Bank, when this is legal, signifying immediate liquidity. Figure 4 shows a diagram illustrating the way to obtain the DDI.

Figure 4: Diagram for DDI calculation



$$DDI = \frac{MCE\ loss}{Economic\ \mathrm{Re}silience}$$

Description	Indicator
Insurance and reassurance payments	F_i^P
Reserve funds for disasters	F_i^P
Aid and donations	F_i^P
New taxes	F_i^P
Budgetary reallocations	F_i^P
External credit	F_i^P
Internal credit	F_i^P

Annex 5: Climate change scenarios for Albania

Scenarios for Albania		Time horizon		
		2025	2050	2100
Annual	temperature (°C)	0.8 to 1.1	1.7 to 2.3	2.9 to 5.3
	precipitation (%)	–3.4 to –2.6	–6.9 to –5.3	–16.2 to –8.8
Winter	temperature (°C)	0.7 to 0.9	1.5 to 1.9	2.4 to 4.5
	precipitation (%)	–1.8 to –1.3	–3.6 to –2.8	–8.4 to –4.6
Spring	temperature (°C)	0.7 to 0.9	1.4 to 1.8	2.3 to 4.2
	precipitation (%)	–1.2 to –0.9	–2.5 to –1.9	–5.8 to –3.2
Summer	temperature (°C)	1.2 to 1.5	2.4 to 3.1	4.0 to 7.3
	precipitation (%)	–11.5 to –8.7	–23.2 to –17.8	–54.1 to –29.5
Autumn	temperature (°C)	0.8 to 1.1	1.7 to 2.2	2.9 to 5.2
	precipitation (%)	–3.0 to –2.3	–6.1 to –4.7	–14.2 to –7.7

Source: Albania's Second National Communication to the Conference of Parties under the United Nations Framework Convention on Climate Change, 2009

Annex 6: Flood events in Albania in the last 50 years

Flood event	Location	Flooded areas	Other information
Flood of November 1962 – January 1963	Part of cities of Shkodra, Berat, Lezhe and others	70000 ha agricultural land flooded	Huge damages in flood infrastructure, road infrastructure, livestock loss, no victims
Flood of December 1970 – January 1971	Vjosa river area	14000 ha land flooded	Damages and destruction of embankment, irrigation channels, bridges, pumping stations
Flood of September 2002 – October 2002	Part of cities of Lezha, Shkodra, Gjirokastra, Berat and others (11 districs in total)	33000 ha flooded	Considerable loss in agriculture, damages in houses, businesses, roads, bridges, pumping stations, dams, electric stations, and other infrastructure, up to 9727 people evacuated, $17.5 million evaluated as total loss cost

Source: Ministry of Environment, Forestry and Water Administration

Annex 7: Damage verification last updated on 02 February 2010

Nr.	County	House buildings	Agriculture assets	Cattle	Businesses
1.	Shkoder	171	102	102	**5**
2.	Qender	8	12	12	**0**
3.	Guri I Zi	152	140	140	**0**
4.	Bushati	132	155	155	**0**
5.	Ana e Malit	124	143	143	**0**
6.	Berdice	121	80	110	**33**
7.	Dajc	156	111	111	**14**
8.	Rrethina	34	72	72	**0**
9.	Velipoje	39	6	55	**0**
10.	Kastrat	6	4	4	**0**
11.	Koplik	5	1	0	**0**
12.	Gruemire	-	13	0	**0**
	Total	**948**	**839**	**904**	**52**

Source: Ministry of Interior