

Climate Change Adaptation Actions in Tirana

JAMARBER MALLTEZI^{1*}, ROMEO HANXHARI², GAVROSH ZELA¹, SULEJMAN SULÇE¹

¹Department of Agroenvironment and Ecology, Agricultural University of Tirana, Tirana, Albania

²Municipality of Tirana, Tirana, Albania

Abstract

Tirana has recently experienced changing weather patterns such as rising temperatures and occurrence of extreme weather events. Such events – in combination with a rapid increase of urban areas and impermeable cement covering the natural soil in the city – have caused increased flooding, riverside erosion, delayed traffic, increased spending for cooling during the summer, increased need for health services, and an urgent need to plan the city smartly.

Tirana is preparing a set of Climate Change Adaptation Actions in order to manage the posed risks and adapt to climate change. The city administration should integrate climate change adaptation in their management and planning processes. This exercise was prepared by using the Climate Compass tool and included the vulnerability assessment of different sectors in the city, evaluated the risks posed to vulnerable target groups and proposed feasible adaptation options. It outlines mostly actions to be taken to manage risks and build climate resilience across essential public infrastructure and services.

Such actions would require better land use planning to maintain – and where possible increase – the natural areas and leave the natural soil undisturbed. Key to success is integrating adaptation concepts into the city planning and development investments. The result is a novel approach and guidance to better integrate adaptation concepts in city planning and new technologies to prevent heat waves, flood risks in the city, etc. Administrators of the Tirana Municipality should keep in mind and integrate the climate change adaptation actions into daily planning and decision making for several sectors including urban planning, transport, public services, water infrastructure, emergency response, etc. in order to ensure sustainable development for the city.

Keywords: Tirana, land use, climate change, climate change adaptation, city planning

1. Introduction

The world's climate and weather patterns are changing, global temperatures are rising, rain water distribution is changing in space and time, and much more extreme weather events are happening. Recent climate changes and climate variations are beginning to have effects on many other natural and human systems [1]. But what does this mean for Tirana and its citizens? That means a much hotter summer and more frequent heat waves over the city, an increased flow of rainwater in the streets, an increased need for cooling during the summer for all the citizens and an increased need for health services to the children and elderly, etc. To better manage these new risks and challenges for the city, Tirana Municipality has recently performed the Climate Change Adaptation Action Plan [2]. This document was prepared by using the Climate Compass tool, as developed by the

European Union. It provides a vulnerability assessment of the different sectors in the city, evaluates the risks to vulnerable target groups, and proposes feasible adaptation options to be introduced in the already existing city development instruments. It outlines mostly actions to be taken to manage risks and build climate resilience across essential public infrastructure and services.

The Tirana Municipality cooperated with the GIZ-funded Climate Change Adaptation Project in order to integrate climate change adaptation (CCA) into their management and planning processes within the different sectors of the city administration and into cross-cutting activities like spatial planning and strategic project development [3]. The mayor of Tirana nominated the Director of the Environmental Policies and Environmental Education department to

*Corresponding author: Jamarbër Malltezi; E-mail: abi.malltezi@gmail.com
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coordinate the activities in Tirana. A working group with representatives of all relevant directorates and sectors carried out a vulnerability assessment and the development of an action plan. The focus was at two indicators:

- City administration approves jointly developed measures on integrating CCA in cities planning and management processes (e.g. CCA strategy and action plan).
- Capacities of selected representatives and decision makers (like councilors, etc.) are developed to follow-up implementation of the developed measures after setting up the action plan.

Adaptation to climate change is a continuous long term process that has no real start or end date. Thus the results documented in this report are interim results on the long way to adaptation. They shall allow the city administration to improve the decisions and plans in the light of potential impacts of climate change. The interim results are guidance for the political and administrative work in the city. CCA actions cannot be realized separate from other tasks; they can only be incorporated into the administrative structured planning tasks.

Background situation and developments in Tirana

Tirana is the biggest economical, administrative, political, social and cultural center of Albania and has been subjected to fast change and growth in the past two decades [4]. The Urban Regulatory Plan adopted in 1990 became quickly irrelevant since it failed to predict and adapt with the rapid demographic and demographic changes. Hence, there is intense alteration in land use, converting the unused or agricultural areas on the outskirts of the city into intensely urbanized areas. This has put great pressure on existing infrastructure and services, which have failed to adequately respond to the increasing demands from rapid growth.

After a long participatory process, the new Urban Regulatory Plan for Tirana was approved in February 2013. The plan tries to integrate and improve the current urban situation by promoting environmentally friendly developments through the creation of some suburban parks, increase green areas within the city, rehabilitation of hot spots, creation of new green areas through urban requalification of former industrial sites, a new complete network for bicycle movement, etc.

The Municipality of Tirana has also completed several sector plans, such as the Transport Plan, Water and Wastewater Management Plan, Urban Solid Waste Management Plan, etc.

Furthermore, several major development projects have their feasibilities and designs completed and are ready for tendering of civil works such as:

- Tirana Multi-Modal Terminal Passenger (Main Train Station, Bus Terminal, Tram starting station, car parking, bike parking, etc.)
- Tirana Tram with two initial lines
- Urban Solid Waste Recycling and Management
- Tirana Northern Boulevard and River Rehabilitation Project.

2. Methodology

Climate change adaptation (CCA) processes is interdisciplinary and interactive. Therefore the working process comprised interdisciplinary working group (WG) meetings within different actors of relevant departments of the city administration. In addition, the steering group meetings served to coordinate the working steps, prepare the WG meetings and conclude interim results.

Working group meetings comprised trainings on CCA, work on the vulnerability assessment and the development of an action plan (joint discussions of interim results). Different stakeholders joined the WG meetings depending on the topic of the respective meeting.

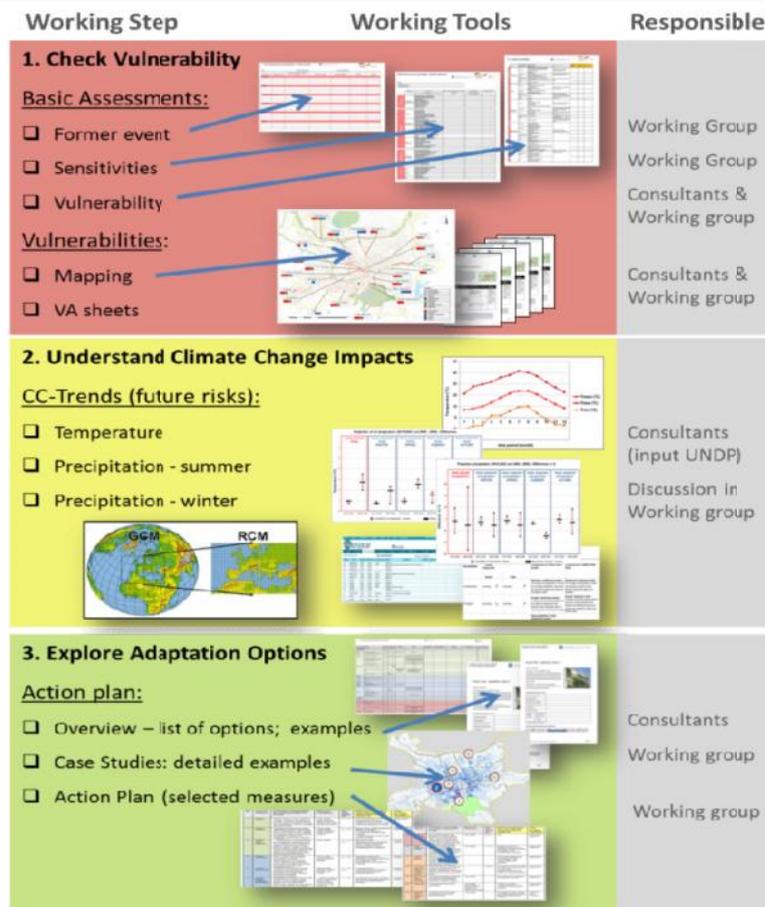


Figure 1: Working steps, tools and responsibilities [5]

The methodological approach of the CCA project in Tirana is related to the working steps of the Adaption Compass of the EU project Future Cities [4]. The Future Cities Compass is a practical adaptation approach which was developed by a partnership of cities from different EU countries, and it is used in several countries. Main advantages of this approach are a clear structure, available checklists to structure the working steps and the use of estimations and trends appropriate for the practical daily work.

Furthermore it offers a view to the city as a whole (not only on a single sector). The approach can be described with 6 steps that are highly interlinked.

Both the Vulnerability Assessment (VA) and the development of adaptation options are part of this process. The vulnerability assessment contains three working steps - check vulnerability, understand climate change impacts and assess risks and opportunities.

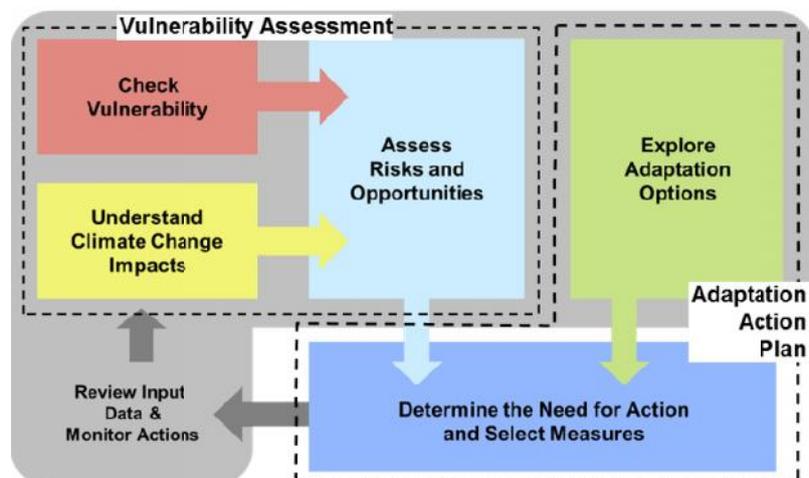


Figure 2: Overview of the methodological approach [5]

The local physical features and socioeconomic conditions - called receptors (such as population or infrastructure) - are the starting point for the check of current vulnerability towards extreme weather events (like heat wave or heavy precipitation).

The classification of the specific capacity to adapt of a receptor builds on the ability (financially,

technologically or socially), willingness and preparedness to cope with weather extremes. For example, in case of a high sensitivity / exposure combined with a low capacity to adapt - the class of vulnerability of a receptor is “high”. In case of a high capacity to adapt – the class of vulnerability is “medium”.

Table 1: Matrix to determine the class of vulnerability of receptors

Class of vulnerability		Capacity to adapt		
		Low	Medium	High
Sensitivity/ Exposure	High	High	High	Medium
	Medium	High/ Medium	Medium	Medium/Low
	Low/No	Low	Low	Low

Based on a general catalogue of adaption option (compilation of structural and non-structural adaption measures) both measures that are already taken into

account in the city of Tirana and additional potential measures to face future risks are identified.

Table 2: Categories of adaption (and mitigation) options

Structural measures	Green structures
	Water system
	Urban structure
	Building design
Non-structural measures (e.g. awareness raising, restrictions, etc.)	
Mitigation measures with a close link to adaptation (e.g. renewable energy measures)	

3. Results and Discussions

Tirana has recently experienced changing weather patterns such as rising temperatures and occurrence of extreme weather events. Such events – in combination with a rapid increase of urban areas and impermeable cement covering the natural soil in the city – have caused increased flooding, riverside erosion, delayed

traffic, increased spending for cooling during the summer, increased need for health services, and an urgent need to plan the city smartly.

Tirana is strongly influenced by the Adriatic Sea and is characterized as a mild Mediterranean climate. The average yearly temperatures in Tirana are provided in the chart below.

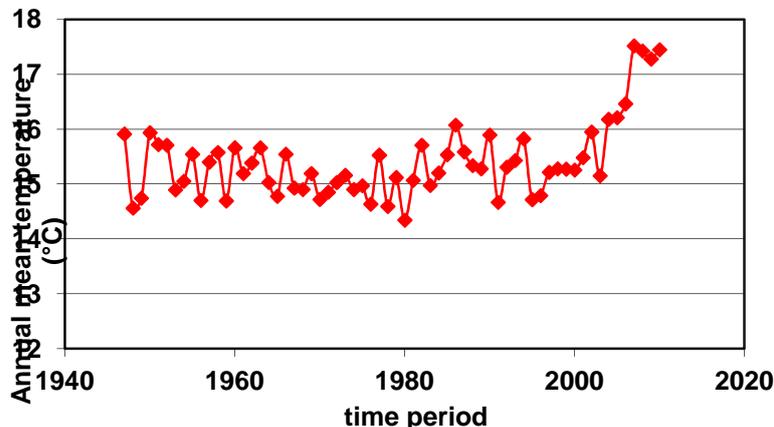


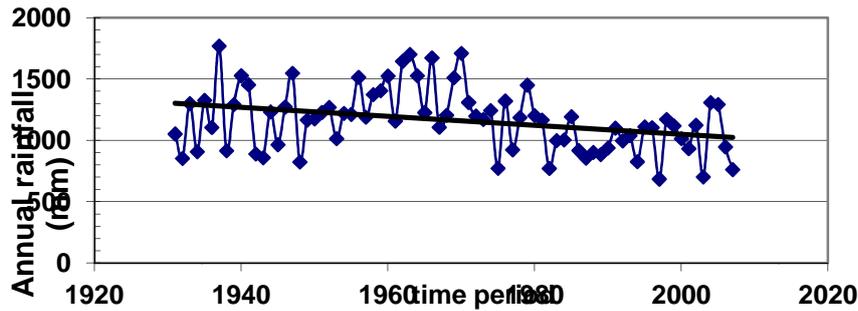
Figure 3: Annual mean temperature in Tirana (1947-2010) [6]

The location of Tirana in a plain relief surrounded by hills and Dajti Mountain in the Northeast and its close proximity to the Adriatic Sea allows for a wet climate. The average annual rainfall in Tirana is considered about 1200 mm (see Table 3) but there is a decreasing pattern (Fig. 4).

Table 3: Average monthly and annual rainfall 1951-1990 [6]

Months	1	2	3	4	5	6	7	8	9	10	11	12	annual
Rainfall [mm]	135	126	113	102	92	63	38	45	84	111	162	141	1210

Figure 4: Annual rainfall of Tirana (1931-2007) [6]



Climate Change Scenarios

The results of climate projections regarding the climate parameters temperature and precipitation for

Tirana are summarized below based on the data provided by UNDP project that recently submitted the draft 3rd National Communication of Albania to the UNFCCC [7].

Table 4: Projection of average air temperature change in Tirana (1961-1990) [7]

Change of	2015 – 2045	2065 – 2095
mean annual temperature (°C)	1.0 (0.7 -1.2)	2.8 (2.0 - 3.5)
mean seasonal temperature (°C)		
winter	0.8 (0.7 - 0.9)	2.0 (1.7 - 2.3)
spring	1.0 (0.8 - 1.1)	2.6 (2.2 - 3.0)
summer	1.6 (0.8 - 1.8)	4.3 (3.8 - 4.9)
autumn	1.0 (0.9 - 1.1)	2.8 (2.7 - 3.0)

Values in bracket refer to the expected variability around expected average values

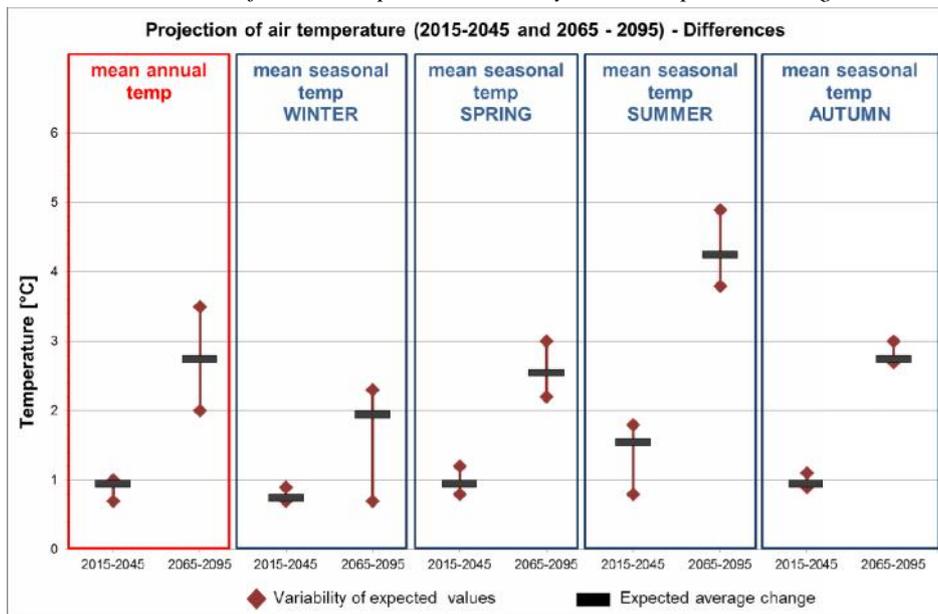


Figure 5: Projected Air Temperature (2015-2045 and 2065 – 2095)

The mean annual and mean seasonal precipitation is expected to decrease (most noticeable in summer). Furthermore an increase of precipitation intensity is expected [7].

Table 5: Projection of average precipitation change in Tirana (1961-1990) [7]

Change of		2015 – 2045	2065 – 2095
mean annual precipitation (%)		-3.8 (-35.4 - +27.7)	-14.4 (-78.6 - +81.1)
mean seasonal precipitation (%)	winter	-6.0 (-15.9 - +4.0)	-14.3 (-44.7 - +16.1)
	spring	-2.5 (-11.9 - +7.0)	-14.3 (-45.1 - +16.6)
	summer	-10.4 (-12.8 - -7.9)	-41.9 (-49.2 - -34.5)
	autumn	0.5 (-10.1 - +11.1)	-6.9 (-38.1 - +25.2)

Values in brackets refer to the expected variability around expected average values. Positive values might refer to an increased frequency of heavy rain events and negative values might refer to increased frequency of drought events.

Figure 6: Projected Differences in precipitation (2015-2045 and 2065 – 2095)

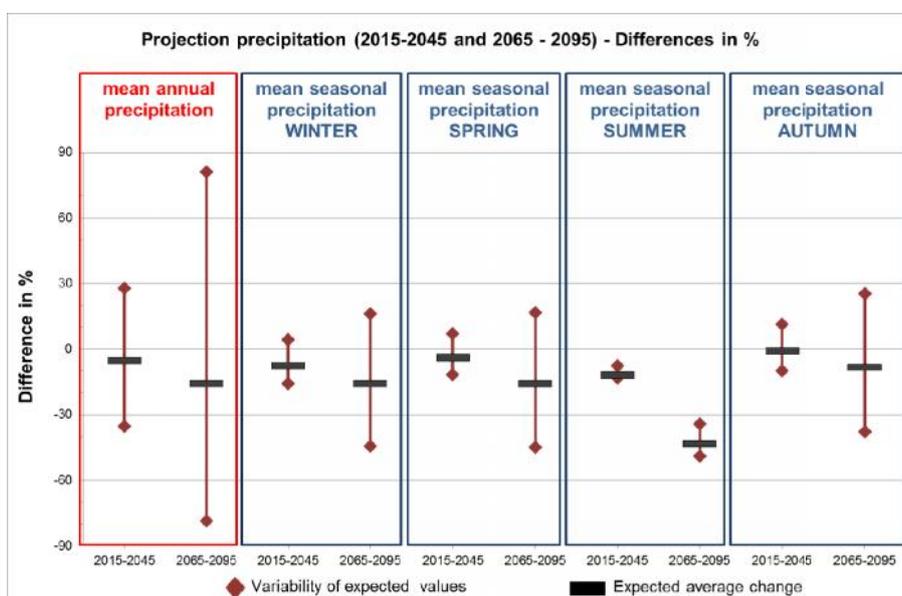


Table 6: Conclusions for climate change impacts for Tirana area for period 2071-2100

Key parameter	Summer	Winter	Consequences for weather events – spring/summer	Consequences for weather events – autumn/winter
Air temperatures and number of hot days	Increasing	Increasing	Heat waves reinforcing in summer ↗	Cold - balancing in winter ↘
Precipitation	Decreasing	Decreasing	Drought reinforcing in summer ↗	Drought – indifferent in winter →
Heavy precipitation / number of days with heavy precipitation	Increasing	Increasing	Heavy precipitation / Floods - increase in intensity on relatively more days: reinforcing in summer ↗	Heavy precipitation / Floods - increase in intensity on relatively more days: reinforcing in winter ↗
Storm/Wind	<i>No data available</i>			

Heat wave and drought in summer as well as heavy precipitation are the most predominant weather events causing problems in Tirana. Most affected receptors and exemplary locations, for which high

vulnerabilities were identified, are shown in the following table. The examples of potentially vulnerable areas or hot spots are also shown in the vulnerability-map.

Table 7: Evaluated classes of vulnerability for different receptors of Tirana

Receptors	Heat wave	Extreme cold	Drought	Heavy precipi-	Storm
Public health / vulnerable groups	high	medium	Medium	low	medium
Transport	medium	medium	medium	high	medium
Electricity services	medium	medium	medium	high	high
Water supply and sanitation services	high	medium	high	high	medium
Social infrastructure	high	medium	high	low	low
Building stock and materials	high	medium	medium	medium	medium
Tourism	low	medium	medium	medium	low
Small scale industry	medium	medium	medium	high	low
Retail	medium	low	medium	medium	low
Green spaces	high	medium	high	medium	medium
Water resources and quality	high	n/a	high	medium	medium
Air quality	high	n/a	high	n/a	n/a
Agriculture	n/a	n/a	n/a	n/a	n/a
Forestry	medium	medium	high	medium	medium
Biodiversity / eco-systems	medium	medium	medium	low	low

Adaptation Action Plan

The action plan refers to both the results of the Vulnerability Assessment and the ongoing projects of the municipality. The focus was on improving the existing processes in the light of CCA needs, rather than development of new processes. The objective was the improvement of existing procedures (both sectorial as well as interdisciplinary) and the installation of guidance systems (mechanisms) and coordination units. The process also improved awareness for CCA in all relevant departments and processes of urban development and planning.

The adaptation action plan focused on three steps in close relation to each other:

1. Evaluation of general adaptation options regarding the identified most existing and future risks for the vulnerable sectors, objects and areas as results of the vulnerability assessment.

2. Exemplary survey of selected representative situations (case studies) and development of exemplary solutions or adaptation options.

3. Development of an action plan summarizing all potential adaptation options for the different fields and sectors



Figure 7: Case study areas

Table 8: Selected case study areas

Area no	Area name	Characteristic / Criteria for selection
1	City Centre South-West (Komuna e Parisit / Meda rShtylla street)	Example for city center; highly intensified urban use; dense building structures and texture; few green; area with medium to high-rise buildings and heavy intensity development of 30-40 year old. Infrastructure is under stress from the heavy concentration of population and growth.
2	Lana River Neighbourhood	Area which is at the limits of the city center in the flood risk area of Lana River; partly uncontrolled (illegal) buildings; reconstruction area with the objective of increasing green space; connected to the green areas along the future Lana River. Partly high rise buildings, low building and greenhouses.
2a	East Lana River Neighbourhood	<i>For this area the situation and the options were not separately evaluated. This area is comparable regarding the Lana River situation with no. 2.</i> Flood Risk of Lana River, residential urban development area; less than 15% green space. Vulnerabilities concern the impacts of floods, high temperature and heat waves and low circulation of air. The window of opportunity is the ongoing Lana River Restauration from the new Maternity hospital until Kombinat Quarter, which potentially creates options for CCA measures.
3	West-City-Center area	Example for a densely used, traffic highly impacted and closely city-center-related area; influenced significantly by large roads and intensive traffic, almost no green space, poor air conditions and low ventilation (potential heat islands).
4	Urban Area Don Bosco street	Urban area with documented urban flooding problems; intensive urban uses.
Good practice examples		
5	Tirana River project	Ongoing project on restoration of the Tirana River regarding flood risk mitigation, improvement of the banks, new recreation and housing areas.

		Mainly informal settlements along Tirana River; flood risk; waste and river pollution problems; most important development project in Tirana with for restoration of the Tirana River and flood plains; high potential for upgrading the situation; ongoing redevelopment activities (River, Housing, land use).
6	Northern Boulevard Project	Ongoing project on improvement and development of the northern area of Tirana City Center to the Tirana River in the north. Connection of the City center and developing a new Boulevard, housing areas, business areas and a green corridor.
7	Magnet project area	Ongoing development of a new quarter in the west of Tirana City Center. The whole block is subject to new investments, housing, businesses, parking, green space. Focus on sustainable solutions, climate friendly and adapted design and constructions. Experiences in climate oriented urban development.

Each of the case studies was reviewed in detail and several adaptation measures were provided for each. Most of the adaptation measures included structural measures (i.e. green structures, water system, urban structure and building design), but additional non-structural measures were also considered in depth.

Some best practice of the Tirana Northern Boulevard and River Project include (i) ecological corridors (N-S & E-W), (ii) air ventilation corridors, (iii) shaded areas with high canopy for pedestrians, (iv) environmental friendly transportation system, (v) rehabilitation of riverbanks, (vi) flood prevention and (vii) ecological habitats providing richer biodiversity [9].

Other positive examples introduced by Magnet residential project include (i) green areas planted with olive trees, flowers or vegetables, (ii) water surfaces in the ground level, (iii) vegetated terraces, (iv) whiteterraces for albedo effect, (v) usage of solar panels, (vi) self-cleaning white facades, (vii) water permeable concrete used in pavements to allow water penetration in the soil, (viii) LED technologies and photovoltaic elements for public lights, (ix) thermo insulated and fire-prevention facades, (x) Thermal insulated and fire-prevention windows and fire hydrant [10].

Apart of the aforementioned structural measures, the Tirana Municipality will also need to pursue non-structural measures such as public awareness campaigns, upgrading their skills, inter-departmental cooperation and information sharing, better monitoring of extreme weather events and embrace technological improvements to cope with climate change. Some departments of the Municipality need to be upgraded to better address these challenges.

4. Conclusions

Adaptation to climate change is a continuous long term process that has no real start or end date. Thus the results documented in this paper are interim results on the long way to adaptation. They shall allow the city administration to improve the decisions and plans in the light of potential impacts of climate change. The interim results are guidance for the political and administrative work in the city. Actions named in this report are not a “stand-alone policy”. They work only in close relation with sector plans and project initiatives. They deliver proposals on how to improve planning and investment decisions regarding the long term challenges of climate change.

Several CCA measures are already planned and being implemented in Tirana as described through a number of best practices and examples. Most of the adaptation measures included structural measures (i.e. green structures, water system, urban structure and building design), but additional non-structural measures were also considered in depth. This paper has documented detailed adaptation options, which can be integrated into daily planning and decision making by all sectors of municipal planning.

5. References

1. Climate Change 2007 – **Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment.** Report of the IPCC. Cambridge University Press. ISBN 978 0521 70597-4
2. https://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4_wg2_full_report.pdf
3. Municipality of Tirana. 2015. **Adapting our City to a Changing Climate – Vulnerability**

- Assessment and Adaptation Action** Plan for Tirana. In press.
4. GIZ. **Climate Change Adaptation** Project in the Western Balkans. <https://www.giz.de/en/worldwide/29000.html>
 5. SelfoL., SulceS., GuriS., Hanxhari R. dhe Malltezi J. **Vleresim Strategjik Mjedisor i Planit Rregullues te Tiranes**. 2013. Shtëpia Botuese Albanian University Press. ISBN 978-9928-127-28-0
 6. Future Cities Adaption Compass. 2013. **Guidance for developing climate - proof city regions**, Lippeverband, Essen, 2013.
 7. <http://www.future-cities.eu/project/adaptation-compass/>
 8. Institute of GeoSciences, Energy, **Water and Environment, Albania**. 2015. Unpublished data of Institute. Personal Communication with Prof. Molnar Kolaneci (well-known expert with experience more than 30 years at IGEWE).
 9. UNDP. 2015. Third National Communication of Albania to the United Nations Framework Convention on Climate Change (UNFCCC). In Press. Professional communication with Prof. Dr. Eglantina Bruci on draft report.
 10. International Panel on Climate Change. 2014. **Climate Change 2014: Synthesis Report**. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland
 11. Tirana Municipality. 2013. Tirana Northern Boulevard and River Rehabilitation Project. Project files.
 12. Tirana Municipality. 2013. Plani Detajuar Vendor per Njesine 7-25. Magnet-Libeskind Project Files.