



Regional Adaptation to Climate Change

Guidelines for Croatian regional and local decision makers

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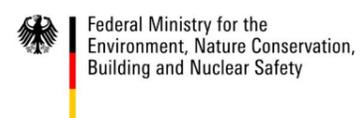
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1. Introduction

Climate change is undeniably one of the biggest threats to the world in the 21st century and various scholars and experts from different fields stress the urgent need to respond. In the 5th Assessment Report of the Intergovernmental Panel on Climate change (2013), the organization presented that since 1950s, numerous changes to the climate system were already recorded. The world's averaged combined land and ocean surface temperature has increased by roughly 0.85 °C between 1880 and 2012, the amount of snow and ice is diminishing and this contributes to the continuous rising of sea levels. All of these changes are almost certainly attributable to human activities particularly on emissions of Greenhouse gases (GHG) (Ibid). Climate change impacts have been risking the humanity and will continue to affect everyone if not adequately addressed. Scientists and various organizations in the international community are proposing two ways in addressing the causes and impacts of climate change-mitigation and adaptation.

Mitigation and adaptation are different approaches in dealing with climate change risks. Mitigation is a set of activities, which focusses on the different causes of man-made climate change. These activities are designed specifically to reduce GHG emissions, and also by thwarting those already emitted to reach the at-

2. Climate Change Adaptation as a Priority

Climate change is a threat that needs to be prioritized now. Gradually, its impacts are already threatening humanity. Different parts of the globe have been experiencing and suffering from various natural catastrophes associated to the change of the climate system. Stronger typhoons, heat waves, rising sea levels, and frequent flooding are being experienced now worldwide.

Croatia will not be spared from experiencing the undesirable impacts of climate change unless the country will work on its own climate change plan timely. According to a United Nations Development Program (UNDP) report in 2008, Croatia is a country, strongly affected by climate change since central sectors of its economy are highly vulnerable in terms of climate: Croatia's tourism sector, which generates about 20% of GDP and 28.7% of total employment in the country, is an outstanding example for this statement. Rising temperatures may lead to a shift of the tourist season. Furthermore, dangers to public health may occur as the

mosphere. On the other hand, adaptation is about the adjustments in human and natural systems. This approach focuses on the actions and initiatives in dealing with the inevitable consequences of a changing climate. These approaches have different focuses but they are complementary to each other thus neglecting one will not solve the problem. In spite of the initiatives and commitments done globally, it is still not sufficient to address the issues of climate change comprehensively. Involvement from the lower level is encouraged in this endeavor, particularly an active participation from the national level down to the local level. After all, climate change is a global problem that requires local and regional solutions.

These guidelines are designed to serve as a first introduction for the regional and local level in adapting measures for climate change. The idea of these guidelines are to explain the main steps of developing adaptation policies and documents such as an adaptation strategy and an accompanying action plan. There are plenty of exhaustive descriptions freely available that guide the practitioner in detail through individual steps or methods when setting up adaptation strategies and plans. These guidelines will make a reference to these recommendations so that the reader can look up further details.

risk of cardiovascular attack and heat strokes increases. Allergic reactions and vector-borne illnesses carried by mosquitos, birds and other organism are also expected to become more prevalent. All this could contribute to making Croatia less attractive as a touristic destination. The UNDP report also added that by 2100, the global sea level is expected to rise between 9 and 88 cm, more precise projections are still needed. The countries extensive coast line makes it vulnerable to sea level rise. Particularly low-lying areas such as the Neretva Delta, the Krka River, Vrana Lake near Biograd or the island of Krapanj will be affected.

Most notably water resources will be affected by a changing climate. As a consequence Croatia will face altered ground water levels as well as changes in the discharge of rivers (for further information see the National Communication of Croatia to the UNFCCC of 2014). The latter one will affect the hydroelectric power production, which is the basis of half of the electricity production in the country. The agriculture sector of

Croatia is expected to experience harms particularly as crop production may diminish due to drought or heavy precipitation. In previous years, extreme weather events cost the country's agriculture sector average losses of EUR 176 million per year from 2000-2007 or 0.6% of the national GDP.

Only in May of 2014, the Balkan region experienced one of the worst natural disasters in their history. The torrential rains that hit South-Eastern Europe triggered flashfloods and landslides in Serbia, Bosnia and Herzegovina and the eastern part of Croatia. The quantity of the three-day heavy rain in the region was equivalent to an average precipitation during 3 months. It caused a sudden rise of fluvial water levels, ground waters and backwaters. According to reports, the probability of this incident to occur is only once in 1000 years, hence, experts believe that what happened in the region might be linked to the changing climate. Croatia has estimated the damage caused by the rainfalls to 65 million euros, with agriculture contributing the biggest share of 30 million.

In the future, it is forecasted that Croatia will experience losses of between EUR 6-16 million in 2050 and EUR 31-43 million in 2100 on its maize production due to climate change. Additional effects of climate change to Croatia will hit fish supply and aquaculture. The warming sea temperature also causing lower oxygen concentrations is affecting all levels of the marine ecosystem. Fish migration pattern are likely to change and new species will probably invade (UNFCCC 2014). Finally, there is a social dimension to climate change since consequences are not distributed evenly: the UNDP report argues that there are vulnerable groups who will feel the most effects of climate change. People living in the regions with minimal economic opportunities are more affected by the phenomenon. This argument is supported by a report published by OECD in 2009. In the said report, people with fewer economic opportunities will more experience and suffer from the effects of climate change due to the lack of capacity and resources to address the problem.

Nevertheless, it is not too late to address these problems. There is still adequate time for countries and regions to formulate action plans, which will dampen

these impacts of climate change threatening the people economically and socially. Climate change is certainly a global issue that needs local solutions. It is one of those problems that requires involvement from all level of administration (BASE, 2013). Active participation from municipalities and regions is necessary in address problems like this, because consequences of climate change will show on a local level.

There are three reasons why climate change adaptation has to be mainstreamed on the local level (OECD, 2009):

- Firstly, the local level has a pivotal role to play because effects of climate change have to be counteracted by measures on the local level e. g. dikes, land-use changes, information campaigns, refurbishment of physical structures etc.
- Secondly, vulnerabilities and adaptive capacity depend on the small-scale local conditions: some meters distance to a river or the sea can make all the difference between extremely and barely vulnerable.
- And finally, it is best to observe adaptation initiatives on the local level, learn from them and try to multiply their effect.

Hence, it is crucial to have an expansive and sustained engagement among the different stakeholders in the local level, including the political leaders, members of the different civic organization, and representatives of the business sector. Most likely, bottom-up approaches are the most desirable and effective strategy to succeed in this endeavor.

Read up on impacts of climate change here:

- Republic of Croatia 2014. Sixth National Communication of the Republic of Croatia under the United Nations Framework Convention on Climate Change.
- OECD 2009. Integrating Climate Change Adaptation into Development Co-operation: POLICY GUIDANCE.
- UNDP 2008. A Climate for Change: Climate change and its impacts on society and economy in Croatia - Human Development Report



3. Designing Climate Change Adaptation Action Plans

A good adaptation concept includes an adaptation strategy and an action plan. These documents are sometimes confused. In general, a strategy and a plan are separate documents with a different focus although they could be intertwined with each other. A strategy describes the foundation or principles of the country or region towards a certain goal like climate change adaptation, laying down general objectives and priorities. An action plan describes how the strategy will be realized through various concrete actions in a given timeframe. A good action plan will:

- prioritize measures,
- set a clear timeframe,
- lay down responsibilities in the implementation of adaptation actions,
- and indicate resources necessary to implement the proposed actions.

When drafting adaptation strategies and action plans for the regional, and municipal level and perhaps certain sectors, it must be ensured that these policy documents are aligned with the national adaptation strategy or plans and vice versa as well as with existing sectorial plans. An overall coordination is necessary to

3.1 Phase 1: Preparation Phase

A strong and effective adaptation policy requires a solid foundation, which can be based on the national adaptation strategy of the country if the higher administrative level has developed an adaptation strategy for the national level already. We will discuss 4 important elements that need to be considered in order to have a strong foundation especially in crafting climate change adaptation initiatives:

- (i) available climate information,
- (ii) political interest and commitment,
- (iii) right team and
- (iv) resources.

To read-up more about the preparation phase in English:

- EU's Guidelines On Developing Adaptation Strategies¹,
- BASE's Planning For Adaptation To Climate Change:

1 Available at http://ec.europa.eu/clima/policies/adaptation/what/docs/swd_2013_134_en.pdf

coordinate this.

This part of the paper is designed to assist the leaders and practitioners of the local level in starting up their climate change adaptation policy. Sets of guidance and toolkits from different organizations and online sources were fused and arranged in this part, for the local level to be guided gradually.

Crafting climate change adaptation documents may sound simple but there are crucial aspects that need to be considered. There must be sufficient attention given in every step of the entire process from the first phase until the last one (as described below). The efficacy of the adaptation plan will also vary depending on the location, and condition of the community involved, consequently it is very important that these variables will be considered when running through the three phases of setting up climate change adaptation policies: The first phase tackles the basics, specifically on how to be prepared and how to succeed in designing an effective and efficient adaptation plan of actions. The second phase presents the step-by-step cyclical process in working adaptation policy. And the final phase guides the practitioners and policy makers on how to make the plan sustainable.

- Guidelines For Municipalities² and
- ICLEI's Preparing For Climate Change A Guidebook For Local, Regional, And State Governments³

3.1.1 Available regional climate information

In the last decades, a wealth of scientific studies has been published on regional climate changes and their impacts. The IPCC as one of the main bodies working on the subject matter has published numerous reports, in particular the assessment reports, which discuss a wide range of climate change aspects. These reports allow drawing conclusions on the general expected trends down to the macro-regional scale, e.g. Southeast Europe. Such reports will give an overview on the general expected changes and impacts. However, in order to develop a regional strategy, climate information on the regional and local level is needed, such as trend of the temperature, records of

2 Available at <http://base-adaptation.eu/sites/default/files/306-guidelinesversionefinale20.pdf>
 3 Available at <http://www.cses.washington.edu/db/pdf/snoveretalgb574.pdf>

unusual extreme weather events in the region such as flood, soil erosion, and drought and reports regarding new diseases, and impacts on biodiversity as well as projections about future developments. In particular, regional climate scenarios which can generate more precise regional projections for several meteorological parameters (wind, precipitation, temperature, number of frost days etc.). Most national weather services, also the Croatian Meteorological and hydrological service, develop and run such models and can provide data to decision makers. A further information sources are the European Climate Adaptation Platform for EU projects. Additionally, universities and scientific institutes in the region might have prepared additional regional or sectorial studies on climate change changes and impacts in the region.

WHAT TO DO:

- Check the latest IPCC reports to get a general understanding. There are summaries for policy makers which summarize the main points of each report. Look for the information in the reports that describe changes for the Mediterranean area – this is where you will find information applicable to Croatia.
- Consult the meteorological and hydrological service for reports and data as necessary
- Consult local research institutes or universities and browse the internet or local libraries for reports that deal with your region or important sectors in your region.

3.1.2 Political interest and commitment

One of the barriers in implementing climate change adaptation policies is the lack of political will. In order to design and implement an adaptation strategy successfully, political support and commitment should be present and established as early as the preparation phase. Without political support and commitment, it will be challenging to succeed in implementing adaptation initiatives especially when it comes to funding and long-term measures. Point-of-departure is the fact the amount of societal problems surmounts the amount of available political attention and room to maneuver at any given time. Therefore, different actors and interest coalitions compete for political attention. In order to succeed as a first-range-topic in local and regional policy, climate adaptation should be connected to other soci-

etal discussions such as economic development and public security. The connection to these topics (by indicating the links between them and the changing climate) will help to increase the impact of adaptation activities.

WHAT TO DO:

- Make sure that the adaptation efforts are communicated across departments and on to the decision makers
- Engage the civil society sector, especially interest groups in the community that lobby with the politicians
- Look for potential coalition partners with whom there are shared interests in tackling a topic.

3.1.3 The right team

The success of the adaptation policy will also depend on the people working together, thus forming the right team with the appropriate composition is a must and should be considered as an important element. Climate change is not merely an environmental issue but it is also a political, economic and social issue. Therefore, ideally, a multi-disciplinary team should be established as part of the preparation phase. On the side of the public administration, this translates to the practice that several departments should be involved in the development of the adaptation documents and their implementation later on.

The table below lists potential sectors and cooperation partners that could be part of the adaptation team. One of the major functions of the adaptation team is its role as contact point and connector between policy makers and the stakeholders in each sector. The team does not need to be institutionalized; in fact, in many cases this is even less practical. A less formal working group, consisting of stakeholders from different sectors who meet regularly, can have the function of a core team. In such a working group, a main coordinator or contact person should be appointed as well, that can take the function of the contact point.

SECTOR	Potential cooperation partners
Energy	energy providers, energy agencies, house owner associations, municipal facility management, local action groups



SECTOR	Potential cooperation partners
Water resources (shortage, flooding, quality)	Local water services, municipal infrastructure services, authority regulation national waterways, hydrological service
Terrestrial and Marine biodiversity	Nature protection bodies, NGOs working on biodiversity
Agriculture & soil degradation	Agricultural bodies, association of famers
Forestry	Forestry authorities, national park administrations, forest owners
Fisheries and Aquaculture	Association of fishermen, fish processing industry
Transportation and Infrastructure	Municipality facility management, public transportation services, private transportation companies
Coastal and Marine environment	Shipping companies, harbor operators, nature protection bodies
Tourism	Tourism board, associations
Urban and regional planning	Municipality facility management, planning agencies, municipal and regional authorities
Cultural Heritage	Cultural associations, museums
Public Health	Health services, Civil protection, Scientific institutes dealing with viruses etc., hospitals, health insurance
Emergency Management	Emergency services, municipal authorities, health authorities

WHAT TO DO:

- Identify stakeholders from all sectors affected by the planned adaptation measures
- Establish a working group with representatives from all sectors (cross-cutting) or sectoral working groups for specific problems/discussions
- Define clear communication channels and a coordinators as well as meetings on a regular basis to ensure a continuous exchange

To read more about stakeholder involvement

- Read the experience report from Germany “Stakeholder Participation in Adaptation to Climate Change – Lessons and Experience from Germany” for inspiration and ideas how to go about stakeholder participation⁴

4 <https://www.umweltbundesamt.de/en/>

3.1.4 Financial Frame

Another element that determines the success of the climate change adaptation policy is the availability of the resources, particularly financial resources. Ideally, every adaptation plan should be equipped with adequate funding. Hence, it is advised to identify the potential sources for funding the project as early as the preparation phase – this can include

- already budgeted and earmarked public funds which are directed to climate-proof investments,
- third party funds (such as EU grants, for example the EU Programmes on Competitiveness and Cohesion, on Central Europe and the Mediterranean, Horizon2020, LIFE+), that are applied for specific activities, and
- private funding, either as private financial precautions or through public-private partnership projects.

WHAT TO DO:

- Check public funds and announcements of third party grants
- Analyse possibilities of projects in cooperation with stakeholders from the public sector
- Look if adaptation measures can be integrated into other planned measures and thus be indirectly financed through planned investments

3.1.5 Case study Slavonia

In the project CroAdapt2, in which these guidelines were developed, the project team started a regional adaptation process in the region Slavonia. This was the first time that adaptation as a key topic was addressed on the regional level in Croatia. As a first step, all possible stakeholders that could either have an active role in the adaptation process or provide knowledge were listed. In total 107 stakeholders could be mapped in the region. These stakeholders includes amongst others public administration, scientific institutes/universities, civil society organisations, service providers etc. In a next step, a questionnaire about adaptation to climate change was sent out to all 107 registered stakeholders which 13 of them filled in. This questionnaire included questions on the background of the citizens, their

[publikationen/stakeholder-participation-in-adaptation-to-climate](https://www.umweltbundesamt.de/en/publikationen/stakeholder-participation-in-adaptation-to-climate)



Methods and Tools to promote engagement of stakeholders

Starting from the planning phase through the whole climate adaptation process, members of the community and relevant sectors should be actively participating in the process of designing climate change adaptation strategies and plans. Due to the complexity of gathering insights from the stakeholders, methods and tools were developed to make this task easier and well organized. The following are the common methods used to engage the stakeholders in the community in the adaptation process, however it necessary to keep in mind that the efficacy and efficiency of these methods vary depending on the types of stakeholders involved.

1 Stakeholder round tables

A round table discussion is one of the effective approaches to engage various stakeholders in the community. This approach could take place attended only by people who are member of a specific field or sector, or leaders from different sectors in the community. With the former type of attendees, it is easier to discuss a particular issue because everyone in the table are coming from the same sector hence they speak common language. On the other hand, the latter could be a little complicated given that these sectorial leaders will try to protect and prioritize their own interest. Nevertheless, the inputs of every member in the table will be heard and considered valuable. Usually, round table discussion is for long-term engagement, thus, the member sitting in the table are expected to be committed and active all throughout the process of the development of the adaptation strategy and plan.

2 Awareness-Raising Campaigns

Local stakeholders could be engaged in the adaptation

process through awareness-raising campaigns organized by the adaptation team. Aside from engaging the stakeholders in the process, the campaign also aims to trigger and build an adequate driven force that could make the members of the community active and participative in this project. In addition, this kind of activity aspires to make the stakeholders understand how climate change can affect the local community. In the 21st century, the different kind of media particularly the Internet could play a vital role in raising awareness and supporting an adaptation campaign. Facebook, Twitter, Instagram and other forms of social media are an effective way to disseminate information and spark commitment. Besides general awareness campaigns on climate change impacts, there could be targeted campaigns e.g. during hot spells that encourage people to look after the elderly.

3 Focus Group Discussions/Group Work

Focus Group Discussions (FGD) is another approach to engage the members in community especially when someone is gathering data. FGD are usually organized and facilitated by an expert who is actively involved in the project or by an external facilitator. In this activity, member of the community are invited and gathered. The moderator will throw open-ended questions that could trigger discussion among the group. FGD allow a deeper insight into the thoughts and concerns of the participants. It is very important to make sure that the composition of the group is balanced to avoid biases especially that there are members of the community who are more vulnerable to climate change than the others – minor ethnic groups and marginalized members of the society. As early as possible, these members of the community should be included in the FGD. Lastly, the facilitator should set aside its prejudices in order to allow every participant in FGD contribute their perspective concerning the issue – climate change impacts.

awareness of climate change and their assessment of the awareness of other stakeholders. Furthermore, the questionnaire asked about expected and already felt consequences of climate change, sectors in need of adaptation and sectors which would need to adapt in the coming decades.

The key findings of the questionnaire were that the awareness/knowledge on climate change is assessed rather low, which was not surprising given that many stakeholders were probably interviewed on climate change adaptation for the first time. The survey

showed that the respondents do not feel sufficiently informed by authorities yet, but expect them to take the responsibility for taking action. Impacts of climate change are already felt by all stakeholders participating in the survey. Issues of concern mentioned were floods and droughts, changes in the temperature regime (warmer winters and summers), as well as changes in flora and fauna. Similarly, the majority expects medium to severe impacts from climate change. All participants mention floods as most important consequence for the region, followed by droughts/water scarcity and summer heat. All other issues are consid-

ered significantly less important, less than half expect heavy rains, landslides or mosquitos. Interestingly, no one considers Slavonia to be well prepared for these challenges; only three respondents think that the region is at least partially ready to deal with the consequences caused by climate change. Sectors that would most need adaptation measures are the agriculture, water management, and nature conservation, followed by civil protection/health, infrastructure and forestry.

As a next step, the project team organized a series of workshops in Slavonia. The goal was to gather stakeholders from the region and discuss the issue of climate adaptation. The first workshop was supposed to set the stage by looking at regional impacts of climate change, socio-economic parameters of the region and adaptive capacities. This workshop was had thus the intention to see which knowledge is available and to engage stakeholders to discuss available expertise and expectations to the process. A second seminar was supposed to pick up where the first workshop

finished and discuss different, selected development scenarios. Based on these scenarios, the participants should develop basic adaptation options and define necessary instruments for their implementation. The first and second workshop were planned as consecutive events, thus ideally, the participants of the first seminar should also participate in the second seminar.

A third seminar was planned to specify the adaptation options developed in the second seminar for a selected municipality in the region. This should make the discussion more specific and allow stakeholders to develop concrete proposals.

For the first event, invitations were sent out to all 107 stakeholders registered, of whom 26 participants followed the invitation. After a round of presentations on various aspects of climate adaptation and the situation in Slavonia, the group discussed sectors and stakeholders which likely affected by climate change in the future. The table (left side) is the result of this discussion.

Sector	IMPACTS / CHANGES until 2030	CUMMULATIVE impacts	STAKEHOLDERS most affected
1. Agriculture and animal husbandry	<ul style="list-style-type: none"> - Soil degradation by drought/ flooding - Uncertainty of production and decreased resistance of cattle to diseases - Loss of some species / appearance of new species/ varieties 	<ul style="list-style-type: none"> in all sectors - Danger of de-humanization (loss of basic human kindness) 	<ul style="list-style-type: none"> - Small producers, processing industry - Consumers - State – national commodity reserves (eg. Commodity Reserves company in Đakovo)
2. Water resources	<ul style="list-style-type: none"> - Interruptions/ disturbance in groundwater regime - Drying of wells - Necessity for irrigation, accumulations reservoirs, retentions – increased costs 	<ul style="list-style-type: none"> - Lower tolerance levels among people 	<ul style="list-style-type: none"> - General population - Producers – industry with water-intensive processes (e.g. sugar processing in Osijek, Županja...)
3. Biodiversity of habitats	<ul style="list-style-type: none"> - Threats/loss of habitats – wetlands, water bodies, forests - Appearance of invasive non-native species 		<ul style="list-style-type: none"> - County nature protection institutions; nature park management; Croatian Forests; public health institutes (monitoring of species) - Wood processing industry - Hunting organisations, freshwater fishers and fish farms
4. Health/ healthcare	<ul style="list-style-type: none"> - New disease agents, expansion of dangerous pests (exotic species), pathogens, ambrosia - Extreme temperatures/heat waves - Increased healthcare costs; undercapacitated healthcare system 		<ul style="list-style-type: none"> - Vulnerable groups (children, old people, chronic patients) - Population in general - Public health institutes – more work and health institutions (hospitals, clinics...)
5. Protection & Rescue Infrastructure	<ul style="list-style-type: none"> - Increased scope of work – public health, natural disasters - Disproportion of investments (too low) into rescue infrastructure against assessed risks/ threats 		<ul style="list-style-type: none"> - Emergency Protection & Rescue Directorate / 112; medical emergency service (outside the 112 system) - Croatian Red Cross; fire-fighting volunteers, mountain rescue services - Civil protection /local government units

The second event took place few weeks after the first event. The same group of 107 mapped stakeholders was invited to the event. 21 stakeholders came to the second workshop, most of them were also present in the first event. The group decided to keep on discussing the issues of agriculture and water, in the context of expected sectoral development in the region until 2050, listing realistic adaptation options and most important regional stakeholders that will be affected and/or need to be activated. The most comprehensive and concrete adaptation proposals were obtained for agriculture sector, given the low coverage of other sectors among the participants and consequently low data availability for a deeper discussion. Since 2000-2011 data show agriculture as the only sector with a positive GDP trend, but it's also an activity significantly exposed to extreme climate-related weather events such as droughts, floods and strong winds, this makes the agriculture sector also the most vulnerable one. The proposed measures by the participants are summarized in the following table.

Proposed adaptation measures for agriculture in Slavonia
EDUCATION + REGIONALISATION <ul style="list-style-type: none"> • Conventional, integrated and organic approach in agriculture • Education on climate scenarios – including strengthening of the fire protection system
ADAPTATION OF AGRO-TECHNICAL MEASURES <ul style="list-style-type: none"> • Irrigation, drainage (retentions) • Soil treatment (reduced, conservation systems) • Crop rotation • Selection of sorts/varieties resistant to climate change • Plant and animal management and protection (infrastructure, nets, weeds, pests)
ADAPTATION OF FOOD INDUSTRY <ul style="list-style-type: none"> • Modernisation of technical & technological systems for food production, methods of product market placement. • Synergy of agriculture and tourism
MANAGEMENT OF NON-AGRICULTURAL LANDSCAPES

Proposed adaptation measures for agriculture in Slavonia

GENERAL MEASURES

- Education on all levels and capacity building, e.g. hiring young researchers in meteorology, agronomy, agriculture (on research and other projects)
- Financial support to expanding the network of educators, e.g. agrometeorological workshops of Croatian Agrometeorological Society
- Development of integrated agricultural management systems and intersectoral cooperation
- Innovating the legal framework (adaptability of legislation to CC adaptation needs)
- Monitoring (of all measures)

The third event, held in November 2015, focused on the topic of education on impacts and adaptation to climate change in the sector of agriculture in Slavonia (also taking into account education needs and potentials of other related sectors, as needed), and developed a draft action plan for a future education project and related intersectoral cooperation. Some additional stakeholders were invited based on recommendations and personal engagement of previous participants. From among 25 workshop participants, a core group of 15 people was created, including experts from the Osijek Faculty of Agriculture, agrometeorology experts of Hydromet Service of Croatia, regional agricultural administration, development agency and nature protection institutions of the Osijek-Baranja County, Croatian Food Agency, specialised agricultural media and some interested NGOs, that will continue to work on the development of the education project, for which CroAdapt provided the core content. The resulting action plan is a practical tool for continuing climate-related activities of most active Slavonian stakeholders, and can be also used as fundraising basis for a future education project/program.



Methods and Tools for assessing vulnerabilities

Evaluating and scrutinizing vulnerability of the concerned community using the four components exposure, sensitivity, potential impacts and adaptive capacity should be done in a systematic fashion. These four components are key factors to be able to achieve a reliable result of the said assessment. These four components should be taken equally, because neglecting one and prioritizing the other would give you results that might not be accurate and plausible, and will just lead the team to maladaptation or total failure.

In assessing vulnerabilities, there are two possible approaches that can be used: qualitative assessment and quantitative assessment.

1 Qualitative assessment

The qualitative method of assessing vulnerability aims to provide information or result that cannot be measured or translated into numbers. This method often uses tools such as gathering the stakeholders for a group discussion, individual (expert) interviews or community assemblies and workshops.

The advantage of a qualitative assessment is that it allows for an in-depth assessment of the phenomenon without being limited to a set of fixed variables that most quantitative assessments have. This qualitative type of assessment relies on subjective information, which is suitable in projects where the stakeholders' perspective is most desirable and needed. By doing this kind of assessment, the different perspective from different stakeholders involved could be collected because it allows individual to share their personal experience and judgment with the phenomenon. The openness of qualitative assessment could give way to people to think out of the box and open new areas that could be possibly explored for new adaptation options.

However, some researchers and policy makers criticize the qualitative method for being less accurate and more prone to biases since gathered data is analyzed without the use of statistical tools. Nevertheless, results collected from an assessment using qualitative approach can still provide valuable insight.

2 Quantitative assessment

Results of a quantitative assessment are often analyzed using the different statistical tools available and findings which are supported by numbers and figures. Most of the time, this method is preferred by a lot of researchers and policy makers due to its greater transparency and traceability. The urge to present

seemingly accurate results may be another reason to choose a quantitative assessment.

Other researchers also emphasize that quantitative results can be presented easily because numbers and figures give the impression to be intelligible with less danger of complication and misinterpretation. However, experts conducting a quantitative assessment need to have a solid knowledge on interpreting statistical data to avoid these dangers. In addition, conducting this type of assessment requires sufficient knowledge, equipment and often it costs a lot more than qualitative assessment.

In conducting a vulnerability assessment, there is no standard method set by the experts to achieve a better result. Both methods mentioned have their own strengths and weaknesses, thus it would be better to use both in order to end up with more plausible and more accurate assessment results.

Technology has made vulnerability and risk assessment easier to conduct. Nowadays, people conducting the assessment have the options to exploit the numerous vulnerability tools that are available.

Methods and Tools for Assessing Risks

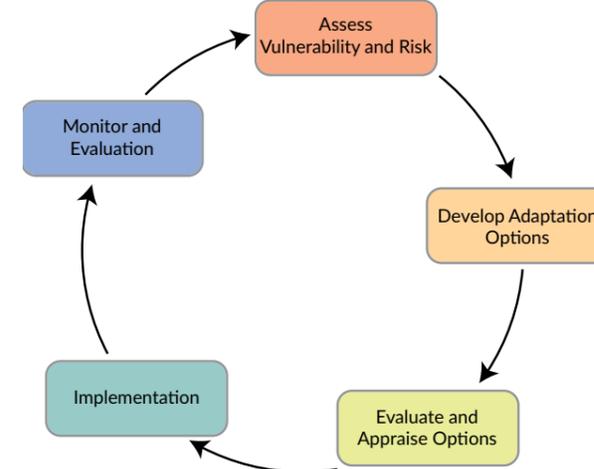
As with vulnerability assessment, risk assessment has two main approaches: the qualitative and the quantitative one. The descriptions and process of conducting risk assessment using these two approaches is analogue to the one of the vulnerability assessment. The UKCIP Risk framework¹ provides background and specific instructions for such risk assessments.

¹ Available at <http://www.ukcip.org.uk/wordpress/wp-content/PDFs/UKCIP-Risk-framework.pdf>

3.2 Phase 2: Step-by-step Process of Adaptation Policy Making

After the preparation phase has been completed, the step-by-step policy process in designing an adaptation initiative can begin, using the following five major steps as a guide. Be reminded that stakeholders should be involved in every step of this cyclical process. Together with the people who are tasked to work with the adaptation plan, their insights and inputs should be heard and valued.

Cyclical policy process in designing adaptation initiatives



In the following chapters, we will explain the policy cycle regarding adaptation policy. Concrete methods to carry out the individual tasks are mentioned in boxes below the respective step.

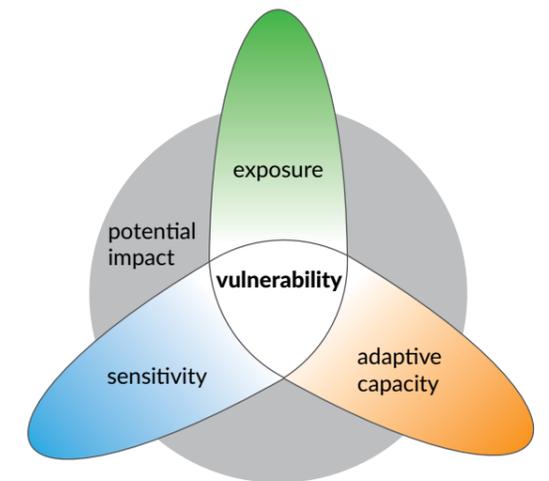
3.2.1 Assess Vulnerability and Risk

The first major step in preparing a climate change adaptation initiative is to clarify how the climate changes affect local conditions and which consequences people and infrastructure in the researched area have to cope with, e. g. could the increased occurrence of heavy precipitation events lead to a higher discharge in a certain water body? On the grounds of climatic and topographical data one can define the area that is threatened by flooding and the probable future frequency of this event. Afterwards the number of endangered people and the affected physical assets and material values in the area can be assessed as well as the probability of any climate related impact.

Though there is no standard definition of the term vulnerability, IPCC (2007) shared its definition as "the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes". Moreover, conducting a vulnerability assessment is one of the rather complicated steps in designing an adaptation strategy; hence, in order to

be successful with the task, it is very important to have a sufficient understanding of the essential components of vulnerability:

- **exposure:** "extent to which a system comes into contact with climate conditions or specific climate impacts"
- **sensitivity:** "the degree to which a system is affected, either adversely or beneficially, by climate variability or change"
- **potential impacts:** "impacts of climate change are the effects of climate change on natural and human systems. Potential impacts are all impacts that may occur given a projected change in climate, without considering adaptation"
- **adaptive capacity:** "the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantages of opportunities, or to cope with the consequences"



In the following chapters, we will explain the policy cycle regarding adaptation policy. Concrete methods to carry out the individual tasks are mentioned in boxes below the respective step.

Another crucial task in designing a climate change adaptation plan is conducting risk assessment. The term risk is generally defined as "the product of the consequence of an impact and the likelihood of its occurrence." In order to be successful in assessing risk, one should consider two important components of the subject as part of the holistic process of risk assessment, namely (i.) the probability, or likelihood, of the impact occurring, (ii.) the magnitude, or consequence, of the impact should it occur.

Risk assessment could help the adaptation team in deciding which adaptive option they should prioritize. The success of the adaptation team in conducting their risk assessment depends on an accomplished vulnerability assessment.

Assessing the vulnerabilities and risks will help the team to identify the severity of the climate change impact in the area concerned though it will take time, preciseness and proper equipment to come up with an accurate result.

During the assessment, parameters that influence the degree of vulnerability and risk (e.g. urban sprawl, cutting in public spending for public health, use of certain crops, housing conditions, problem awareness etc.)

should also be identified. This can help in choosing the right response and avoiding maladaptation. Identifying the cause will lead the people working on the adaptation plan to the right path especially when it comes to developing different alternatives for action.

For a detailed example of qualitative and quantitative assessment of vulnerability and risk, please also refer to

- Part 3 of BASE's Planning For Adaptation To Climate Change. Guidelines For Municipalities.



WHAT TO DO:

- **Clearly define the scope and limits of the vulnerability and risks assessment**



Methods and Tools for Dealing with Uncertainties

Uncertainties exist due to insufficient knowledge about the possible risks and impacts of climate change. Furthermore, sources of uncertainty are: social, economic, technical trends, and changes in legal, fiscal, and regulatory system. Aside from the aforementioned sources, there are also 3 primary sources of uncertainties when it comes to climate change itself. These primary sources include, (i) natural climate variability, (ii) future emissions of greenhouse gases, and (iii) modeling uncertainties.

Uncertainty is one of the major issue in climate change adaptation for it could greatly affect the entire adaptation plan of every community. In designing an adaptation plan, the team must know how to address uncertainties in order to avoid future complications and risks. Moreover, one of the reasons why uncertainties have to be addressed as early as possible is to avoid ambiguities or misunderstanding amongst the policy makers and political leaders. In order to deal with uncertainties, the adaptation team should have the capacity to identify the reasons for the uncertainties and communicate them openly.

1 Adaptive Management and Robust or Resilient Strategies

Adaptive Management and Robust / Resilient Strategies are two similar approaches that have one common principle - flexibility. The actions that have been chosen to be implemented should be flexible enough for the policy makers or implementers to be able to react to new information or experience gathered from the latest research studies. Furthermore, the chosen action or strategy should have the capacity of performing well in the long run no matter

what the circumstances are, and or no matter how the future keeps changing due to some factors such as political, economical, social and environmental. In other words, in developing an action plan, put into consideration that the plan must be resilient and flexible enough to cope with uncertainties and a range of unforeseen developments that the future can offer.

2 Scenario Planning

Consider multiple plausible scenario analysis, i.e. the comparison of different scenarios based on different plausible assumptions regarding the future development, in order to deal with uncertainty. This is one of the common and useful approaches among practitioners and policy-makers for it has the ability to bring clarity regarding the trade-offs done within the decision-making process.

3 Prioritising no-regret measures

In order to avoid maladaptation or to being surprised by changes that deviate from actual trends and forecasted developments, policy and decision makers tend to prioritise so-called no-regret measures. This terms describes activities that can prove societal / ecological beneficial no matter whether the problem it was designed for occurs or not. The enlargement of urban green spaces e. g. can be an efficient way to counteract the above-average rise of temperatures in densely built-up areas. However, even if the expected rise in temperature will not come true, these green spaces bring societal, economic and ecological progress for their urban surroundings (e. g. additional possibilities for free-of-charge recreation, migration paths for animals and plants, increased attractiveness of adjacent quarters).

- **Use already existing data for the vulnerability and risk assessment**
- **Include the knowledge of stakeholders and the local population for the assessment**

3.2.2 Developing adaptation options

Once the vulnerabilities and risks have been identified, the next step will be to develop adaptation options. Brainstorming for possible adaptation options to respond climate change impacts should be based on the results and information gathered from the assessment of the risks and vulnerabilities. Available good practice examples can serve as an orientation. There are various types of adaptation options that can be considered (according to UKCIP):

- Temporary measures (e.g. use large umbrellas to reduce solar heat gains)
- Managerial measures (e.g. introduce flexi-time; facilitate working from home during unfavorable weather conditions)
- Technical measures (e.g. refurbish building; enhance flood defenses)
- Strategic measures (e.g. commission new building with climate resilient design as part of a planned programme).

A portfolio of different options is also advisable for it can help the team to evaluate the options in a systematic way. Another way to think of various adaptati-

on options is to address the sphere which the options address (based on the European Environment Agency):

1. addressing grey infrastructure: this refers to physical interventions or construction measures based on engineering services. This intervention aims at making buildings and essential infrastructure more capable to withstand extreme events.
2. addressing green infrastructure: refers to measures that increase the resilience of ecosystems and contribute to the halt in biodiversity loss, reduced degradation of ecosystem and the restoration of water cycles. Green infrastructures rely on ecosystem services and measures addressing green infrastructure can sometimes be more cost-effective or feasible adaptation options compared to grey infrastructure measures.
3. addressing soft non-structural approaches: corresponds to the design and application of policies and procedures and employing, inter alia, land-use controls, information dissemination and economic incentives to reduce vulnerability, encourage adaptive behaviour or avoid maladaptation. Some of these measures can facilitate the implementation of grey or green measures (e.g. funding, integration of climate change into regulations).



Methods and Tools for Choosing and prioritizing the right option

Choosing the right adaptation option is also a tricky step. The adaptation team has to consider numerous factors in order to come up with the best plausible option/s and most of the time, they have to consider the most important factor which is the economic factor of climate change adaptation options. Possible tools to choose from when it comes to prioritizing adaptation options include (UNDP 2004):

Tools	Description
Expert judgment	Assessment by experts in the field of probabilities and risks
Focus groups	Groups of stakeholders that discuss their opinions on specific topics
Brainstorming	Free-flowing lists/diagrams of all ideas and options

Tools	Description
Cost-benefit analysis	Assessment of economic efficiency, assigning a monetary value to the measure of effect
Cost-effectiveness	Economic analysis that compares the relative costs and outcomes (effects) of two or more courses of action
Delphi method	Iterative, group-oriented, idea-generating strategy
Multi-criteria analysis	Examination of more than one also non-monetary criteria involving subjective ranking of options
Decision/probability trees	Charts of relationships between decision modes
Influence diagrams/ mapping tools	Graphic identification of options

Grey infrastructure	Green infrastructure	Soft non-structural approaches
Building or strengthening of coastal and river flood defenses/dikes	Land-use management and crop diversification	Early warning systems
Technical reinforcement of the built environment and natural defenses such as dunes	Enlarging and linking green spaces to enhance connectivity for plant and animal species	Vaccination campaigns against health risks caused by invasive species, disaster risk management
Water supply and demand management systems for drought and water scarcity risks	Restore natural water retention potentials to reduce flood risks	Economic diversification and insurance Natural hazard monitoring Awareness raising campaigns



WHAT TO DO:

- Include all stakeholders in the idea collection process based on vulnerability and risk analysis
- Use best practice examples from the region as an inspiration
- Prioritise no-regret-measures and flexible actions

3.2.3 Evaluate the adaptation options

After the team has identified and prepared the list of possible options, the next step to be made is to weigh which option should be taken. It is very important that each option must be scrutinized and evaluated. UKCIP⁵ has listed criteria that need to be considered in evaluating the list of options identified in the previous step:

- Effectiveness – will the actions meet your objectives?
- Efficiency – do the benefits exceed the costs?
- Equity – does the action avoid adverse effects to other areas or vulnerable groups?
- Flexibility – is it flexible and will it allow for adjustments and incremental implementation?
- Sustainability – does it contribute to sustainability objectives, and are they themselves sustainable?
- Practical – can the action be implemented on relevant timescales?

⁵ Available at <http://www.ukcip.org.uk/wizard/adaptation-options/>

vant timescales?

- Legitimacy – is it politically and socially acceptable?
- Urgency – how soon should it be implemented?
- Costs – is it financially feasible – also taking into account social and environmental costs, not just economic costs?
- Robustness – is the option able to cope with a range of future climate projections or societal developments?
- Synergies / coherence with other strategic objectives – does it help to achieve other objectives?

These criteria should be met in order to avoid problems and complication in the implementation stage. In addition to the aforementioned criteria, there are also general methods in evaluating the adaptation options: (i) formal method, (ii) deliberative method, and (iii) intuitive method.

- The formal method is based on the formalizing the decision and applying mathematical reasoning (cost-benefit analyses, multi-criteria decision analysis).
- The deliberative/participatory method is evaluating the options by eliciting information from actors involved and harmonizing their preferences.
- The intuitive method relies on cognitive processes that have been developed through experience and learning.

WHAT TO DO:

- Make clear which method/tool you use for the evaluation of adaptation options
- Include stakeholders and experts for feedback on planned adaptation measures

3.2.4 Implementation

The implementation stage is one of the crucial steps in designing climate change adaptation strategies and action plans. After identifying and choosing the right option, there should be a clear blueprint that will serve as a guide on how to implement the adaptation options. A good adaptation action plan should:

- Clearly identify roles and responsibilities for the individuals involved;
- Describe how preferred adaptations should be implemented (e.g. through new or existing management systems);

ment systems);

- Identify opportunities that could be exploited to incorporate climate adaptation with other planning and development projects;
- Indicate what resources (staff, facilities, capital) will be required to implement the individual adaptation options and monitor their effectiveness;
- Note what institutional and community support will be required to implement the adaptations;
- Contain an effective communication strategy;
- Identify potential barriers to action and mechanisms to overcome these;

- Include mechanisms for evaluating the performance of the strategy, and the actions within it; and
- Lay down a detailed timetable for action.

WHAT TO DO:

- Consider different kinds of instruments for implementation (see table below)
- Check other planning projects for possible co-implementation
- Make sure responsibilities, resources, goals and time schedule are clear to all parties concerned



Methods and Tools for an effective implementation

As mentioned in the previous section, the implementation of the adaptation plan is one of the challenging steps of the entire process of designing climate change adaptation. The European Union Climate Adaptation Platform (Climate-ADAPT) provides a table of instruments that could be utilized when implementing the actions listed in an adaptation plan.

Overview of possible instruments for adaptation			
Instruments	Strong	Weak	Ideal for
Legal instruments (laws, regulations, policies, decrees)	Strong and rapid controlling effect Effective achievement of objectives	Unpopular/ politically risky Inflexible in achieving objectives requires monitoring. Often complicated and expensive to implement (for the regulators and the regulated)	Ensuring a minimum standard Emergency situations
Economic instruments (taxes, fees, tax incentives, grants, interest-free loans, public procurement)	Regulation through economic incentives rather than bans/requirements Makes use of market mechanisms, flexible in implementation	Unpopular (taxes) or expensive (grants), achievement of objectives is not always ensured because behaviour changes are uncertain	Fostering innovation Creation of niche markets Alternative to legal instruments
Informational instruments (studies, brochures, websites, campaigns, events, labels, etc.)	Politically unproblematic because not mandatory, pools resources of several actors, cost-efficient for the public sector	Only indirect and frequently weak or uncertain effects, effectiveness is difficult to assess	New problems whose resolution is in the self-interest of individuals Promoting awareness
Partnership instruments (voluntary agreements among companies, partnerships, collaborative projects, etc.)	Politically unproblematic because not mandatory Pools resources of several actors. Cost-efficient for the public sector	Complex process (high transaction costs) Achievement of objectives uncertain. Often ineffective	Problems that one actor alone cannot solve because of a lack of resources (e.g. money, knowledge, contacts)

3.2.5 Monitoring and Evaluation

The last stage, at the same time the prerequisite for the assessment of vulnerability and risk to begin anew, is the monitoring and evaluation stage. A close monitoring and regular evaluation of the adaptation measure is essential in order to distinguish if the community is adapting well. Considering the uncertainties and non-linear developments of a complex socioecological environment, adaptation options may become outdated or attractive again. With this step, the team has the chance to point out what are the things that need to be changed in light of new developments and also new scientific findings, and those things that need to be kept and improved. This step will help the team to enhance, update and polish the adaptation option that they have implemented.

3.3 Phase 3: Sustainability of the adaptation process

Sustainability is one of the important criteria that has to be considered in evaluating and choosing adaptation options. It is one of the challenges that the adaptation team has to think beyond the implementation phase of the adaptation project. How long will it last? What has to be done to make it sustainable? These are some of the questions that every practitioner or a policy maker needs to address especially in designing an adaptation initiative. It is not the cyclical process alone, which is difficult and challenging to accomplish, but also making the project last in the long run.

There are projects that require only a short time to achieve the desirable results, while there are some that demand more time and effort before the results will be tangible. Climate change adaptation policies definitely belong to the latter. It will take time and a lot of effort before the community achieves the target goals of the strategy. In this last part, we would like to guide practitioners and policy makers through this phase and mention two essential steps to ensure that the newly established adaptation initiative is sustainable and effective in the long run.

Designing a climate change adaptation initiative is a cyclical evolving process; it is a continuous and repetitive activity until the best result is achieved. Since this is a cyclical and repetitive process, it is expected that some steps will be given lesser attention in the next cycle, while others should be prioritized and emphasized.

WHAT TO DO

- Consider future monitoring and evaluation possibilities from the beginning of project planning
- Define responsibilities for monitoring and evaluation
- Use the evaluation results to improve adaptation measures

In order to have a long-term impact, there is a need for perpetual and continuous engagement of the stakeholders. They have to be involved actively all throughout the entire first cycle of the adaptation process and beyond. Stakeholders should continue working with the adaptation team especially during the post-implementation phase. They can bring in a lot of local knowledge which is valuable for the monitoring and evaluation. They could give inputs if the initiative is working properly and effectively or not. Therefore, it is also important that these stakeholders will be kept informed and updated. Up-to-date information regarding the issue should also be available and accessible for the public because it can motivate them to continue their support and commitment towards the long-term goals of an adaptation strategy. The link between single adaptation action and long term strategy should be clear in order to keep the community on track and the issue alive also in terms of political attention.



WHAT TO DO:

- Establish long-term communication channels to keep the public and stakeholders informed about the adaptation process
- Initiate regular meetings of stakeholders to gather feedback and information about implementation



Methods and Tools for Evaluating and Monitoring the initiatives

Monitoring and evaluating the adaptation initiative is the last step of the entire cyclical policy process. And most often, it could take time to reach this stage. However, if the previous steps will be done precisely

ly and smoothly without any interruption, one can reach this final stage with the objective of monitoring and evaluating (M&E) the entire initiative. UKCIP has also provided a guideline with tools that will aid the people in-charged in this level to fulfill their tasks¹.

¹ <http://www.ukcip.org.uk/wordpress/wp-content/PDFs/UKCIP-AdaptME.pdf>



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