

# Recommendations for the Croatian national adaptation strategy to climate change





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Summary of survey results and the events held in the Croatian regions and derived recommendations for the future development of the Croatian national adaptation strategy to climate change

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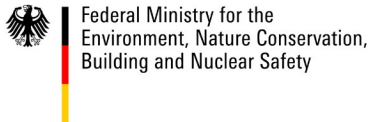


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## 1. Introduction

The project CroAdapt-2 aimed at integrating the regional level into the emerging policy on adaptation to climate change on the Croatian national level. The project partners organised a number of regional round tables which were should allow regional stakeholders to express their concerns, observations, ideas and expectations for the national adaptation strategy. At the same time it gave a chance to the Ministry of Environmental and Nature Protection to

explain the planned adaptation strategy and outline the next steps in the national adaptation policy. To prepare these round tables, a stakeholder survey has been carried out in 7 Croatian regions. This report will outline the results of the stakeholder surveys, summarize the outcomes of the round tables and present ten recommendations for the national adaptation strategy and policy that are developed based on the findings from the survey and the round tables.

## 2. Climate Change Adaptation as a Priority

### 2.1 South Dalmatia

In the stakeholder survey, 21 filled in questionnaires were sent back to the project team. Most of the respondents were informed about climate changes in the media or through their work. As for adaptation to climate change, the answers are quite biased. While some respondents deal with adaptation to climate change on a daily basis, others never deal with this topic. Asked for their awareness about the regional consequences of climate change, most stakeholders assess their awareness as being average – three said that it is very good, three that it is bad. Most respondents agree that South Dalmatia will have to face medium to severe consequences of climate change although not all respondents observe climate change impacts yet – five respondents answered this question with no. As consequences of climate change, besides the usual changes in weather patterns, the stakeholders expect a decreasing quality of agricultural products and the spread of diseases. Most respondents mention extreme rainfall events as the most significant change in the region. Among other expected changes, the frequency of forest fires plays a significant role according to the respondents. The main responsibility to adapt to climate change is seen on national level. Only 8 out of the 21 respondents see responsibility for taking adaptation measures on the level of individual citizens or the private sector. Many respondents do not feel sufficiently informed, only few state that they are well informed. Similarly, two thirds would not know whom to approach with questions regarding adaptation to climate change. Similar in number, two thirds of the respondents think that the region is not well prepared to cope with climate change, while one third thinks that some measures have already been implemented. Talking about the future, the sta-

keholders think that adaptation measures should be undertaken in several sectors. Agriculture and tourism should enjoy the highest priority. Furthermore, many stakeholders think that the fishery sector needs to adapt. The most important part of the adaptation strategy should be the integration of adaptation measures into regional strategies and development plans according the respondents. More public events and stakeholder consultations are wished, as well as guidelines for architecture adapted to climate change.

The roundtable discussion in Metković has highlighted agriculture, water management and tourism as priority sectors in the region. Main consequences for the sectors include increased irrigation needs, especially in summer, loss of natural values and reduced resource basis for sustainable tourism (Neretva Delta is one of the last remaining Mediterranean marshlands, its biodiversity is threatened by adventure sports activities disturbing the ichthyofauna of the Natura2000 site). Effects of hydroprojects in Bosnia and Herzegovina will be aggravated through climate change due to reduced inflow of freshwater and may result in restrictions for mariculture intensity and agriculture. Also, a warmer and longer tourist season will increase the needs for cooling in summer which will increase the energy demand for air conditioning).

According to stakeholders, the most urgent actions include policy measures at national level, such as signing the MARPOL Protocol by Croatia, a stronger focus of the national energy strategy on renewable sources and more sustainable tourism. Proposed local measures include the restoration of wetlands as natural lagoons, as well as the construction and

renovation of existing water tanks for future increasing irrigation needs and for drinking. However, human resources for dealing with the consequences of climate change are lacking: municipalities in Neretva Delta have no capacities to develop projects on their own. Additionally, cooperation among municipalities is hindered by conflicting interest groups. It was suggested to consider a stronger involvement of international initiatives and organisations (e.g. Euro-

### 2.2 North Dalmatia/Lika

In North Dalmatia and Lika, 18 stakeholders took part in the survey, 15 of which work in the public administration. Thus it is not surprising that also many respondents learn about climate change during their work, but also from the media. Most stakeholders say that they have medium or bad knowledge of climate change. The stakeholder groups which are assumed to be most knowledgeable on climate change is the EU as well as universities and other higher education institutions. The private sector was evaluated as being the least knowledgeable. Asked for the expected impacts of climate change in the region, almost all respondents anticipate medium to strong impacts. Only one person thinks that there will be no impacts of climate change. Almost all respondents say that they already feel the changes in the climate, e.g. colder July and August but warmer Septembers. Furthermore, respondents fear that pollutants might be washed out from polluted sites and contaminate the ground water. Extreme precipitation events and forest fires are considered as other severe consequences for the region. Besides these negative impacts, also positive consequences are expected, e.g. the shift of limits of vegetation which allow a better cultivation of certain cultures, as well as the advantages of the warmer climate for tourism and the shorter heating period. Currently, the region is poorly prepared to deal with climate changes. Water management and agriculture are the two sectors that would need most adaptation measures, followed by tourism, the health sector and the energy sector.

Talking about the responsibility for adaptation policy, the stakeholders see the national level as most important, followed by EU, the regional and local level which are considered approximately equally important. The private sector and citizens score lowest. In line with this perception, the majority of respondents feel medium or even badly informed by the public authorities, which is to some extent surprising as most of the respondents work in pub-

Mediterranean Forum) to gather relevant regional stakeholders. Social networks and online media will be crucial for a stronger presence of climate topics in the public and on the political agenda, since the bottom-up influence of civil society and the academic sector is low. Education and awareness-raising are needed to make the public actors understand and to trigger political decisions.

lic authorities. Thus the information flow inside the authorities and the education of public officials on climate adaptation needs to be improved.

Asked for a future regional adaptation strategy, most respondents see the need to include actual physical protection measures, followed by guidelines for climate proof architecture which has lower priorities in other regions. A point that was added was measures in the field of civil protection.

The roundtable in Zadar focused on the presentation of experiences of the city of Zadar in the EU Cities Adapt project where they received training on local adaptation and developed an adaptation vision and action plan, and the results of the Šibenik-Knin County's climate change cost assessments and climate-sensitive planning through the project "Integration of climatic variability and change into coastal plans and national Integrated Coastal Zone Management strategies".

The city of Zadar has set up an Adaptation Task Force, but in order to implement the corresponding action plan, to monitor relevant opportunities for funding and to develop successful project ideas efforts have to be intensified. The core of the task force are the municipal departments, as well as county departments in charge of environment and tourism, representatives of the tourist board, building managers (for actions related to energy efficiency in the building sector) etc.. In order to disseminate its experiences the city plans to organise info-weeks, engage media, organise educational workshops, working group meetings and regional workshops with good practice examples. For the regions of Lika and North Dalmatia the priority sector was defined as "agri-environment" (including forestry, agriculture and tourism). Consequently, the proposed adaptation measures called for fire protection, irrigation, civil protection as a multidisciplinary field, reforestation and improved wastewater discharge, taking into ac-

count the need for an improved collaboration among the sector's stakeholders and actions focused on increased public awareness, e. g. targeted promotion actions. However, capacities for implementing

### 2.3 Istria

In this region, 31 persons have participated in the survey. The respondents have learned about climate change either through work or through the media, although two thirds have however never or hardly dealt with climate change adaptation issues so far in their daily work. Half of the respondents assess their own knowledge about climate change impacts as low, the other have as medium to good. Asked about the awareness of others, the respondents rate the EU and the academic sector as the most aware, and the private sector as the least aware stakeholder group. The perception of climate change impacts in the region differs. 17 respondents expect severe consequences in the region, 8 medium and 6 none. This is to some extent contrary to the finding, that only two respondents do not yet feel any changes, which 29 out of 31 stakeholders do. Mentioned impacts that are already observed include amongst others temperature extremes, changes in weather patterns, invasive species in the sea, floods, fires, landslides and forest degradation. Positive climate change effects for the region include a reduction of heating costs, extension of the touristic season, fire prevention and better irrigation of fields thanks to more frequent rainfall.

The main responsibilities are seen with the higher political levels, such as the EU and the national level. Still two thirds see a responsibility with the private sector or individuals. The academic sector is not regarded as having a responsibility in adaptation to climate change; only one person selected this stakeholder group. The own assessment on how well stakeholders feel informed by the public authorities shows that the majority does not yet feel informed. Two thirds also would not know whom to address regarding questions on adaptation to climate change. In line with these answers, a majority also states that it is not yet ready to deal with climate change, however, a quarter feels at least somewhat prepared. The issues that need to be addressed when it comes to adaptation are water management; specific measures mentioned include the construction of water management systems with standards that are adapted to higher extremes and the change to natural water retention measures. This is followed closely by tou-

these priority actions were deemed insufficient for the moment in terms of both human and technical capacities.

rism, agriculture, nature conservation, infrastructure and the energy sector. When asked which elements a regional adaptation strategy should include, the priority is seen in mainstreaming climate change into sectoral plans, followed by communication with the administration and the public (round tables, information events). Both, physical measures and renaturation/reforestation programmes come in third.

At the roundtable held in Rijeka, two case studies were presented, namely in the sectors of tourism and forestry. One case study presented the potential of energy efficiency measures in Croatian hotels as a mean to mitigate climate change. The second one focused on climate change impacts on forestry and nature protection including the progressive changes in forest species brought by various causes including climate change (warmer weather - drought and invasive insect species, changes of wood species and habitats, destruction of forest material from frequent rains and extreme weather events, forest fires). As an example, the presentation referred to the damage to National Park Risnjak (forest-based) caused by heavy ice rain in 2014 in the region of Gorski Kotar. This event costed at least 25 MEur while long-term effects still need to be assessed. According to experts from the forestry sector, impacts of climate change are already handled by regular forest management. The sector apparently has sufficient capacity and knowledge to address it.

During discussion, the agricultural sector (food security and availability) was mentioned as the most vulnerable one in Primorje-Gorski Kotar since this region has no own production and depends on the import from other regions. Agri-production should be encouraged. Access to financing needs to be decentralised, currently all sources are focused in Zagreb. The local situation often is not known to those who do the planning, while no concrete results can be expected without local initiatives. Challenged with the consequences of climate change, tourism requires improvement and additional offers as well as a more distinct profiling of destinations. The development of new sectors and new jobs could turn out beneficial for the region. However, stronger intersectoral

cooperation is needed and bigger shares of the profits need to be reinvested into the development of capacities. Here, proposed adaptation measures include reforestation, incentives for organic/eco production, incentives for cattle breeding (domestic species), development of family and health tourism. As at the

### 2.4 Capital region (Zagreb)

In total, 13 participants took part in the survey in the region of Zagreb. Most respondents came into contact with questions of climate change through work, less through media. 9 of the 13 respondents also deal with climate change issues at work at least occasionally. Given that 8 of the 13 respondents work in the public sector and one in research and considering that a local adaptation strategy has been developed in Zagreb, it is perhaps not surprising that 54% feel well informed about climate change consequences in the region. Most respondents (8) expect medium impacts, four persons severe impacts and just one person does not expect low impacts of climate change. Eleven respondents feel the impacts of climate change already now. As most important consequences for the capital region, floods, summer heat, heavy rainfall events, landslides/torrents, and droughts were mentioned. Positive aspects that were mentioned include renewed groundwater reserves or levels from increased rain fall. This would have a positive impact on growth and development of lowland floodplain forests. Furthermore, the possibility of growing lemons and tangerines in Zagreb (in urban areas) was mentioned. Roughly three quarters respondents do not think that the region is prepared to climate change yet, similarly 9 out of 13 respondents do not feel informed about adaptation to climate change by the public authorities but a majority would know who to contact with questions regarding climate change adaptation. According to the stakeholders answering the survey, the sectors most in need of adaptation measures in the next 10-20 years are water management, agriculture, followed by physical planning, civil protection, nature conservation and infrastructure. When asked who is responsible for taking adaptation measures, all respondents consider the national level responsible; almost all also think that the regional, EU and county level bears some responsibility. Citizens and the private sector are considered the least responsible, but still more so than in other regions.

When asked about the elements that a regional adaptation strategy/policy should include, the highest

other roundtable events, participants stated that public knowledge on climate change needs to be increased. It was emphasized that people need to be told in simple language what climate change and adaptation means for their everyday life.

ranked options were physical protection measures (dikes, reservoirs, retention basins etc.), the renaturation of rivers and creeks, reforestation programmes and the inclusion of climate change measures in sectoral plans/strategies/documents as well as the provision of guidelines for climate adapted architecture. When asked which initiatives the respondents would start if they were in a position to do that, many answers refer to two main aspects - the implementation or improvements of laws and by-laws and the increase of the awareness of citizens.

Based on results of the survey, the discussion at the roundtable in Zagreb concluded that the topic is still relatively unknown: most stakeholders propose measures which actually relate to mitigation rather than adaptation, and additional efforts are needed to expand education on adaptation and to connect various sectors and stakeholders through strategic planning. In Sisak-Moslavina County water management was named as the most vulnerable sector. This is due to reduced retention potentials and frequent flooding in the Sava River catchment, as well as a possible increase in vector diseases through the spreading of invasive species and the deterioration of water and soil quality. For Zagreb County, infrastructure sector (transport, energy, municipal services) was singled out. The proposed adaptation measures included institutional networking, more applied scientific research, education and enlightenment of the public. Financial resources were deemed as sufficient but not used in a targeted manner due to the lack of coordination and insufficiently trained human resources. The project „Zagreb on Sava“ was identified as a potential large infrastructural project which might bring benefits to all vulnerable sectors in the region. Of similar importance is the introduction of more green infrastructure measures in urban areas.



## 2.5 Central Croatia

In Central Croatia, 13 persons participated in the survey; most of them work in public administration or institutions/agencies. Approximately half of the respondents did come across the topic of climate change at work, a bit more read or heard about it in the media. Only one respondent assesses her or his awareness/knowledge of climate change as very good. The others think their awareness is medium or even poor. As for the awareness of climate change of other actors, the EU is ranked as the most aware actor, followed by NGOs/academic sector, then with some distance regional and local administration follows. The national level, citizens and the private sector are considered to be least knowledgeable. This is to some extent in conflict with the opinion of most respondents who think that the national level is responsible for taking adaptation measures. Other actors that are considered to be responsible for taking actions are the EU, followed by the regional level and then the local administration. The private sector and individual citizens are considered least responsible when it comes to adapting to climate change. Interestingly, also the global level was mentioned by two respondents. In general, respondents do not feel well informed about adaptation to climate change by the authorities; only 3 respondents say they are well informed. However, despite this lack of information, a clear majority (8 out of 13) would know who to contact if they would have questions regarding adaptation to climate change.

Six of the respondents expect severe impacts, five still medium impacts, only two say that they think that climate change will only have low impacts to Central Croatia. Almost all respondents confirm that they already notice climate change or its consequences, for example too much or too little water, sudden weather changes with negative consequences on crop yields, or health problems. The observed climate changes correspond also to the most significant impacts in the region which the respondents expect: floods and droughts as most frequent mentioned impact, followed by heavy rainfall and summer heat. In line with that, the sectors that will need adaptation in the next 10-20 years are, according to the stakeholders, in decreasing order agriculture, water management, civil protection/health, tourism, infrastructure, less so forestry and nature conservation.

Future adaptation policies or strategies should, according to the respondents, definitely include physical protection measures. This answer stands out clearly from all other options. Other less important options are (in decreasing order) guidelines for climate adapted

architecture, renaturation/reforestation, inclusion of climate change in sectoral plans/strategies and information and awarenessraising for the public and public authorities.

At the roundtable held in Daruvar, the town officials presented their activities in the frame of Climate Alliance (Daruvar is one of only 2 Croatian members of the alliance) and EU Mayors Adapt (the only signatory in Croatia): engaging in environmental education activities, involvement in the Climate Alliance's project "EYD2015 The Future we want", promoting/encouraging sustainable use of natural resources – importance of forests for sustainable development; development of sustainable continental tourism. The municipality has identified vulnerable sectors at town level: agriculture, forestry, biodiversity, infrastructure, water management. They also support and implement energy efficiency actions (LED lighting, water-saving pipes, solar collectors for citizens and public buildings, educational paths).

The experts from the regional emergency and rescue service for Bjelovar-Bilogora County talked about a risk analysis conducted in 2014, which showed that there are aspects which have not been taken into account in risk management planning - especially landslides due to heavy rains. These events could become more frequent due to a higher number of extreme weather events. The damage caused by landslides grows rapidly but this is insufficiently taken into account in plans and strategies. It was pointed out that there is a need for a coordinated regional/national action on landslide damage remediation, including financial support, and the work on raising awareness on the situation. All physical plans need to include findings from the field in order to prevent construction on landslide-prone areas and reduce future negative impacts on local and national budgets – these are prevention measures, which require multidisciplinary approach. According to the Croatian Forests, the forestry sector in this region is also very vulnerable: Due to human activity and natural factors forests now cover less than 25% of their original area. Consequently, their function as protection against floods and droughts has been significantly reduced.

Although many sectors were mentioned, agriculture and water management were identified as priority in the end and some adaptation measures proposed, including adaptation of crop types, incentives for ecological farming, insurance of crop production against risks/damages, as well as improved management of retention areas and floods.

## 2.6 Northwest Croatia

In Northwest Croatia, 14 stakeholders answered to the survey. The group answering to the survey is more or less split in two groups – those who are regularly exposed to climate change issues at work and those who are rarely or never. In line with this finding, the knowledge of climate change impacts varies among the respondents from very good to poor. Asked for the awareness of others, we find again that the awareness of individual citizens and the private sector is considered to be the lowest. The EU is considered the most aware actor, also in Northwest Croatia.

Asked for the changes in climate in Northwest Croatia, the majority of respondents say that they already notice changes. Also for the future, a lot of impacts of climate change are expected. Most predominantly, changes in the precipitation as well as increased annual average temperatures and its consequences are expected. This includes floods, heavy rainfall events, water scarcity in summer seasons combined with summer heat. Furthermore, the respondents worry about an increase in landslides. Positive consequences that are expected to emerge from climate change are improved possibilities to grow crops that need warmer and longer summers, a shorter heating period and sufficient water quantities for the electricity production in power plants during the rainy season. In line with these answers, the need for adaptation is mostly seen in the agricultural sector, the energy sector and the infrastructure and nature conservation. Especially with regard to agriculture, the respondents wish for solutions involving regulation and containing erosion. More than half of the respondents think that the region is at least partially prepared for the challenges arising from climate change. However, in contrast to most other region, a majority would know whom to contact with questions on adaptation to climate change. As for the responsibilities to address and deal with climate change, the respondents think that the

national, regional and local level should be in charge, less so the private sector and the individuals. Similar to other regions, the respondents think that local adaptation policies should most importantly include physical protection measures and the mainstreaming of adaptation into sectoral plans, followed by the inclusion of round tables, events and providing information for the public.

At the roundtable held in Varaždin, a case study on risk management in cases of extreme weather events was shown. The Sutla River floods of 2010 in Krapina-Zagorje County served as an example, which also included some recommendations: since Northwest Croatia can expect more intense precipitation / flooding events (and, consequently, more landslides), a revision of risk assessments and adaptation of operational forces to new threats is required. This includes capacity building, and material and technical resources for emergency response units, as well as strengthening of the forecasting and warning system

Discussion revealed more recommendations, such as a necessity to intensify cross-border cooperation in water management so that Croatia can cope with upstream water from neighbouring countries more easily. The introduction of stricter obligations and sanctions for county governments in the field of air quality protection and climate change should guarantee that measures are included in county budgets. Also, counties should set up cross-sectoral climate change teams within their administrative services. Some good practice examples were mentioned at local and regional level, including the Koprivnica's annual Climate Week and Varaždin County's cooperation with civil society groups on environmental education.

All vulnerable sectors identified by the stakeholder survey were discussed, adaptation measure in the fields of water management, energy, health and agriculture were proposed.

## 2.7 Slavonia

In Slavonia, 13 stakeholders have responded to the survey, 9 of which work in state or regional application or in other public institutions. The remaining 4 respondents work in civil society organisations or research institutes. Almost all stakeholders have been come across the topic of climate change in the media and at work. Approximately half of the respondents deal with climate change adaptation topics at least occasionally at work, the other half never. That is also reflected by

the fact that only 5 respondents say that they have a low awareness/knowledge on climate change. The actor with the highest awareness is the EU, according to the surveyed stakeholders, followed by the national, regional and local level as well as the academic/NGO sector which is believed to have a medium knowledge. Again, the stakeholder groups least aware are the private sector and the citizens. In Slavonia, this does not correspond to the responsibility that the individual

stakeholder groups should have according to the respondents of the survey. All stakeholder groups should have approximately equal responsibility, according to the respondents, also citizens. The need for more focused action is indicated by the fact 7 out of 8 respondents do not feel sufficiently informed by authorities so far. At least half of the respondents would know who to address with questions on climate change adaptation.

Impacts of climate change are felt by all stakeholders participating in the survey already. Issues 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 considered 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.

Three workshops have been organized in Slavonia, with the aim of starting a more detailed climate adaptation planning and motivating local and regional stakeholders to take concrete action towards regional adaptation planning. Slavonia could become a model for other Croatian regions. During the the first event, the group discussed sectors and stakeholders which, in all likelihood, will be affected by climate change in the future. Five sectors were identified, including agriculture, water resources, biodiversity of habitats, health, and civil protection. The second event took place a few weeks after the first one, the same participants were present. The group decided to continue

discussing the issues of agriculture and water, in the context of expected sectoral development in the region until 2050. The most important regional stakeholders which will be affected and/or need to be activated were listed as well as realistic adaptation options. Given the low coverage of other sectors among the participants and consequently low data availability for a deeper discussion, the most comprehensive and concrete adaptation proposals were obtained for the AGRICULTURE SECTOR. In a comparison of data from 2000 and 2011, agriculture stands out as the only sector with a positive GDP trend. However, it is also significantly exposed to extreme weather events such as droughts, floods and strong winds. This makes the agricultural sector also the most vulnerable one. The proposed adaptation measures included general education on climate change (at all levels), education of farmers and other agricultural stakeholders about adaptation possibilities.

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. Participants developed a draft action plan for a future education project and necessary intersectoral cooperation. Some additional stakeholders were invited based on recommendations and personal engagement of participants of the preceding events. Out of 25 workshop participants, a core group of 15 people was created, including experts from the Osijek Faculty of Agriculture, agrometeorology experts from the 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. They will continue to work on the development of an educational project, for which CroAdapt provides the basic content. The resulting action plan is a practical tool for continuing climate-related activities in Slavonia, and can be also used as a basis for project fundraising.

### 3. Recommendations for the national adaptation strategy

The results from the surveys and the events show a quite homogeneous overall picture with just smaller regional differences which are partly due to geographical differences. In general it can be seen that the majority feels not yet sufficiently informed, although the overwhelming share of respondents sees or feels the consequences of climate change. Most stakeholders are concerned about water and agriculture issues throughout the country. This is where many problems are observed already (floods, drought) and where most respondents see a need for adaptation measures. This assessment is in line with available assessment by third parties which describe such problems, e.g. the synthesis report of the regional climate vulnerability which

was done in the project "South East European Forum on Climate Change Adaptation (SEEFCCA)".

A general set of recommendations on climate adaptation policy is available in many publications and guidebooks, and is in line with good governance principles for any horizontal, environmental issues (transparency, stakeholder communication, public participation, cost-benefit considerations, mainstreaming). The following recommendations will not refer to these more general principles again; however we are convinced that these principles are very important and should be taken into account throughout adaptation policy development and implementation.

#### (1) General education on climate change and individual precautionary measures– information for citizens

**What?** The general public has been identified as one of the least knowledgeable group by the stakeholders surveyed in the Croatian regions. Interestingly, the vast majority of respondents have said to feel the consequences of climate change already. We assume that this would probably also be the case if we would conduct a survey of the general public, regardless whether the observations are actually in line with statistical observations of the weather and climate or not. This shows that there is a general basic awareness, which needs to be expanded by knowledge about climate change and by translation of this knowledge into own action. It is important to increase the general understanding of climate change and its consequences among all society levels, including children. It is also important to stress precautionary measures of individual citizens, especially with regard to summer heat, floods, sea level rise and landslides. We recommend developing specific brochures and, other info-materials (e.g. cartoons for children), as well as providing information on websites – generally on climate change consequences and scenarios for Croatia, and specifically on how to prepare for extreme weather events. In case of floods such measures include e.g. measures in cellars and ground-floors, having pumps, proper insurance, safe storage of hazardous substances e.g. oil tanks. For summer heat, a campaign to check regularly the well-being of elderly friends and family or about measures to protect from summer heat (but keeping in mind mal-adaptation e.g. through increased air conditioning) could be carried out. Furthermore, participatory processes e.g. when designating flood zones can help

to communicate risks and inform citizens about measures to mitigate risks and to be prepared for extreme events. A specific problem that should be addressed is houses that were built without proper permission in potentially flood-prone or landslide-prone areas but which are now being legalized or are already legalized. Citizens of such households need to be taught of the special risks and they should be encouraged to undertake enough precautionary measures to be prepared as good as possible in case of flooding/landslides. Since the regional and local authorities are themselves poorly informed on the subject for reaching out to citizens locally, some basic education (training of trainers) should be provided to them first.

As a first step, the project CroAdapt-2 has developed a brochure informing citizens about adaptation to climate change. This brochure will be available for download from the website of the MENP and the project partner REC Croatia.

**Who?** The main responsibility to inform citizens is shared between the national level, which should provide general information and the municipal level, which should provide specific localized information for their citizens, addressing the particular problems that are expected. Authorities responsible for the designation of flood zones (EU Directive 2007/60/EC on the assessment and management of flood risks) should communicate potential risks and discuss these during the public participation process. Expert institutions such as universities, hydrometeorological service, national emergency and rescue service, public health institutes and related public agencies should be included in



development of materials as well as training/preparing the municipal level for reaching out to citizens locally.

**When?** Measures to inform citizens on the importance of precautionary measures should be started soon. We recommend that a set of general materials on climate change and thematic materials on how to deal with

## (2) Education of agricultural companies/farmers

**What?** During the workshop discussions it became clear that the agricultural sector is one of the most vulnerable sectors when it comes to climate change in Croatia. Especially droughts, floods and heat waves have an influence on the yields, as well as changing wind patterns, hurricanes, hail and fires (both natural and caused by humans). A changing climate might force some agricultural actors to reconsider or adjust their farming practice. As agriculture is an important sector for some, otherwise economically disadvantaged regions, such as Eastern Croatia or the Neretva delta, a badly adapted agricultural sector can have strong negative impacts in some regions. During the regional round tables it was confirmed by a number of stakeholders, that farmers need more education on sustainable farming practices under climate change conditions. This should include both education on climate change effects in agriculture (changing agro-climatological conditions for growing traditional cultures, new pathogens in the environment, agro-fenological reactions (plant and animal stress) to climate change and ways to adapt/minimise them), as well as education on damages & possible prevention measures according to different types of losses/damages/natural disasters caused by extreme weather and climate events in agriculture. The seasonal forecasts should also be introduced by Meteorological and Hydrological Service (DHMZ), which are currently not run due to limited human and financial capacities.

## (3) Awareness raising for selected sections of the private sector

**What?** From the stakeholder survey we found that the private sector is often considered to be the least knowledgeable on adaptation to climate change. However, actors from the private sector will often be directly affected from climate change, e.g. in forestry, agriculture and fishery, the tourism industry or the processing industry. Consequently there is a demand to raise the awareness of especially vulnerable sectors and to recommend them to take precautionary measures. Typical measures for awareness raising can be information events, brochures, electronic databases on good practice examples, the expansion of information

specific risks is developed and provided on the thematic website section of the MENP as soon as possible. The awareness raising on municipal level should be a part of regional and local adaptation policies and should start as soon as feasible, but no later than 6 months after the first materials have been prepared.

We recommend thus to put a focus on agriculture and declare it as one of the priority sectors in the adaptation strategies. This should translate into concrete activities in the action plan on how to qualify farmers and agricultural companies.

**Who?** The planned measures should be defined in cooperation with the ministry of agriculture, farmer unions and farmers extension service, national emergency and rescue directorate, agrometeorology section of DHMZ, scientists and specialised associations in agriculture, forestry, construction, hydrology, as well as food and rural development agencies. The Croatian Agrometeorological Society (HAgMD), which consists of DHMZ's and experts from several universities, have recently implemented several country-wide educational workshops for farmers, farming extension and fire-fighting services, but the program is not permanent due to a lack of finances. We recommend updating this programme as well as setting up the seasonal forecasts programme, and searching for possibilities to finance the implementation of both.

**When?** Given the vulnerability of the agricultural sector and the dependence of some regions on this sector, we recommend carrying out educational activities for farmers and agricultural companies as one of the first measures of an action plan to be implemented.

offered on the adaptation section of the website of the MENP and especially the cooperation with stakeholders and networks, such as the chamber of commerce, the hydro-meteorological service etc.. Third-party funded or self-financed adaptation model projects in the private sectors should be encouraged and facilitated.

**Who?** The initiation of the process should come from the MENP, responsible for the national adaptation policy. We recommend including networks and stakeholder groups, such as the chamber of commerce, farmer associations etc. early on and to develop and run awareness raising campaigns in cooperation. Larger

industries and companies which are highly relevant for the regional or national economy should be directly approached during the adaptation process. This includes energy providers, large energy production plants, harbours, transport providers and transport infrastructure services but also insurances and banks on the national level.

**When?** Awareness raising actions for the private sec-

## (4) Continuation of stakeholder communication in the setting started in Cro-Adapt2

**What?** The project CroAdapt-2 has initiated round tables in 7 different regions. The events grouped stakeholders from regions with similar characteristics and in geographical proximity. The events were held once and the first recommendation is to continue holding regular round tables in the same or close locations during the development of the National Adaptation Strategy and beyond (Metković, Zadar, Rijeka, Zagreb, Varaždin, Osijek, Bjelovar). This will ensure a continuous dialogue with stakeholders and allow the possibility to give a feedback to stakeholders how their contributions have been considered in the national adaptation process.

Second, for specific topics, we recommend thematic seminars or round tables which can deal with specific sectors (water, agriculture). This could encourage additional stakeholders, which have been reluctant to join the more general regional round tables so far. These thematic seminars do not need to be standalone events, but could be integrated as specific sessions into expert conferences etc.

Third, we recommend continuing the process on the climate adaptation model region in Slavonia. During CroAdapt-2 we organised three events on adaptation questions. By the third event a core-group of stakehol-

## (5) Guidance for the regional and local authorities

**What?** We recommend developing guidelines and instructions for regional and local authorities to either develop their own adaptation strategies or including the issue of adaptation into plans and strategies when updating them. The project CroAdapt-2 has developed guidelines on how to start regional adaptation policies. These guidelines are ready for use but should be complemented by a set of recommendations drafted by the responsible ministry (MZOIP) which describe legal requirements and aspects, e.g. which new policy documents are mandatory (if so)? Which planning documents must or should include adaptation to cli-

tor should become a part of the action plan, accompanying the national adaptation strategy. Awareness raising measures should be undertaken in priority sectors defined in the adaptation strategy and follow the timeline to be set in the action plan. Third-party funded projects (e.g. through EU-funded LIFE or H2020 projects) or self-financed initiatives can be promoted already before the adaptation strategy and the action plan are in place.

ders has formed which is eager to continue working on adaptation even after the project CroAdapt-2 has ended. Ideas for activities have been drafted during these meetings and it is now up to the stakeholders to find means and ways to implement them.

**Who?** We recommend that the organization of the regional and thematic round tables is coordinated centrally. They do not need to be moderated or technically organized by the same actor, but the feedback and experiences from the round tables should be collected, compared and evaluated centrally so that it allows a direct feedback into the national adaptation policy. We recommend that representatives of the national or regional level responsible for adaptation to climate change participate in these round tables also in the future. As for the model region Slavonia, we would recommend the MENP to keep this process alive by regular communication with the most active stakeholders in the group and by participating in future events to be organised. Future events on climate adaptation in Slavonia should involve this active core group.

**When?** As this activity is the continuation of an already started process, we recommend continuing this activity during the development of the national adaptation strategy.

mate change? Which communication and reporting is expected between from the national and the regional level?

We recommend that the guidelines take into account the information needs from the regional administration. Their specific requests for legal information can be gathered through a survey or during the round tables (see recommendation on continuation of stakeholder communication).

**Who?** We recommend that such guidelines are developed by the MZOIP or a commissioned subcontractor.

They should to be harmonized and agreed between the different ministries.

**When?** The guidelines should be prepared towards the end of the finalization of the national adaptation strategy.

## (6) Drought management

**What?** Floods are intensive dramatic events that generate a lot of media attention; however droughts are at least an equal threat to the local economy and quality of life. Droughts are sometimes not perceived as equal problem because they often do not pose an immediate threat to life and health. Nonetheless an adequate management of water scarcity and drought will be necessary to deal with the consequence of climate change in the warmer seasons in Eastern and especially Adriatic Croatia. Sectors directly affected are agriculture, energy generation, drinking water abstraction, but potentially also tourism etc. A potential increase and longer duration of drought makes it necessary to pay special attention to this problem. We recommend discussing how to strengthen early warning systems, water storage measures (e.g. storage of rainwater in reservoirs), a critical review of existing and planned irrigation schemes (which could aggravate the problem) and the possible introduction of drought response plans in specifically vulnerable areas. Such drought response plans categorize the allowed water uses for different

degrees of the severity of the drought. We assume that the introduction of drought response plans can potentially cause controversial discussions, which are to be expected when scarce resources need to be allocated. It is therefore of utmost importance to have a transparent, participatory process, preferably moderated by a skilled, well-accepted moderator or mediator.

**Who?** This process should be initiated on the national level. During the development of the adaptation strategy, responsibilities and processes should be defined. Drought response plans, if necessary, should be developed on regional level, possibly by commissioned experts, in a participatory process with local stakeholders.

**When?** The issue should be taken up when developing the national adaptation strategy. Results of the discussion should translate into direct actions in an action plan accompanying the national adaptation strategy. If regional adaptation plans are required in the future, requirements on drought management actions should be included for areas mostly threatened by droughts.

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## (7) Eligibility of adaptation measures in the environmental fund

**What?** We recommend that the Environmental protection and energy efficiency Fund (Fond za zaštitu okoliša i energetske učinkovitosti) includes climate adaptation as a topic into their programme, possibly as a subtopic to the already existing focus on climate change. The fund could support pilot projects in different sectors that clearly demonstrate how to adapt to climate change. Clear criteria should be set for such pilot projects, e.g. mal-adaptation should be excluded. Furthermore, the fund could support awareness raising and education programmes. These “soft measures” should be focused on priority sectors defined in the future national adaptation strategy.

**Who?** The Management Board and thus the representatives from the different ministries appointed to the Management Board of the fund need to include adaptation to climate change into the Fund’s work programme.

**When?** The possibility to support pilot projects should be established by the time the national adaptation strategy and the action plan are adopted.

## (8) Development and implementation of physical pilot projects as best practice examples

**What?** Pilot projects that include physical adaptation measures should be implemented and serve as best practice examples. Such pilot project could include infrastructure measures (e.g. increase of dykes) financed from the state budget or measures fully or partly-financed by third parties (e.g. changes in production processes, use of new techniques and technologies,

e.g. changes in agricultural or forestry schemes, urban adaptation measures – green roofs etc.).

**Who?** Private actors and infrastructure providers are the primary responsible group. The MENP should collect best practice examples and pilot projects from Croatia on their website section on adaptation to climate change. If adaptation measures are supported by

the environmental fund (see recommendation) then this possibility should be advertised.

**When?** The documentation of best practice examples requires little, but regular effort and could be started with the development of the adaptation plan.

## (9) Cross-border communication on adaptation measures in water management

**What?** Adaptation measures, especially those measures that have an impact on floods or on the water availability in the dry seasons need to be communicated and coordinated with neighbour countries (Slovenia, Hungary, Serbia, Bosnia-Herzegovina). Cross-border early warning systems e.g. in case of heavy rainfall events in neighbour countries and rising water levels should be improved. We recommend reviewing existing communication channels used during extreme weather events on the level of ministries and also other actors, e.g. the weather services, national emergency and rescue services, international river commissions relevant for the region (ISRBC, ICPDR). Planned adaptation measures with impacts on neighbour

ring countries should preferably be discussed using the existing meeting and working group formats, e.g. in Priority areas 5 (Environmental Risks) and 6 (Biodiversity, landscapes, quality of air and soils) of the Danube Strategy.

**Who?** The process should be led by the governmental level.

**When?** Adaptation measures should be communicated with neighbouring countries already in the preparation phase if they have a potential impact there. The review and adjustment of cross-border communication channels and warning systems in emergency situations should be carried out as soon as possible.

## (10) Integration of an evaluation mechanism in the national adaptation strategy


**What?** In order to assess the success of a political strategy and the advance of a thematic policy, national strategies, such as the adaptation strategy and action plan, should include proper evaluation mechanisms that allow a critical review of the achievements in regular intervals. We recommend developing an evaluation mechanism, e.g. in form of a scoring system, during the drafting of the national strategy. This mechanism should define success

criteria and determine when the adaptation strategy is evaluated and revised. Similar mechanisms should be included in regional strategies.

**Who?** The subcontractor that will be commissioned for the development of the adaptation strategy should carry out this task

**When?** During the development of the national adaptation strategy.





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