Climate-Proofing for Sustainable Water Management

Results from a Good Practice Assessment on Climate Risk Management by Sustainable Water projects funded by the Dutch Sustainable Water Fund (FDW)

Climate and Sustainability

Netherlands Enterprise Agency

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This report provides the results and key findings from a good practice survey on climate risk management for water projects conducted amongst beneficiaries of the Dutch Sustainable Water Fund (FDW).

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Foreword

On behalf of the Netherlands Ministry of Foreign Affairs, the Netherlands Enterprise Agency RVO is responsible for the implementation of the programme Sustainable Water Fund (FDW). Through FDW, RVO supports collective initiatives between governmental bodies, industry and NGOs for safe and secure water in developing countries. These initiatives include projects for integrated water resource management, clean and safe water provision in industry and (rural / urban) settlements, and efficient water use in agriculture.

FDW projects connect several aspects of sustainable development as they contribute to economic growth, self-reliance of communities and alleviation of poverty. An important cross-cutting theme for FDW projects is climate change. After all, climatic changes can have a profound impact on water resources and water management activities. A complication of considering climate change in FDW project management is that estimated short- and long-term impacts are often surrounded by uncertainties, while actions to mitigate climate change related risks often go beyond the direct span of control of the FDW project management.

In order to support project teams in dealing with climatic changes, RVO has taken the initiative to perform a survey amongst a number of FDW projects to analyse already existing good practices regarding climate risk analysis and management. Within this survey we put emphasis on the following aspects:

- Identifying risks of climate change impacts on FDW projects,
- Characterising the risks in terms of how possible impact (severity) and likelihood, and whether the risks can be managed by the project teams,
- Assessing good practice of application of tools and information to handle the risks, based on FDW project experiences.
- Recommendations based on identified climate-related risks and effective adaptation solutions for these, for use by other (FDW) projects and activities in sectors exposed to climate-related risks.

This report aims to contribute to improving the resilience of water management projects to climatic changes. The relevance of these results and recommendations is not limited to climate-proofing of FDW projects alone, as it can also be useful for other water, food, nature-based, and energy projects that are likely to be exposed to and need to adapt to climatic change.

Acknowledgements

We express our gratitude to all FDW project partners who have contributed to this report by sharing their hands-on and day to day experiences with (climate) risk assessment and management of their water project. Their insights, feedback and background information was invaluable for our analysis.

Glossary and acronyms

Adaptation	=	Adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts, usually covering a wide range of social, economic, environmental aspects that are mostly connected
CRA	=	Climate risk assessment
FDW	=	Sustainable water fund
GCA	=	Global Center on Adaptation
ICSR	=	International corporate social responsibility
IPCC	=	Intergovernmental Panel on Climate Change
ISO	=	International Organization for Standardization
IWRM	=	Integrated Water Resource Management
MCDA	=	Multi-criteria decision analysis
NGO	=	Non-governmental organisation
PPP	=	Public private partnership
RVO	=	Netherlands Enterprise Agency
SAM	=	Stakeholder attribute matrix
SME	=	Small and medium-sized enterprise
TAP	=	Technology action plan
TNA	=	Technology needs assessment
UNFCCC	=	United Nations Framework Convention on Climate Change

Introduction

THE INCREASING IMPACT OF CLIMATE CHANGE RELATED RISKS TO SUSTAINABLE WATER MANAGEMENT

In its Fifth Assessment Report, IPCC (2014) explains the risk of water stress in different regions in the world due to climate change. Similarly, the IPCC Special Report on the impacts of global warming of 1.5°C (IPCC, 2018) explores water service-related climate vulnerabilities, both under a 1.5°C and a 2°C scenario. For instance, while water stress will occur under both scenarios, in a 2°C scenario the proportion of the world population that will be exposed to water stress will be 50% higher than in case of achieving 1.5°C. IPCC (2018) also shows that regions differ considerably in terms of water vulnerability.

Identified climate risks can appear in different contexts, and "risks across energy, food, and water sectors could overlap spatially and temporally, creating new and exacerbating current hazards, exposures, and vulnerabilities that could affect increasing numbers of people and regions" (IPCC, 2018, p. b.5.6). Also the Global Commission on Adaptation (GCA, 2019) indicates that "we must invest in a massive effort to adapt to conditions that are now inevitable [such as]: higher temperatures, rising seas, fiercer storms, more unpredictable rainfall, and more acidic oceans."

In terms of reducing climate change risks, including for sustainable water management, the report explores options for adapting to climate change impacts, such as efficient irrigation, social safety nets, disaster risk management, risk spreading and sharing, community-based adaptation and sustainable water management. The need for and required scale of these options will vary depending on whether a 1.5 or 2°C scenario is pursued.

Based on this growing scientific insight on climate change impacts, it is likely that financial institutions, such as pension funds, commercial banks, venture capitalists, insurance companies and development banks, will increasingly demand climate risk assessments, risk management and mitigation action plans when considering an investment (see Box 1). A robust strategy for addressing climate-related risks thus becomes increasingly relevant, if not indispensable, for future energy, water, food, nature, and infrastructure projects, and to allow for the scaling-up of such projects in a sustainable and 'climate-proof' manner.

Given these challenges and solutions regarding 'climate-proofing' of sustainable water management projects, this report provides an analysis, explanation, and step-wise approach towards identifying potential climate-related risks to sustainable water management, analysing these and their root causes, and formulating actions to mitigate these risks, depending on the locally-specific impacts of climate change and scale and intensity of required adaptation actions.

The analysis and approach in this report are based on a review of relevant literature on climate-related vulnerabilities and relevant tools for assessing these, as well as the outcomes of a series of interviews with representatives of twelve projects in the Dutch Sustainable Water Fund programme (FDW). The interviews helped to gather good practice examples of assessing and handling climate-related risks, and how to engage stakeholders in that process. Particular attention was paid to consideration of climate-related risks as part of already existing project risk management practices, including the international corporate social responsibility (ICSR) risk analysis that FDW projects have to carry out.

Box 1: The concept of climate risks & risk management

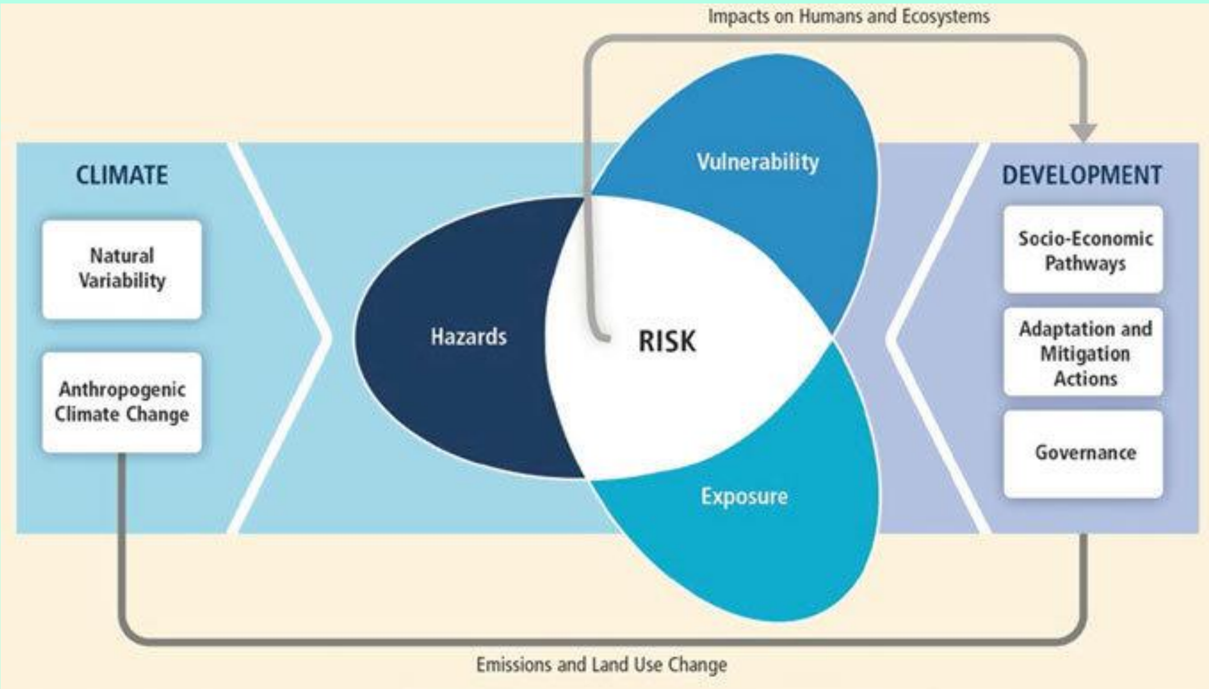
Risk management is *"the identification, evaluation, and prioritization of risks as the effect of uncertainty on objectives followed by coordinated and economical application of resources to minimize, monitor, and control the probability or impact of unfortunate events or to maximize the realisation of opportunities"* Source: Wikipedia.

The IPCC in its fifth assessment report (IPCC, 2014) describes climate change risks as:

"[…] results from the interaction of **vulnerability**, **exposure**, and **hazard** (see Figure 1)."

And defines risks as: "The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur.

Figure 1: The concept of climate risks



Source: (Oppenheimer, 2014)

$$\text{Risk} = (\text{Probability of Events or Trends}) \times \text{Consequences}$$

Where:

Exposure is: The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.

Vulnerability is: The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

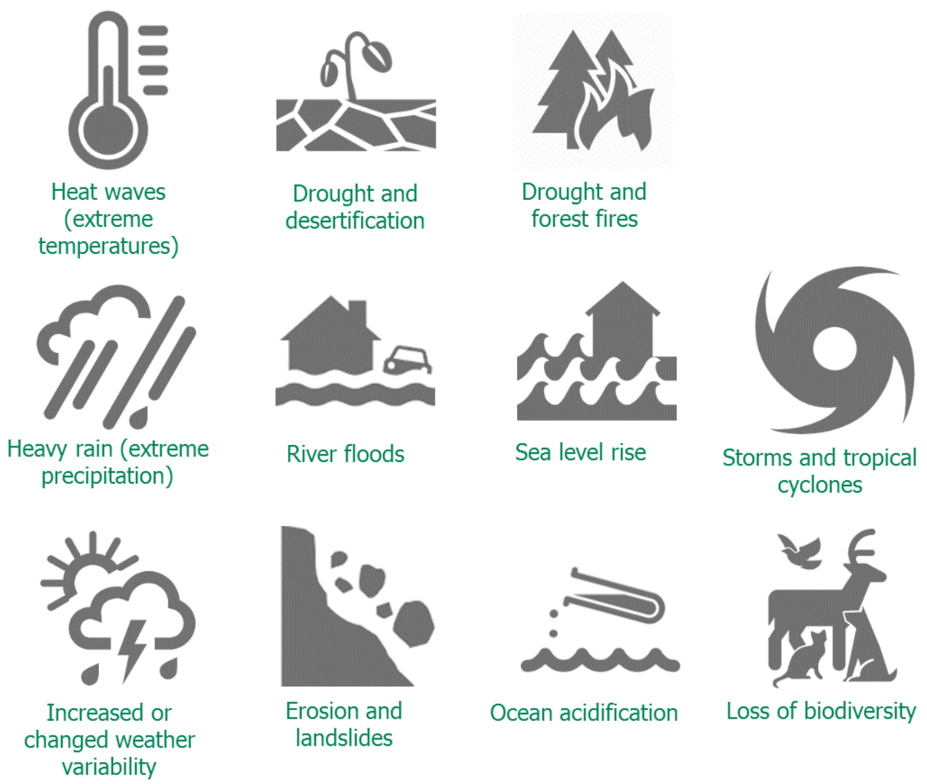
Hazard is: The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources. […] the term hazard usually refers to climate-related physical events or trends or their physical impacts"

Method

For the good practice assessment JIN Climate & Sustainability set up a series of semi-structured interviews with selected FDW project partners. These interviews have been conducted in 2018 with the aim to obtain better insights into the various good practices regarding climate change ***risk assessment***, conventional project risk management, as well as ***stakeholder engagement***. Including good stakeholder engagement practices within the scope of our assessment is driven by the notion that a participatory and inclusive approach is likely to have a higher chance of success when it comes to effective risk management, (social) acceptance, and implementation of risk mitigation actions.

The interviews specifically zoomed in on the way in which climate change related risks stemming from the exposure and vulnerability relative to climate hazards Figure 2 are embedded within existing participative project risk management practices.

Figure 2: Overview of climate hazards



To frame the interviews, we linked the discussion to the existing risk management and risk reporting by the FDW funded projects. The FDW projects all submit a mandatory International Corporate Social Responsibility (ICSR) risk analysis to RVO.

With regard to the (climate) risk management practices, the interviewees have been asked to characterise and assess the likelihood and severity of a subset of climate change hazards as well as the set of project risks that they already include (as part of the mandatory ICSR reporting). For this we developed a simple table structure in Excel format. The completed tables provide input for the discussion on the importance and impact of climate change related risks relative to other risk categories. During the interview discussion we addressed questions such as:

- Are climate change related project risks automatically flagged by stakeholders?
- Which climate change related hazards are relevant for the project / activity?
- How vulnerable or exposed is the project to these climate change risks?
- If and how are these risks managed? And if so, how are/can they be addressed?

In addition, a set of questions was developed to perform semi-structured interviews with FDW project partners on the ways in which stakeholder engagement was a) initiated, b) organised and c) monitored. During the interviews we asked questions such as:

- How did the project partners ensure that all relevant stakeholders are involved (i.e. ***inclusive***)?
- What difficulties/challenges did they face during the engagement process (e.g. disputes)? and
- How is the stakeholder engagement process best managed and monitored?

Together with representatives of RVO an initial selection of FDW projects and stakeholders was made to engage in the good practice survey process (see Annex I: Selection of FDW projects approached).

Results

GOOD PRACTICES ON CLIMATE RISK MANAGEMENT

1. Perform qualitative and participatory risk assessment

All interviewees indicated that they perform a project risk assessment with regular intervals (often in line with the annual ICSR reporting requirements). We observed a variety of approaches towards risk assessment and risk management.

While there was consensus that a risk assessment would benefit from participation of project partners as well as external stakeholders, most interviewees indicated that the risk assessment was initially performed internally (i.e. within the project consortium). In most cases one person was responsible for compiling and reporting the relevant project risks in a repository (e.g. most often an excel file), while the other consortium partners provided input upon request (e.g. via e-mail, phone or in a small group meeting).

Most interviewees indicated that for the risk assessment an internal consultation would suffice, as most key risks would be signalled. However, for ensuring that appropriate risk mitigation measures are taken, it was considered useful to establish early interactions with key stakeholders from outside the consortium.

The findings above mainly refer to more general project risks. With respect to assessing climate change risks, most interviewees are generally well aware (albeit in qualitative terms) of the type or category of exposure/vulnerability their project would have to specific climate change related risks. However, the interviews showed that there was much more uncertainty about the exact impact in more quantitative terms (severity / magnitude) of a specific climate risk could be. For example:

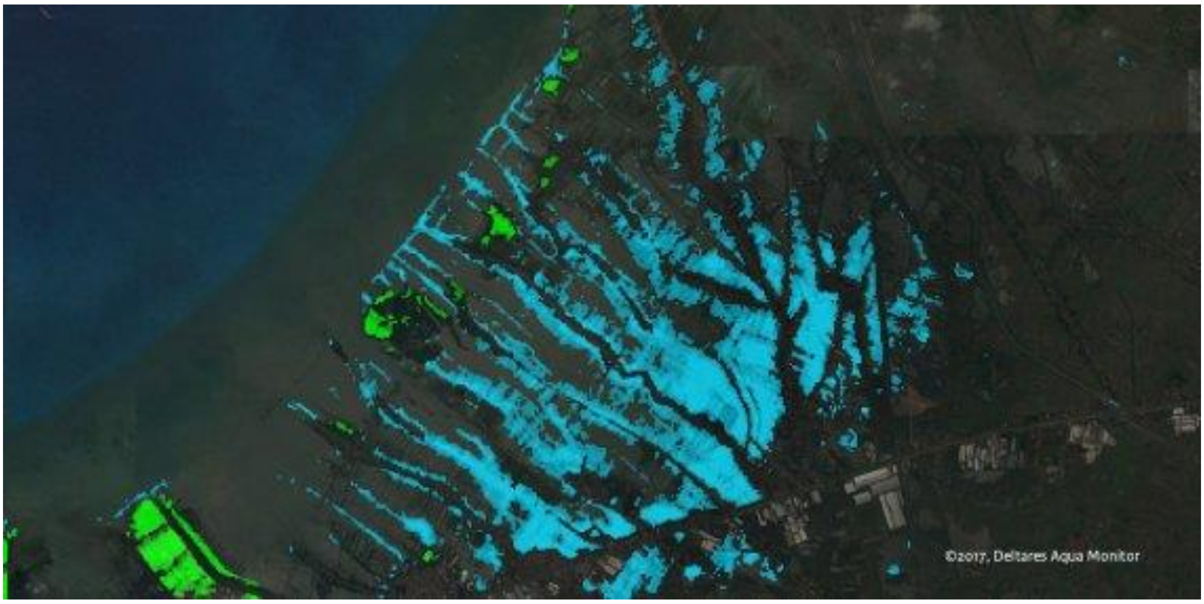
- What could be the anticipated range of sea level rise (0-20cm by 2050, or 20-100cm)?
- What increased frequency of flooding can we expect (once every four years or two times per year)?
- What is the anticipated speed of decline in groundwater table levels per year (in centimetres range)?

To answer questions about the severity/magnitude of a given risk or impact, several FDW projects have used or plan to use/develop specific models, monitoring frameworks and/or earth system observation (EO) tools and resources.

A number of projects from the FDW portfolio already use EO monitoring tools in their projects. Although in most cases this relates to in-situ monitoring (e.g. water quality testing from sampling, water flow measurements, soil sampling, etc.), there are also examples of FDW projects that use satellite data. In most cases, EO data is applied to observe a project's effectiveness and performance in terms of e.g. water use efficiency, crop yield optimisation, etc. However, potentially, this application can be extended to using EO data for better assessment of the projects' exposure to climate change.

For example, the Building with Nature project in Java, Indonesia, uses the Aqua Monitor to observe the effectiveness of measures to prevent and reverse the trend of coastal erosion. The Aqua Monitoring results (Figure 3) have shown that in the project area several patches of coastal zone have been reclaimed (by means of mangrove reinforcements), and help prevent further coastal erosion.

Figure 3: Aqua Monitor results from mangrove reinforcement project on Java, Indonesia*



Source: Deltares Aqua monitor. 2017

** Surface water changes (1985-2016): Green and blue colours represent areas where surface water changes occurred during the last 30 years. Green pixels show where surface water has been turned into land (accretion, land reclamation, droughts). Blue pixels show where land has been changed into surface water (erosion, reservoir construction). Results as per December 2016: Constructed: 0.7 km coastline defence; Maintained: 1.04 km. Sedimentation rates are good, and mangroves are recovering.*

Source: Courtesy of FDW project – 'Building with Nature: A natural solution for Java'

In another FDW project, in South Africa ('Reducing the Water Footprint of smallholder sugarcane producers'), remote sensing (EO satellite) data is used to optimise the in-field crop and irrigation performance. Within the project, stakeholders switched from sprinkler systems to irrigation systems for more efficient water use. The Dutch company eLEAF has developed analytical tools (PiMapping ®) to more accurately assess the water requirements for specific plots of arable land.

These two examples show the potential application of EO data for monitoring a projects' performance (see Annex II: The use of Earth Observation data for Climate Risk Assessment for more background information). However, similar data and observations can also be used to develop better, and more regionally disaggregated scenarios for describing potential climate change scenarios for a relevant project area. These scenarios allow for a better understanding and quantification of the climate-related risks that are specific to the relevant region or project site. From our analysis, we conclude that it is good practice that a climate risk assessment is conducted by a broader group of stakeholders, i.e. stakeholders beyond the project borders, including researchers from universities, representatives of regional authorities, private enterprises and community-level stakeholders.

2. Maintain risk assessment registry

Virtually all interviewees have some kind of risk registry or repository where they list all relevant project risks. However, the extent to which climate-related risks are included in those registries differs from project to project. In some cases, the risk registry comprise a simple table with a few descriptive parameters for each risk. In other projects, more extensive risk management databases have been developed and used to perform the risk assessment and risk management.

An example of a number of risks included in such a risk repository is provided in Table 1, taken from the FDW project, Sustainable and Resilient pro-poor water supply Cebu, in the Phillipines. Such repositories are often an integrated part of a larger project management and monitoring structure (i.e. to keep track of project goals and/or expected results / outputs).

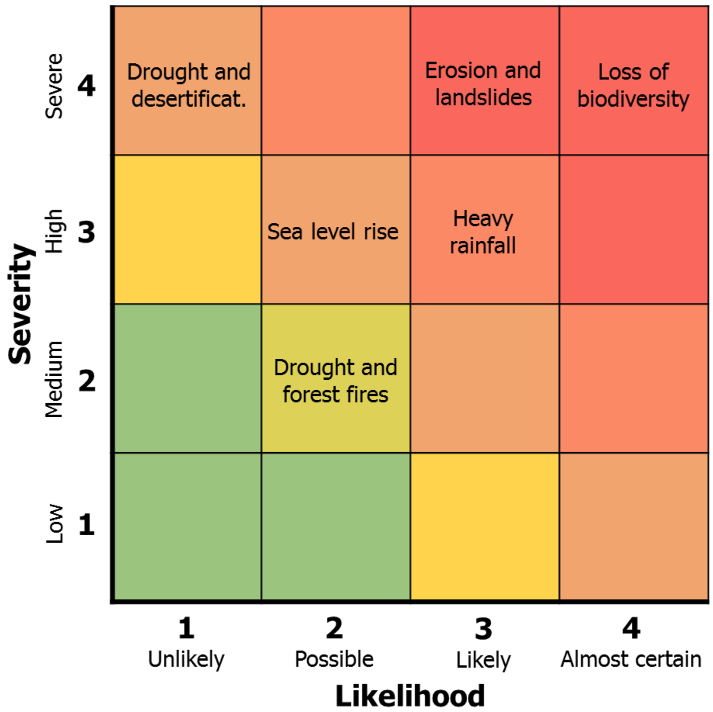
Table 1: Risk registry example

ID	Risk item	Effect	In / external	Likelihood	Severity	Risk management and mitigation	Responsible
Overall							
1	Partner withdrawal and/or non-performance	One or more work packages not deliverable / delivered	Internal	Low	High	Partnership Agreement in place. Robust co-financing mechanism in place with genuine risk-sharing. Effective & respectful working relationships. Ongoing M&E	VEI/All partners'
CSR / FIETS							
CSR1	Disclosure		Internal	Low	Low	Advocate transparency in the project. Upscaling activities to be open and inclusive.	All partners
CSR2	Human Rights		External	Low	High	Disassociate from misbehaviour by stakeholders and any government agencies. Advocate free choice by IPs and low-income communities to participate in the project.	All partners
CSR3	Employment and Industrial Relations		External	Low	Low	Staff employed in compliance with employment legislation. COWD CEO/senior staff to manage union interface.	All partners
CSR4	Environment		External	Medium	Low	Full compliance cooperation with relevant permitting, EIA and PCIA/FPIC requirements for projects.	COWD, HFI, PRC, all partners

Source: Courtesy of Vitens Evides International (VEI)

Maintaining a risk registry enables a risk assessment and ongoing project reporting, but it can also provide visual support within a stakeholder setting. In some analysed project cases, the risk registries enable the extraction of risk 'heat maps' which can help to prioritise risks, i.e. risks that need to be addressed first. For example, as illustrated in Figure 4, by indicating in the excel registry the likelihood of each risk to occur and its expected severity (magnitude or impact), highly likely risks with potentially severe impacts 'heat up' most in a risk heat maps. These are the risks to be addressed first. Such heat maps can be generated for all kinds of risks and risk categories, including climate change risks. Similar risk evaluation and priority selection procedures are being applied in several FDW projects including the FDW Intelligent Water Management project in Colombia. It is noted though that in practice the 'hottest' risks may not always be addressed first, as this also depends on capacity and resources of the project.

Figure 4: mock example of a climate change risk 'heat map'



3. Mainstreaming climate change related risks in existing risk management

For the mandatory annual ICSR reporting, the interviewees generally extract information from their own risk registries to comply with the reporting requirements. We observed that there was a bias in those registries to list only non-climate project risks that the consortium could solve themselves (i.e. within 'their own means' and 'own span of control'). In most cases (but not in all projects) climate-related risks are therefore structurally underrepresented in comparison to 'controllable' project risks. Several interviewees indicated that the discussion on all the different climate-related hazards (Figure 2) during the interviews and considering their own projects' exposure and vulnerability, did trigger their thinking about what climate change risks might have been overlooked.

In relation to this we observed that there is a tendency for project partners to primarily focus on listing and addressing short-term risks that could occur (and be solved) during the FDW project period. Although this is quite rational, given that the promised impacts have to be met at the end of the funded project, for longer term viability, sustainability and resilience of the project also risks that could occur in the longer run (e.g. beyond ten years after project completion) should also be ensured. With this longer term risk perspective in mind we found that the Sustainability Compact assessment reporting would be more suitable for documenting climate-related risks for the period after completion of the FDW funding. Hence, while the ICSR reporting seems to include the more short-term and 'easier' to self-manage non-climate project risks, for considering climate-related and other longer-term risks, the sustainability compact assessment reporting is more suitable for FDW projects. A particular, often quoted characteristic of the latter type of risks is that solving these requires engagement (and responsibility) of a higher governing authority/body.

Although there is a certain logic in maintaining these two different assessment and reporting frameworks, we consider that there are good arguments for integrating risk reporting and management actions that have both a short- and long-term perspective. We acknowledge that - even though climate-related risks may only have an expected significant impact in 20 years from now - such expected impacts can still be relevant for today's risk mitigation actions. For example, assume that within 10 years average annual rainfall is expected to decline to levels where drinking and irrigation water use will structurally exceed natural replenishment in rain fed catchment areas. Or imagine that climate change will result in massive resettlement of rural population to neighbouring areas within about 10 years' time. These cases illustrate risks that would require risk mitigation actions during todays' water project design and investment plans, especially when infrastructure investments are foreseen.

Box 2: Existing risk management standards

The ISO 31000:2018 standard on Risk Management (here) provides a guidance with principles, a framework and a process for managing all kinds of risks. The guide provides project or risk managers to set up and execute a robust risk assessment. Although this general guidance is not specifically tailored to address climate change risks, it is a useful reference for risk managers. Other risk management standards are available as well, including: 'A Risk Management Standard' (here) by the Institute of Risk Management (IRM, 2002) or the tools and resources for performing an International Corporate Social Responsibility (ICSR) risk analysis (here).

Risk analysis as well as monitoring can be done with the help of a risk registry or database. Within such a registry, all relevant risks can be listed and characterised. On top of that the risks can be (qualitatively) assessed in terms of, for example, their likelihood (e.g. high, medium, low) and impact (e.g. marginal, small, considerable, large and catastrophic). Several basic tools and instruction video's on how to develop and perform a risk assessment tool are available online, see for example an Oregon risk assessment tool, an explanatory clip on risk assessment use, and a clip on creation of risk assessment charts.

In light of the above we recommend applying a broad scope (both climate and non-climate) and time horizon (short and long-term) when performing a project risk assessment, so as to not overlook relevant risks. As such we do not see a direct need to make an operational distinction between a) the ICSR risk analysis and the b) sustainability compact assessment. While separate final reporting could still remain in place (e.g. during project phase and after project phase), the integrated risk assessment and management actions could – in principle - be embedded in one single risk management process (see for example ***Box 2***).

4. Perform a risk prioritisation, formulate risk mitigation actions and ensure follow-up actions

Following the above good practice observations on characterising, 'ranking', and mainstreaming risks in existing risk management, we continued our analysis with an assessment of how project stakeholder take final decisions on what risks to address first and how to organise actions needed for that. Based on the interviews and documentation studied, we found a 'natural bias' towards formulating and implementing non-climate, more short-term oriented project risk mitigation actions. Actions to mitigate the consequences of climate-related impacts are more sparsely formulated and implemented. Most interviewees indicated that climate-related risks are generally more difficult to address within the capacities and capabilities of a single (FDW) project. For example, for a single (FDW) project it is very difficult to take responsibility for managing flood risks (e.g. by investing in replanting large acreages of trees alongside and upstream a river) as it would require a collaborative effort of many different stakeholders. Nevertheless, most interviewees supported the notion that such a difficulty - in itself – is not a valid reason not to prioritise and manage climate-related risks.

Interviewees have also been asked about the methods that they use for prioritising risks, which involves a decision on which risks will be addressed first given the available limited (financial, human) resources. When considering impacts and likelihood only, prioritised risks are those that appear as the 'hottest' risks in Figure 4. However, in reality, which risk to address first also depends on availability of resources, whether the risk applies to the short or long-term, etc. In this section, we explore how projects make such risk prioritisation assessments and what measures they take to still be able to prioritise the 'hottest' risks given available resources.

There are several methods and tools available for risk prioritisation, and most interviewees reported different ways in which risk prioritisations are executed. The heat map in Figure 4 is among theses. The interviewees indicated that risk prioritisation is ideally done within a participatory setting with relevant stakeholders. However, participatory decision making requires that stakeholders partaking in the process have the knowledge to take well-informed decisions. Without that, information biases can lead to unbalanced decisions (i.e. not all aspects are equally considered) or decisions driven by those stakeholders that are well-informed. In several project cases, we learned that, in particular, external stakeholders (to a project, such as government officials or NGOs) do not always have an accurate understanding of the project. As a result, risk prioritisation can result in an outcome that is not optimal for sustainable water management by the project, or there could be no consensus at all.

On top of that we found that many FDW projects have difficulties in determining responsibilities for risk management. For example, while exogenous risks, such as corruption, armed disputes as well as climate change impacts, can strongly determine the success or failure of an FDW project, addressing these risks, especially the main reason why a risks arises, is generally beyond the control of the project stakeholders. In these cases, the project's action span is limited to damage control. This dilemma essentially boils down to the question of who should be 'problem owner', i.e. which entity is best placed to manage this risk (e.g. a water board, research institute or government body is better placed and equipped to manage this risk)?

Most interviewees acknowledged this dilemma and raised the question where an FDW project should 'draw the line' when it comes to assessing and assuming the responsibility for managing an identified risk? For example, a project for sustainable drinking water is located alongside a river, where the downstream communities are affected by increasing floods in times of heavy precipitation. In an effort to mitigate this risk, the FDW project decides to implement a reforestation project upstream to reduce water run-off from mountainous areas alongside the river. While sensible, the FDW project also realises that this measure is only truly effective if implemented at the right scale. This generally implies that actions have to be taken at a larger scale (i.e. a larger section of the upstream area is reforested). This, however, could easily span several hundreds of hectares across land that is owned by different stakeholders, who all need to be engaged in the risk management solution, including assigned actions in the risk action plan. It also requires that both the project and the external stakeholders share the sense of urgency and agree on the solution of reforestation, including the accompanying responsibilities. Without that, the project will have to identify sub-optimal solutions and actions.

Through the feedback of the interviewees we observed that risks that require to be transferred to an external entity for example with more capacities and resources, tend to occur more frequently in FDW projects focussing on integrated water resource management. In such circumstances it is considered good practice to transfer the responsibility of managing that risk to a governing entity (e.g. the local water board, local government) that is adjacent to the project and that can more effectively address the risk (cause). This entity has to ensure that all actions are coordinated and implemented at the scale that is required for solving the risk problem (e.g. a reforestation programme at the entire river basin level, rather than a patchwork of different reforestation projects). We found that most of the climate-related risks require actions to be taken through some level of centralised governance. This does not imply that project stakeholders consider themselves relieved from any responsibility when the leading entity in risk management is non-project, external stakeholder. On the contrary, most interviewees acknowledged their role as a relevant stakeholder to remain involved in mitigating a risk (i.e. they would contribute within their capacities and capabilities).

At the same time, we observe, based on the interviews, that FDW project stakeholders tend to exclude many (if not all) climate-related risks from their projects' risk assessment, just because they consider these risks as being beyond their control (i.e. someone else will have to manage that!). However, even though the individual actions of a single project might not be sufficient to address a climate change risk, we consider it highly valuable that this category of risks is included within the project risk analysis, assessment and reporting. After all, a proper recording and monitoring of such risks can aid in the development of good proposals for actions to mitigate those risks at the regional level. Moreover, based on the interviews we consider it unlikely that a centralised governing body will immediately appear when project stakeholders spot and motivate a risk with proposed set of actions. In that case, it is valuable to perform a broad risk assessment and monitoring at the project level and share risk assessment results with broader stakeholder groups, as this familiarises external stakeholders with the risk and creates awareness of actions to be undertaken. Building, updating and expanding such risk registries from the bottom-up ensures that risks will remain 'on the table' and that external stakeholders are regularly reminded to take action on addressing the risk.

GOOD PRACTICES ON S*TAKEHOLDER ENGAGEMENT*

1. ***Build upon existing social structures/networks***

Most FDW project partners indicated that for effective and efficient stakeholder engagement it is most pragmatic to build upon existing social networks and structures. Such networks are most conducive for building mutual trust and faster project implementation, but are very context-specific as they differ across countries and regions.

Having a ***local presence*** (often embodied by having a strong local partner in the project consortium) within relevant (in)formal social networks in the sector is considered good practice; especially for (government funded) projects with a relatively short project life span. Should in that period also new relations need to be build and trust be established (i.e. new social networks and institutions need to be developed), valuable time is lost to be spent on the project implementation itself.

Most FDW projects have applied this good practice as they built their partner consortium upon existing relations from previous projects or collaborations. In addition, they often carried out a stakeholder mapping and/or stakeholder attribution analysis, in order to characterise a stakeholder in terms of:

- Status in relation to the project (e.g. participant, part of target audience)
- Regional / political influence (e.g. high level policy decision maker)
- Position in the value chain (e.g. technology supplier, end-user)
- Follow up actions (e.g. inform about implementation, consult on social acceptance)

During the interviews we found a great diversity of methods and templates to map/characterise stakeholders (see Annex III: Tools and resources for stakeholder analysis provides some more background information on a selection of different stakeholder mapping and analysis methodologies).

2. ***Ensure inclusiveness by ongoing stakeholder analysis and monitoring***

The interviewees indicated that in most cases the relevant existing social networks for a project are adequate to ensure that all relevant stakeholder groups and local communities are engaged. We observed, however, that in many cases stakeholder mapping and analysis was done only at the beginning of a project without updates during the project. For monitoring purposes and in order to ensure adequate ongoing inclusiveness and representation (e.g. gender, non-organised or very small stakeholder groups, etc.) it is good practice to regularly update (in meaningful intervals) the stakeholder database or registry.

At the bare minimum, stakeholder mapping encompasses a simple registry including names, affiliations and e-mail addresses from relevant stakeholders. Throughout the project such registries can be expanded and developed into a stakeholder monitoring database that is updated periodically and includes complementary descriptive stakeholder information (e.g. development priorities, interests, role in the value chain, capacities and capabilities). Such an ongoing process supports the periodic evaluation if the stakeholder engagement process is:

- Sufficiently inclusive,
- Planned properly (stakeholder engagement and action planning),
- Adequately monitored and evaluated

3. Consider dispute settlement and/or team building

All interviewees acknowledged that the stakeholder engagement process does not always run smoothly in their FDW projects. In most cases this relates to the practical challenges of managing a large stakeholder base (e.g. difficult to align agenda's in larger stakeholder groups, travel distances, etc.). However, some interviewees indicated that stakeholder engagement can also lead to conflicts between key stakeholders, which can delay project implementation and could even result in a failure to meet the project objectives. A few examples of such situations/events have been discussed with project stakeholders in the interviews. For example, in a few FDW projects there have been unclarities or disputes about the formal mandate and responsibilities that some key stakeholders have been granted by the national/local authorities. While the history/origin of such stakeholder conflicts can lie outside the FDW project, they can potentially block any progress to meet the project objectives.

Several FDW project interviewees indicated that they have a dispute settlement mechanism in place to manage such conflicts. However, this generally entails a more informal and reactive approach to dispute settlement (i.e. there was no formal protocol or procedure for dispute settlement). In such circumstances either the chair of the meeting, or one of the project partners would act as an intermediary to solve or neutralise the dispute so that the project implementation actions could continue. However, this approach requires a frequent physical presence and engagement of the project partners with the broader stakeholder base. Here it is generally beneficial to have a fixed group of individuals ('familiar faces') to lead this ongoing process. However, ensuring physical presence of the same individual(s) within all relevant stakeholder groups can become problematic within larger projects (e.g. larger in terms of number of stakeholders or geographical scope). In these cases, dispute settlement may require more formalised stakeholder engagement processes.

As a proactive measure, a few FDW projects organised ***team building activities*** as meet ups for key stakeholders. Team / trust building actions have the potential to defuse or minimise the occurrence of any future disputes. Before establishing an own dispute settlement mechanism (or implement team building actions) it is considered worthwhile to link with any existing procedures and/or mechanisms for dispute settlement that are already in place in the region or relevant stakeholder network(s).

Recommendations

The analysis on climate vulnerability of FDW projects and ways to mitigate this risk has revealed a range of possible actions for resilient projects. We have concluded that it is important to identify risk elements, characterise these, assess their root causes and prioritise actions. The latter includes assigning responsibilities, defining time frames and formulating financial action plans.

A key lesson throughout the observations is that properly conducted climate-related risk assessments need to be participatory with engagement of project and external stakeholders. Having a good relationship with key stakeholders in the region is a basic requirement for all FDW projects. In addition, while the interview responses showed a wide diversity in the scope and ways for structuring risk analyses, generally, project stakeholders start with identifying what could be possible risks to their project, followed by a characterisation of these risks in terms of impact and likelihood. As often not all risks can be addressed for reasons of limited resources or lack of influence on the root causes of the risk, project stakeholders often select which risks they can manage and which they cannot. Finally, projects take actions to tackle the risks, including acquisition of funding for these.

Based on these results from the good practice analysis and complementary literature review (including the handbook for conducting technology needs assessment for climate change by UNDP (2010)) we suggest to develop a step-wise process for performing a (climate) risk assessment (a guidebook). This process or guidebook builds upon the good practices identified.

As an initial proposal we consider the following four main steps (Figure 5) relevant for conducting a climate change risk assessment:

- Step 1 - Project stakeholders make a first assessment of potential climate-related risks to the operationalisation and effectiveness of their project.
- Step 2 - These identified risks are characterised in terms of potential impact on the project and likelihood of this to happen, as well as possible actions to mitigate these risks.
- Step 3 - The risks are prioritised in terms of which risks are most urgent to tackle and what actions are needed for that.
- Step 4 - An action plan is compiled for implementation of risk mitigation actions, in terms of timing, responsibilities, costs, and funding opportunities, as well as a plan for monitoring and evaluation of implementation of the actions.

Figure 5. Stepwise approach for assessing climate risks to sustainable water projects

This stepwise approach, given the focus on local, regional or country-specific aspects, is assumed to be applied in participative settings with active engagement of local stakeholders. The results from the good practice assessment within this report can help project teams to identify potential types of stakeholders, and shares good practice examples on how to organise a participative stakeholder consultation, including keeping a focused timeline and handling of conflicting interests.

While the core focus of these four proposed steps is to provide clarity on climate-related risks for sustainable water management projects and solutions to mitigate these, eventually, an important goal of such a climate risk assessment would also be to formulate climate resilience action plans which can be considered for funding by financial organisations (see step 4). This requires that action plans contain sufficient information about time frame for a solution, responsibilities, separate cost items related to the solution and potential funding sources for these.[1] We recommend to also include this fourth step to ensure that adequate follow-up actions are taken to mitigate climate change risks. While steps 1-3 are more of analytical nature, the fourth step is to proactively ensure the climate resilience and long-term sustainability of the FDW project. Within this fourth step also the roles and responsibilities or managing specific risks should be divided between relevant stakeholders to ensure proper risk management during and after the project duration. This fourth step could imply that risk analysis and reporting for FDW projects both for the short term (ICSR reporting) and longer term (sustainability compact monitoring) should be merged into one process.

[1] An important assumption for that, following the guidance on technology action plans for climate change (Technology Executive Committee; UNEP DTU Partnership, 2016), is that action plans do not necessarily have to be detailed documents. Rather is it recommended, given resource limitations, that an action plan can be considered by potential funders as a token of sufficient understanding among project stakeholders of what are funding needs and requirements. Based on that, potential funders will be able to make a first assessment of financial viability after which a detailed financial plan can be developed under the specific guidance of funders.

Annex I: Selection of FDW projects approached

FDW project name	Country	Description
Increasing water use efficiency in sugarcane growing in India	India	Improved irrigation practices in sugarcane agriculture
Reducing the water footprint of smallholder sugarcane producers	South Africa	Irrigation efficiency, training
Building with Nature Indonesia: Securing eroding delta coastlines	Indonesia	Coastal security and aquaculture, nature rehabilitation
Pollution prevention and water reduction in Leather Cluster	India	Partnership platform, capacity building
Intelligent Water Management	Colombia	Mostly on coffee farming: water management dialogue, extension, bioengineering, and knowledge generation
Performance enhancement of water utilities in Kenya	Kenya	Improvement of water service providers
Anticipatory Flood management in Alexandria Egypt	Egypt	Anticipatory flood management, rainwater harvesting and storage
Sustainable Water Services in Harar, Ethiopia	Ethiopia	Master plan for IWRM, water supply services
Sustainable and Resilient pro-poor water supply Cebu	Philippines	Extend and improve the water network
Alternative approaches and tools for improved WATSAN in Uganda	Uganda	Water network rehabilitation and extension (and sanitation) in 10 towns
PPP for Sustainable Water supply: Ridge to coast, Rain to tap	Philippines	Nature rehabilitation, capacity building, sanitation, water supply

Annex II: The use of Earth Observation data for Climate Risk Assessment

Using earth observations and earth observation data to better assess climate change related risks, such as sea level rise, precipitation trends, etc. are invaluable for taking appropriate and effective measures to mitigate such risks. This not only relates for water management projects such as in the FDW project portfolio, but also for a broad range of other projects, organisations and communities who are likely to be affected by a changing climate.

To illustrate, for effective risk management action planning, there is a big difference between the assessment that:

1. the sea level is expected to rise, or
2. the sea level near this river delta is expected to rise with 20 to 30 centimetres within the coming three decades

This type of information will be useful for developing meaningful action plans, and implementing the right actions. For example earth observations will help to make informed decisions (***see Box 2 below***) on how much time and resources should be put in coastal reinforcement, the speed of implementing an rural development strategy that promotes the use of more salt-tolerant crops (e.g. due to the expected increased soil salinity), or the resource and infrastructure planning for water utilities for providing clean water from fresh water resources with increasing salinity.

Box 2: Earth Observations for Evidence-Based Decisions

Individuals, organizations and governments make decisions every day that impact lives, livelihoods and the environment we live in. Many of the most pressing global challenges require the use of Earth observations for effective action; including climate change, disaster risk reduction, food security, forest and water management and many others.

Earth observations refer to all atmospheric, oceanic or terrestrial data and information collected about our planet. This includes both space-based or remotely-sensed data, as well as ground-based or *in situ* data. Coordinated and open Earth observations enable decision makers around the world to better understand the issues we face, in order to shape more effective policies, make decisions and take actions.

Earth observations allow farmers, governments and businesses to lessen food insecurity and food price volatility by making better decisions for crops and food markets. They help communities identify disaster risks, and forecast and monitor droughts, floods, earthquakes, and other potentially devastating events. They enable first responders to quickly identify disaster-impacted areas and contribute to effective response. They provide insight into species and ecosystem health, climate change, water quality, and much more. They enable countries and institutions to measure progress against global policy, including the Sendai Framework, the Paris Agreement and the United Nations 2030 Agenda for Sustainable Development.

Countries and organizations that fail to incorporate Earth observations into relevant policy processes inevitably make less informed decisions that decrease effectiveness. In order to make it easier for these bodies to find and use Earth observations appropriately, partnerships such as the Group on Earth Observations (GEO) are working to coordinate and improve open data resources and tools, and support knowledge production and sharing, and build awareness. Without Earth observations, internationally-defined goals and targets would not be within reach.

Source: M. West communications manager at GEO, published in JIQ Magazine October 2018

Several tools, methods and other resources have already been developed to assess the probability of specific climate change related risks or to quantitatively assess a projects' climate vulnerability. These tools and resources generally make use of model simulations that require a range of data inputs. For example, for the United States and U.S. territories there is a Sea Level Rise Viewer available, that uses abroad range of environmental monitoring data to allow for analysis of flood risks of specific assets or landmarks (here). The Group on Earth Observations (GEO) runs the Global Agricultural Monitoring model (GEOGLAM) to that links data on precipitation, evaporation, soil moisture, etc. to be able to assess and predict vegetation growth. This in turn allows aid organisations to better allocate their resources by being able to anticipate harvest failures and food supply shortages. Below a small sample of some interesting models, tools and resource repositories on international environmental monitoring are listed in **Fout! Verwijzingsbron niet gevonden.**.

Table 2: Sample of tools, models and repositories for environmental monitoring

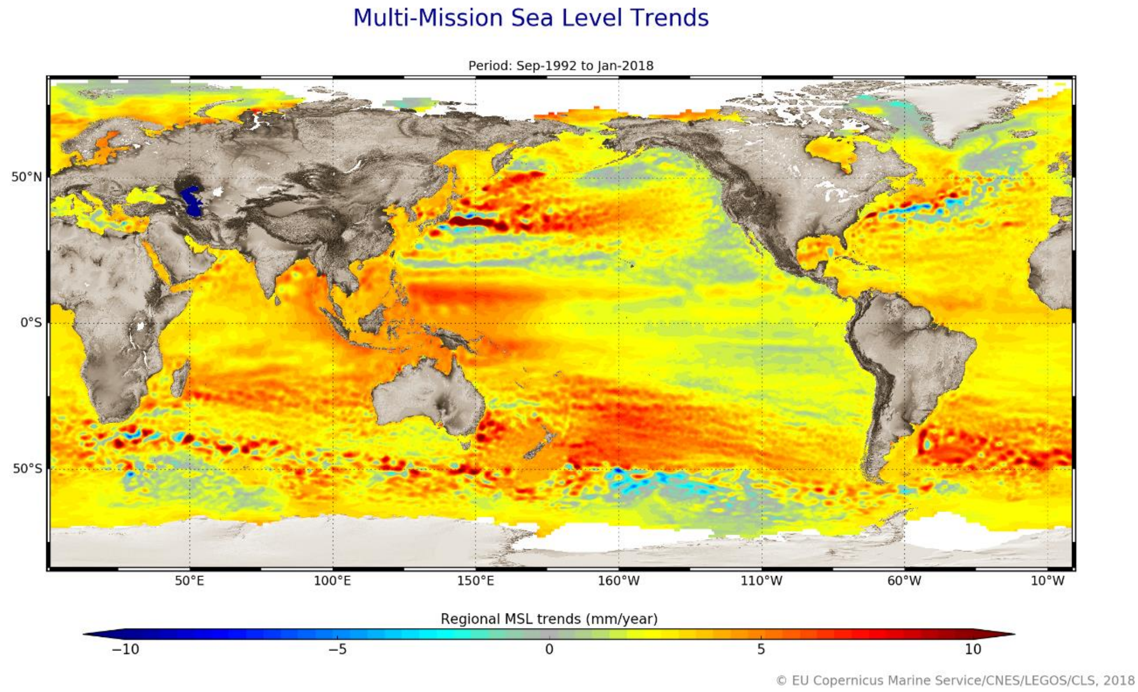
What will you find?	What is it about?	Source
Tool repository	Results from OCTO Community survey on Global Survey of Tools and Resources for Addressing Climate Change Impacts on Marine Ecosystems	link
Open source earth observation data	Earth Observation open data Portal by the Group on Earth Observations	link
Guidance documents & tool repository	Website from Australia's CoastAdapt program	link
Publication	Interesting read by Adger et al. (2018) on 'Advances in risk assessment for climate change adaptation policy'	link
Publication	An interesting paper by Higgins et al. (2014) on 'A Conceptual Tool for Climate Change Risk Assessment'	link

One of the key challenges for many projects that operate in specific environments / geographic areas is that such risk/hazard monitoring and models are not always tailored to their specific context and needs. For example, the spatial resolution can be too low so that probability ranges are too high to be effectively used. Or the underlying data is not of sufficient quality to be representative, for the weather or climatic conditions in the target area (e.g. microclimate, exceptional geography, secluded bay area). As a result, for some projects in specific regions, such models or data might not yet be available. As such it can be useful to develop such models and build up the modelling capacity and environmental monitoring network to enable a better assessment of whether, for example, a specific risk mitigation measure is likely to be effective.

Earth observations can be based on satellite, drone, in-situ or other types of monitoring, and can help in better quantifying these climate change related risks at increasing levels of spatial resolution. A higher spatial resolution means that better estimations on the magnitude of the expected climate change impact can be given for specific regions (e.g. a city, a specific river delta, a particular valley, or a field of sugar cane).

For sea level rise, Figure 6 shows the regional trends in sea-level rise in millimetres per year for the 1992-2018 period. Such historical data, can also be used to make future climate scenarios for specific regions, that enable better climate risk management action planning. There already are several earth observation programmes and tools focus on other climate change related risks, such as droughts, floods, precipitation, as well as monitoring the oceans (e.g. the impact of sea surface temperatures on hurricane intensity).

Figure 6: Regional sea-level trends

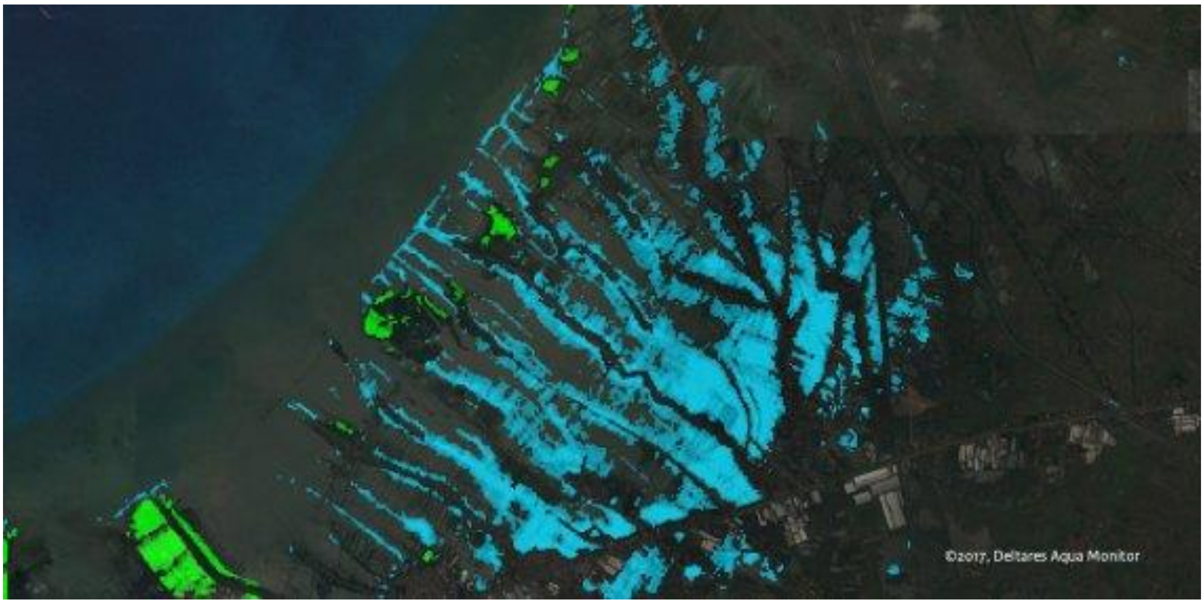


Source: CNES/LEGOS/CLS/EU Copernicus Marine Service/contains modified Copernicus Sentinel data (2018)

There already are several projects from the FDW portfolio that make use of earth observation monitoring for decision making. Although in most cases this relates to in-situ monitoring (e.g. water quality testing from sampling, water flow measurements, soil sampling, etc.), there also are examples of FDW projects that make use of satellite data. The specific application of that EO data in the vast majority of cases relates to being able to observe the projects' effectiveness and performance in terms of e.g. water use efficiency, crop yield optimisation, etc., but there is also potential to extend the use of EO data for those projects to better assess the projects' exposure to climate change.

For example, the Building with Nature project in Java, Indonesia uses the Aqua Monitor to observe the effectiveness of their actions to prevent and reverse the trend of coastal erosion. The Aqua Monitoring results (Figure 7) have shown that in the project area several patches of coastal zone have been reclaimed (by means of mangrove reinforcements), and help prevent further coastal erosion.

Figure 7: Aqua Monitor results from mangrove reinforcement project on Java, Indonesia



Source: Deltares Aqua monitor. 2017

Surface water changes (1985-2016): Green and blue colors represent areas where surface water changes occurred during the last 30 years. Green pixels show where surface water has been turned into land (accretion, land reclamation, droughts). Blue pixels show where land has been changed into surface water (erosion, reservoir construction). Results dec 2016: Constructed: 0.7 km coastline defense; Maintained: 1.04 km. Sedimentation rates are good, and mangroves are recovering.

Source: FDW project – 'Building with Nature: A natural solution for Java'

In another FDW project in South Africa ('Reducing the Water Footprint of smallholder sugarcane producers'), remote sensing (satellite) data is used to optimise the in-field crop and irrigation performance. Within the project they switched from sprinkler systems to more water use efficient drip irrigation systems. The Dutch company eLEAF developed an analytical tool (PiMapping ®) to better assess the water requirements of specific plots (see Table 3) or irrigated land.

The two examples show the potential application of EO data for monitoring a projects' performance. However, similar data and observations can also be used to develop better, and more regionally disaggregated climate future scenarios for a relevant project area. Such scenarios allow for a better understanding, and quantification of the climate change related risks that are specific to that particular region or project. An initiative to assess the climate change risks in a specific project region, however is often best implemented by a broader group of stakeholders that goes beyond the project-level, but involves collaborations of universities, regional authorities, private enterprises and communities.

Table 3: Key features of PiMapping ®

Features	NDVI*	PiMapping ®
Shows whether alive vegetation is present	✓	✓
Shows spatial variation within a field	✓	✓
Provides quantified crop production figures in kg/ha		✓
Is a direct measurement of the actual crop production in field, no need for fieldwork or additional statistics		✓
Provides quantified water consumption in mm/week		✓
Visualises crop water stress in mm/week		✓
Provides absolute values, directly comparable to previous weeks or seasons		✓
Provides absolute values, directly comparable to other regions		✓

**Normalized Difference Vegetation Index (NDVI)*

With the wide array of (often freely) available EO data and information sources, it can become a challenge to find the right type of EO data, that is transferred into the right type of decision making information. The conversion of raw EO data (e.g. from satellites) into useful information for policy makers, farmers, water boards, etc. generally requires specialist knowledge and expertise (e.g. advanced algorithms). To learn more about the ins and outs of earth observations we suggest the Earth Observation Handbook, 2018 Special Edition developed by the Committee on Earth Observation Satellites (CEOS).

Annex III: Tools and resources for stakeholder analysis

1. INTRODUCTION

This Annex provides an overview of relevant tools and resources for those who aim to perform a climate change risk assessment. It provides some tools/methods for stakeholder engagement, as well as for performing general risk assessment and risk management. In addition, several tools and resources specific for climate change related risks assessments have been included, both from available public and online resources, as well as from project managers involved in FDW projects. Based upon the good practice survey (Annex I) we conclude that there is no single best mix of tools, methods and resources that provides the best outcomes, but that each project and each context applies its own mix of tools. Based upon the interviews conducted as part of the FDW good practice survey we consider that there is considerable scope for peer-to-peer learning and sharing of experiences for FDW projects with using the various tools, methods and resources. We propose peer-to-peer learning programs for sharing good practices:

- With the use of tools / methods for stakeholder engagement
- With the use of risk management tools and methods
- On environmental / climate monitoring, the collection and use of environmental/earth observation data and (climate scenario) modelling

Such peer-to-peer learning can be hosted or mediated, for example by RVO or amongst FDW project participants, either via webinars, tutorials, online videos, etc. in an effort to make better use of each other's experiences.

2. STAKEHOLDER ENGAGEMENT

There are different tools and methods for performing stakeholder analysis. There are tools for i) the identification and prioritization of stakeholders, ii) to assess stakeholder preferences, as well as iii) methods for analysing stakeholder behaviour. All such tools involve some kind of stakeholder mapping where different stakeholder groups are described and characterised. Such tools and methods can be useful when one wants to perform a risk assessment and implement risk mitigation actions.

In its most basic form these stakeholder mapping tools are predominantly developed within an excel environment, where they serve as a stakeholder database or registry. However, there are also a broad range of (online) software tools available that provide graphics and visuals (i.e. stakeholder maps). A few stakeholder mapping /analysis tools and methods are briefly described below.

3. STAKEHOLDER ATTRIBUTE MATRIX

The Stakeholder Attribute Matrix (SAM) is an excel based tool that incorporates a range of relevant attributes for different stakeholders or stakeholder groups. The matrix can include relevant attributes such as:

- Organisation
- Position

- Name
- Contact information
- Economic sector (e.g. water, food, energy)
- Organisation size and/or geographical scope (e.g. SME, MNC or national player, local player)
- Role in the project / value chain
- Interests / objectives
- Stakeholder resources (e.g. assets / infrastructure, human capital, financial capital, natural resources, authority

The following steps can be taken to complete the stakeholder mapping in the matrix;

1. Stakeholder screening
2. Initial market role assignment and analysis
3. Initial interest and capabilities analysis
4. Gap analysis and stakeholder network expansion
5. Verification and refinement through stakeholder consultation
6. Results extraction and application to case study analysis

4. POWER AND INTEREST MATRIX

The Power and Interest Matrix is a tool for prioritising stakeholders based on their legitimacy and saliency to influence decision or to be influenced by decisions. The power and interest matrix is primarily designed to identify and prioritise stakeholder as part of a firms' stakeholder management strategy (Parboteeah & Cullen, 2012), see Figure 8.

Figure 8. Stakeholder Power and Interest Matrix

		Interest (saliency)	
		Low	High
Power	Low	Minimal effort - respond when necessary	Keep informed regularly
	High	Endeavour to keep satisfied	Constantly manage key players

5. SYSTEM MAPPING

System mapping (also known as market mapping) is an analysis tool that was initially developed by (Albu & Griffith, 2005) to closely examine the characteristics of the agricultural markets into which small farmers in developing countries might enter. The analysis consists of a description of three core elements: the business enabling environment; the market or value chain; and the supporting services. Within the system different stakeholders have their own role, function and interests and exert a certain behaviour. A better understanding of the key drivers of stakeholder behaviour within a system enables better decision-making processes at the project as well as system level.

System mapping is included in the toolbox for the Global Technology Needs Assessment (TNA) project (UNEP DTU Partnership, 2016). In the TNA project, the tool is used by developing countries for an analysis of the system for deployment or diffusion of a prioritised climate technology, identification of system barriers and elaboration on actions to clear these barriers. These actions are then included in a Technology Action Plan.

6. MULTI CRITERIA DECISION ANALYSIS

Multi Criteria Decision Analysis (MCDA) aims to consider the scope of analysis beyond a single or a few impact dimensions to multiple dimensions. Based on participatory and deliberative approaches the tool aims at balancing different opinions that stakeholders may have and work towards agreements. The primary aim of this method is therefore to provide greater analytical rigour and provide the ability to prioritize actions. The main idea of MCDA is that stakeholders in a participatory setting, such as a workshop, consider a range of options, e.g. multiple climate and non-climate risks and assess these against a set of criteria. These criteria can be pre-defined, such as likelihood, severity, expected costs, etc., but can also be determined by the stakeholders before the MCDA starts. This enables them to take decisions on prioritization of (risk mitigation) actions.