



Climate-robust development and the use of EIA and SEA

Lessons learnt from the Netherlands and abroad

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The Netherlands is very vulnerable to climate change, as currently about 25% of its land surface lies below sea level and is home to half of its population. As a result of its long history of having to cope with various threats from water, the adaptive capacity of the Netherlands is considered to be very high. The country therefore has vast experience in what we define as climate-robust or adaptive management. In this article we present the lessons the NCEA has learnt from using EIA and SEA to support decision-making for climate-robust or climate-adaptive management for projects and plans at home and abroad. This article does not cover climate mitigation strategies.

Three steps for integrating climate change in environmental assessment

Environmental assessment (EA) offers good opportunities to map out the uncertain effects of climate change. It enables an integral comparison between climate change objectives and other sector-specific objectives. This integral comparison reveals on the one hand the impact of climate change strategies on sectors such as nature, biodiversity, landscape and cultural heritage. On the other hand, it shows how achieving sector- and area-specific objectives can contribute to climate change goals. To ensure that climate change adaptation is considered in environmental assessments, the NCEA recommends to use a stepwise approach. Each of the three steps is explained below and illustrated with examples from the Netherlands and elsewhere.

Step 1 - Assessing climate change risks

The first step is to assess the vulnerability of the project or plan area to the effects of climate change in the short and long term, and the related risks the area faces. Climate change scenarios in combination with other scenarios (for example, relating to socio-economic development) provide the information required for a vulnerability assessment. After this assessment, the probability of the proposed plan or project changing the vulnerability is analysed and the likely extent of any changes is estimated.

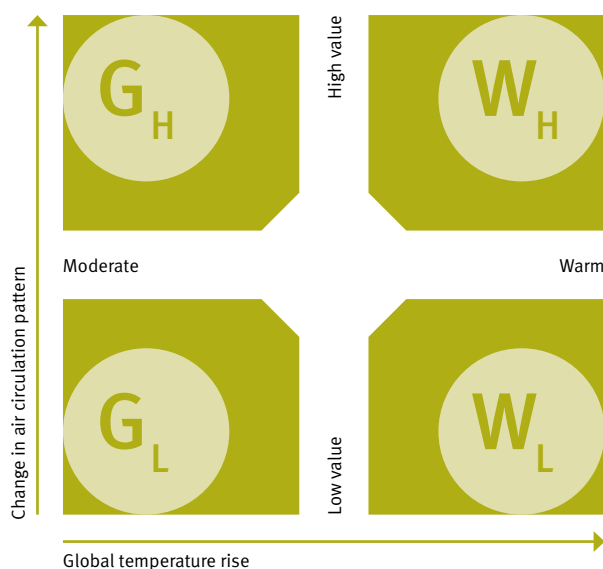
Using scenarios

In its advice, the NCEA generally recommends to describe the vulnerability of a project or plan by means of at least two climate change scenarios: the moderate scenario and the most extreme scenario. The first scenario will give insight into the climate effects that are most likely to occur in the near future. The latter will give insight into the need to reserve areas for future eventualities: for example, for extra-large dikes, for water storage, or for extra drainage capacity. These scenarios provide planners and decision-makers with more understanding of the flexibility needed to deal with the uncertain effects of climate change. In addition, the NCEA advocates a broad assessment including other environmental issues such as biodiversity, air quality etcetera. Researchers and planners should take into account that the effects of climate change can affect a large area, and that these effects will occur over a long time period (50-100 years) and might impact on a variety of sectors.

“Scenarios help planners and decision-makers to deal with the uncertain effects of climate change.”

Climate change effects: water versus drought

The focus in climate change assessment is generally on water-related risks and measures to prevent or mitigate them. Other effects (such as drought and heat stress) receive less attention, even though they are equally important. For example the Dutch water-related research institute Deltares has estimated that the cumulative damage from drought and heat stress in the Netherlands between 2013 and 2030 will exceed the damage from flooding resulting from heavy downpours and rising water levels: 42 billion euros versus 29 billion euros.



KNMI'14 climate scenarios

The Royal Netherlands Meteorological Institute (KNMI) has developed different scenarios for climate change in the Netherlands. They are based on the anticipated global temperature rise and a change from the current westerly air circulation pattern towards an easterly circulation pattern.

For some countries, climate change scenarios are not yet available, or the scenarios produced by different climate models do not point in the same direction and therefore the expected climate change is very uncertain. Moreover, socio-economic development scenarios are often not available, yet socio-economic development such as urban development in areas that are more vulnerable to flooding can increase vulnerability to climate change. The upshot is that decision-makers are confronted with great uncertainty. In such situations, the NCEA recommends following an adaptive approach, starting with no-regret measures. Environmental assessment can support decision-makers in coping with the uncertainties through the development of alternatives that vary from small steps to achieve minimal climate robustness to measures required for maximum climate robustness.

Example of step 1: Adjarala dam in Benin and Togo

In a review of the EIA report for the Adjarala multipurpose dam to be built on the border between Benin and Togo, the NCEA noted that the effects of climate change had not been considered. The NCEA pointed out that if decreased water availability due to climate change had been taken into consideration, the estimated economic feasibility of the dam might have been different. As a result, the decision on whether to approve the dam has been postponed and the effects of climate change are being studied.

Example of step 1: City harbours in Rotterdam

The climate risks for the City harbours area in Rotterdam were assessed by separate groups including experts in climate change, water, landscape architecture and spatial planning. This resulted in a shortlist of most relevant effects and adaptation strategies:

- to adapt to rising sealevels: raising the ground level;
- to maintain air quality during heat waves: green roofs;
- to deal with extreme rain: watersquares that combine public spaces with temporary water storage;
- to adapt to extreme heat: smart facades (envelopes that collect heat during summer and use stored heat for warming the building during winter).



Example of step 1: Land use planning in Kenya

An SEA supporting the development of a land use plan in the Tana Delta in Kenya proposed distinguishing different zones for nature conservation, livestock grazing, fishing, irrigated agriculture and subsistence arable agriculture. The SEA showed that the coastal zone is most vulnerable to salt water intrusion for two reasons: sea level rise due to climate change and a reduction in the discharge of the Tana River in response to more water being extracted further upstream. In the SEA it was therefore concluded that the coastal zone could best be reserved for nature conservation and the development of tourism, as these functions are most suitable for an area that is likely to become more saline in the future.



“The core of environmental assessment is to develop alternatives, including measures that reduce the effects of climate change or improve the adaptive capacity of stakeholders.”

Step 2 - Policy compliance

The second step is to assess the compliance of the proposed project or plan with the objectives of the existing government policy plans for climate change. This step, combined with a vulnerability assessment (step 1), provides policy- or decision-makers with insight into the urgency of acting to make plans or projects more climate-robust. Ideally, the national climate change policy plan has been translated into sector plans with measurable objectives for climate change adaptation. If there are no national or sector policy plans for climate change, or these are at an early stage of development or lack measurable objectives, the compliance assessment has to rely on expert judgment or consultations with local experts representing the different sectors involved.

The box on ‘Living with water’ illustrates that in the absence of a climate change policy, an SEA can be used to support the development of a climate change adaptation strategy. All relevant sectors were involved in the preparation of the SEA for the “living with water” strategy in Bolivia, and expert judgment was used to achieve agreement on objectives.

Example of step 2: Living with Water in Bolivia

The Beni lowlands in Bolivia are characterised by seasonal floods. It is expected that as a result of climate change, these floods may intensify and last longer in the wet season and that during the dry season droughts will be more severe. This, coupled with increased human activities, makes it likely that crop yields, livestock production and domestic water supply will be affected. An adaptation strategy has been developed through the programme Vivir con el Agua (Living with water), which is based on the point of view that the changes involving water cannot be stopped and that the only realistic option is to learn to live with them. In its advice on Terms of Reference for an SEA, the NCEA advised:

- to develop and implement a state-of-the-art early warning system for the Río Mamoré catchment, based on hydrological modelling;
- to update and improve the Regional Spatial Plan for the central part of the Mamoré river basin, based on hydrological conditions, flooding and other environmental risks, hazards and vulnerabilities;
- to draft municipal flooding risk reduction plans in three municipalities: Santa Ana de Yacuma, San Ignacio de Moxos and Loreto;
- to validate the ancient hydro-agricultural structures of the Moxos culture under various hydrological conditions;
- to inventory and study the functional aquatic ecosystems and identify potential Ramsar sites.

Example of step 2: The Dutch Water Act and Delta Programme

* A description of the Delta Programme in English can be found here: www.deltacommissaris.nl/english/delta-programme

The Netherlands developed the Delta Programme* to protect areas that are vulnerable to flooding from the sea and rivers. An SEA report for the programme was completed in 2014. The Dutch Water Act coming into force in 2009 identified the maximum probability of dikes and sand dunes failing in the areas near the major rivers and along the Dutch coast. A survey of the quality of coastal defences revealed eight weak spots in these defences, in locations where a combination of extremely high tide and extremely severe storm could cause the hinterland to be inundated. It was found that the sand dunes and dikes did not meet the standards stipulated in the Water Act.

Several protection projects have been started to make the weak spots more climate-robust and compliant with the abovementioned standards. For details, see the box on Callantsoog, Pettemer and Hondsbossche Zeewering.

Another example of a measure to make weak spots on the Dutch coast more climate-robust is the Sand Motor, an innovative method for coastal protection. Read more about it in the NCEA's article on the Sand Motor, available via www.eia.nl.



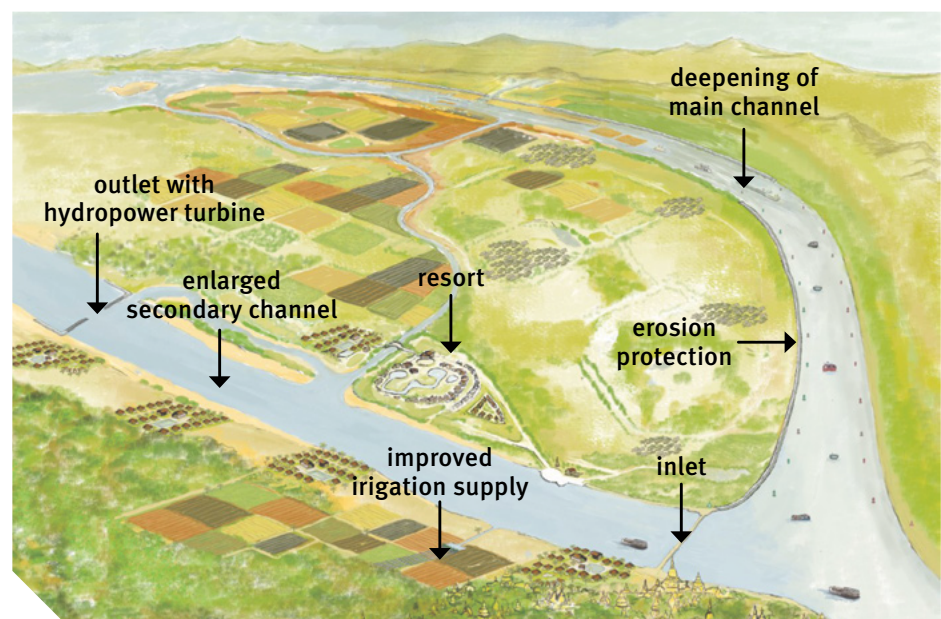
Step 3 - Climate-robust alternative measures

The third step is what we would consider the core of the environmental assessment process: it is to develop alternatives, including measures that reduce the effects of climate change or improve the adaptive capacity of stakeholders in the project area. To this end, the Netherlands has explored the “building with nature” concept. This concept focuses on innovative measures to improve the resilience of a flood-prone area - such as controlled flooding or growing salt-tolerant crops - where it is too costly to limit the actual risk of flooding. Of course, the Netherlands is not the only country that has learned to live with water. In many other delta areas, such as those in Vietnam and Bangladesh, people are used to living with water and often have adjusted their way of life: for example, by living in stilt houses or growing floating rice varieties.

Example of step 3: Bagan river in Myanmar

In a multipurpose river development project in Bagan, Myanmar, the development of a tourist resort was planned on a site that is expected to be flooded annually (a natural island in the middle of the Irrawaddy river that is presently solely inhabited by farmers). The project proponent therefore proposed designing a facility with robust concrete foundations to ensure that the resort will not be inundated or washed away. This design is unlikely to fit in the landscape opposite the old city of Bagan that has been nominated for UNESCO world heritage status. In its advice on Terms of Reference for an EIA the NCEA suggested that the possibility of developing a tourist facility that anticipates the annual flooding be assessed by developing different alternatives that also fit better in the landscape. Examples of such alternatives are a floating tourist facility that could be removed during the flooding season (which is also the tourist low season), or a facility on stilts above the water. Another possibility might be developing community-based tourism that offers tourists accommodation in the local stilt houses that can cope with flooding. All these alternatives are examples of the building with nature concept.

Basic functions of Bagan River Development Project



Example of step 3: Callantsoog, Pettemer and Hondsbossche Zeewering

The EIA reports investigated alternatives for all the weak spots on the coast of the province of North Holland. The most important were:

1. a higher target height for the dikes and sand dunes;
2. seaward sand replenishment;
3. wave-resistant dikes;
4. taller dikes and sand dunes, with a reinforced base.

The impact of the alternatives was evaluated, using the following criteria:

Environmental impact	Impact on security	Chances for development
Spatial impact (especially on buildings)	Reduced risk of flooding	Additional biodiversity
Nuisance during construction	Flexibility	Recreation and tourism
Carbon footprint	Spatial impact after 100 years	New opportunities for economic development
Landscape	Spatial impact after 200 years	
Archaeology and cultural heritage		
Biodiversity		

The EIA reports revealed that the most flexible alternative was seaward sand replenishment, which offered a no-regret measure to improve security against rising sea level. This alternative had a minimal impact on the existing environmental values. Moreover, it also created opportunities for the development of additional biodiversity and recreation, which were considered to be important contributions to local communities.

In conclusion

The NCEA considers environmental assessment to be an important tool for climate-robust development in the Netherlands and abroad. Based on our experiences, we are exploring the options to incorporate the described three-step approach in environmental assessment, to help ensure the integration of climate change issues in decision-making. We would recommend the following:

- Start with a vulnerability assessment of the project or plan area of possible climate change effects in the short and long term. Include social and economic aspects as well.
- Assess the compliance of the proposed project or plan with available climate change policies. This provides insight in the consistency of the proposed plan or project with the objectives for climate change for a respective sector or area. In the absence of measurable climate change objectives, make use of expert judgment.
- Develop a continuum of alternatives that are climate-robust to a greater or lesser degree and include alternatives that can be considered to be no-regret measures.

By following the above steps, environmental assessment can support decision-makers in coping with the uncertainties related to climate change effects. Uncertainties which include effects in the short and long term, effects on the project/plan area but also on other (nearby) areas, effects on the sector involved but also unintended effects on other sectors.

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