Plan-it: A method enabling regional stakeholders to design a green climate corridor: the Groningen case

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Introduction

In this paper we present the implementation of a newly developed method to integrally plan for nature and water measures required to adapt to climate change, together with stakeholders. The identification of required nature adaptation measures is based on metapopulation theories.

The climate is changing and this has a pronounced effect on biodiversity (Van den Hurk, B. *et al.,* 2006; Vos, C. *et al.,* 2008). Researchers expect that a significant part of European biodiversity might be lost in several decades. The shifting climate zones and more frequent extreme weather events, combined with the small and highly fragmented nature areas in West Europe is expected to result in the local extinction of populations and finally of many species themselves (Berry, P. *et al.,* 2007).

Society can help nature to cope with climate change by implementing adaptation measures. In the Netherlands, nature policy is aiming at the realisation of a national ecological network. However, it is expected that the realisation of the Dutch National Ecological network is insufficient for sustaining biodiversity in a changing climate. To adapt the national ecological network to climate change, the realisation of so-called "climate corridors" is proposed (NEAA, 2008). A climate corridor is a national corridor of an ecosystem of several kilometres wide. The corridor contains several spots of large nature areas, in which species that are suffering from climate change can sustain longer. Further, the landscape within this corridor is made better permeable for species, so local populations can connect to neighbouring populations. In addition, it helps species to keep their distribution area along with the shifting climate zone. To make the national climate corridor effective on a larger scale, it is important that it is connected to ecosystems networks in neighbouring countries (Vos *et al*., 2009).

A part of the wetland climate corridor is projected in the Dutch province of Groningen. This province is situated in the north-east of the Netherlands, bordering Germany. The province administration wanted to know what is long-term required for the adaptation of nature and the water system and if, where and how adaptation measures for water and for nature can be combined and can have synergy. This is of importance for the province as support and finance for nature development on itself are limited. Connecting measures for water and nature adaptation can help the realisation of the adaptation measures. To build up support for adaptation measures and to include local expert knowlegde, this assessment was carried out together with the authorities in the field of water and nature: the province of Groningen (nature) and the Water boards (regional water authorities responsible for the water management).

Background

The Groningen case builds on several other studies. In the INTERREG IIIB BRANCH study, it was shown that climate change is expected to result in a shift of the suitable climate space for species for several hundred kilometres in only some decades (Berry, P. *et al.*, 2007). Vos, C. *et al.* (2008) propose international climate corridors as an adaptation strategy. In these climate corridors the cohesion of habitat is improved in areas where ecosystem patterns are not cohesive enough to accommodate species responses to climate change. In van Rooij, S. *et al.* (2007), the adaptation strategy of creating international climate corridors are applied on a regional level, by developing a method for the planning of climate change proof ecosystem networks together with stakeholders (“Plan-it”).

Goals and objectives

Goals of this study were:

- To further develop and test the method “Plan-it” to design a climate corridor on a regional / local scale level;
- To develop and test this method to identify locations where nature and water adaptation measures can be combined and can have synergy;
- To see if this method can be carried in close cooperation with stakeholders.

Method

In the case study of Groningen, the design process for a climate corridor was carried out together with regional water and nature experts from the province of Groningen and two regional water boards in a series of workshops. The procedure followed can be described using four consecutive steps:

1. Quantify <u>required measures for the wetland climate corridor</u> and identify search-areas for these measures;
2. Quantify <u>required measures for the adaptation of the water system</u> and map search-areas for these measures;
3. <u>Identify the spatial overlap</u> between search-areas of water and nature adaptation measures;
4. <u>Assess in more detail</u> if the overlapping areas really offer possibilities to realise water and nature targets and if synergy emerges between the water and nature adaptation measures.

Step 1 <u>Required measures for the wetland climate corridor</u>
Based on the adaptation strategies, developed in Vos, C. *et al.* (2008) and Van Rooij, S. *et al.* (2007), we defined that a wetland climate corridor for the province of Groningen should comply with the following nature adaptation targets:

1. Connecting networks of marshland, brook valleys and wet nutrient poor grasslands within the province, by which the populations of wetland species will be connected and therewith enlarged;

2. The realisation of key areas that offer spatial conditions for large populations that have a low chance of local extinction;
3. Connecting the wetland networks in Groningen to the ecosystem network in the neighbouring provinces and in Niedersachsen (Germany). In Groningen, it concerns the linkage with brook valleys and the marshlands with the neighbouring provinces and with Niedersachsen in Germany.

The nature adaptation targets 1 and 2 are primarily aiming at providing conditions for large, persistent populations. Herewith, species that are located on the south end of their distribution area or vulnerable for extreme weather event can persist longer in the landscape. Nature adaptation target 3 is primarily aiming at enabling species to shift along with their climate zone.

To be able to plan for nature adaptation measures, so-called "climate ecoprofiles" are chosen. Climate ecoprofiles are model species that represent a certain habitat preference, sensitivity for the fragmentation of habitat and sensitivity for climate change. The characteristics of these model species are transferred into guidelines for habitat planning. In principle, we choose two climate ecoprofiles for each different wetland type in Groningen (marshland, brook valley, meadow) of which:

- one ecoprofile that needs a large habitat area for a climate proof population (to address nature adaptation targets 1 and 2);
- one profile that is sensitive for habitat fragmentation (to address nature adaptation target 3).

Scientists and stakeholders analysed the conditions in the current landscape for climate proof populations in a joint workshop, using maps and spatial characteristics of these climate ecoprofiles. Subsequently, spatial alternatives for effective climate corridors were put on the map. Herewith, present nature areas and the abiotic potentials for nature development were taken into account. Also opportunities in project developments and (future) processes of land use planning were considered.

In a sector of the province of Groningen, three routes between the brook valleys of Hunze and of Westerwoldse Aa were identified that might be effective as a climate corridor for wetlands (figure 2):

- Route I: is mainly following present and planned nature areas;
- Route II: is the shortest link between the brook valleys and makes use of project developments in the area;
- Route III: is based on potentials for the development of new nature areas and the opportunities that arise from a land use planning process that is expected to start in this area.

Step 2: <u>required measures for the adaptation of the water system</u>

For the water system in the province of Groningen, the water board that has authority over most of the province has drawn up a water vision for the period until 2050. In this vision, only the effect of increased rainfall is taken into account.

Together with hydrologists of the water board, we decided that in this study we wanted to take into account also sea level rise and a longer time scale (until 2100). The extra task for climate change proofing of the water systems not foreseen in the water vision comprehended measures for water storage and conservation of 35 million m^3.

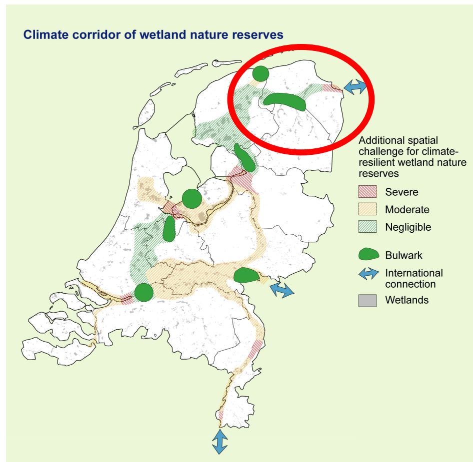

Figure 1. Climate corridor for wetland areas in the Netherlands. In some sections, wetland areas need to be enlarged (in orange), in other sections wetland areas are even lacking and need to be developed (red areas). The province of Groningen is indicated with a red circle.

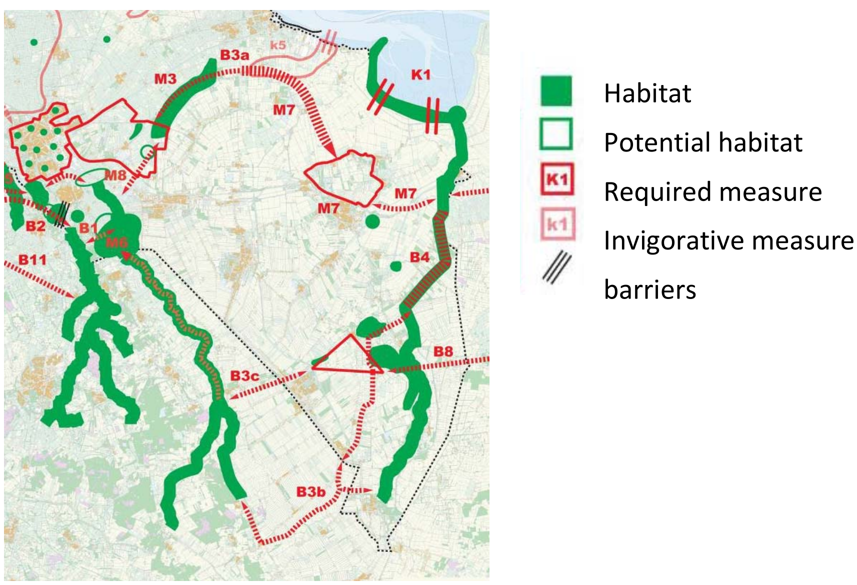

Figure 2. Adaptation measures for wetlands (marshland, brook valleys and meadows) in the eastern part of Groningen. Three potential routes were identified that can bridge the missing link between the brook valley of the Hunze with the brook valley of the Westerwoldse Aa (Roggema, R. *et al*., 2008).

In a workshop with hydrologists and ecologists, search areas were mapped where water adaptation measures could be taken that have synergy with nature (map not shown). Herewith, we used a map of the water vision that divided the area in sectors, based on soil, elevation and hydrological aspects (figure 3). In the water vision, the most effective strategy and measures for water adaptation for each sector were already identified based on the abiotical conditions.

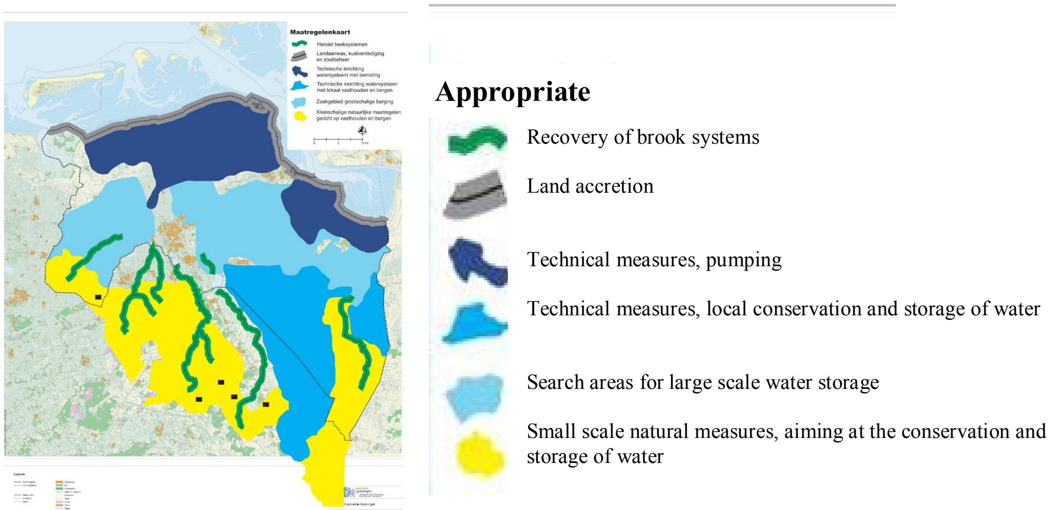

Figure 3. Division of Groningen in sectors, for which most appropriate adaptation strategies and measures for water management per sector where known (from: Grontmij, 2002).

Step 3: *Identify the spatial overlap*

After mapping all potential search areas for nature and water adaptation, we identified the overlapping areas between these two. In a workshop with ecologists and hydrologists, we checked in more detail if the required water and nature measures could be carried out, what was required, and if synergy between water and nature measures could be obtained. It appeared that in all three adaptation routes for nature (figure 2) synergy with water adaptation appeared to be feasable. A fourth adaptation route for nature was added, as a result of potential for large scale water adaptation measures in the eastern part of Groningen.

Step 4: Assess in more detail.

Water and nature adaptation measures can in potency reinforce each other, especially for wet ecosystems, but water quality or physical constraints can limit this synergy or even be a threat for ecology. Therefor, the potential synergy between water and nature adaptation was assessed in more detail for selected overlapping areas in a workshop with ecologists and hydrologists. In this workshop, the synergy between nature and water adaptation was localised and quantified.

Table 1 . Potency for target realisation for nature and water adaptation in 4 climate corridor routes between the brook valleys of the Hunzedal and the Westerwoldse Aa, and estimate of extent of opportunities for synergy between water and nature.

Route	Can climate corridor for nature be realised?		Value for water adaptation?		Amount of water that can be stored/conserved	Synergy between water and nature?
I	large marshland (key) areas	+	Water storage	++	2-3 million m^3	Yes, in large parts, also contribution to goals Water Framework Directive
	Robust corridor nutrient poor meadows	-	Water retention	+		
	Robust corridor marsh land	+	Water quality	++		
			Water reservoir function	+/-		
II	large marshland (key) areas	0	Water storage	++	1 million m^3	No
	Robust corridor nutrient poor meadows	0	Water retention	-		
	Robust corridor marsh land	0	Water quality	+		
			Water reservoir function	-		
III	large marshland (key) areas	-	Water storage	++	1.5 million m^3	Yes, a lot. also large contribution to goals Water Framework Directive
	Robust corridor nutrient poor meadows	+	Water retention	++		
	Robust corridor marsh land	0	Water quality	++		
			Water reservoir function	-		
IV	large marshland (key) areas	+	Water storage	+++	20 million m^3	Limited, more positive for water than for nature adaptation
	Robust corridor nutrient poor meadows	0	Water retention	+		
	Robust corridor marsh land	0	Water quality	+/-		
			Water reservoir function	++		

Each potential route for combined nature and water adaptation was considered in more detail. We mapped where and how the adaptation measures could best be carried out, where synergy between water and nature measures could be achieved, and how much the route could contribute to solve the nature and water adaptation tasks. It appeared that route I, III and IV could partly meet the adaptation task for nature, and the combination of route I and II could meet all nature adaptation tasks. Herewith, 3,5 - 4,5 million m^3 water could be conserved or stored in synergy with nature adaptation, which is 10 – 13 % of the water adaptation task. In other words: by partly planning water adaptation measures in areas where wetlands adaptation is required, a significant part of the required adaptation for nature can be achieved (table 1).

Discussion and conclusions

The result of applying this method is a set of options for a multifunctional climate corridor that is effective for nature adaptation and contributes to water adaptation. Further it can be planned in such that is efficient in the use of (scarce) space and of resources.

Planning a climate corridor on a regional / local scale level: The "Plan-it" method for planning multifunctional climate corridors appeared to be effective and well applicable. We used the method on two scale levels: the level of the province of Groningen, to roughly identify climate corridor routes on areas that seem to have good potential for wetland development (step 1). Later on, in step 4, we assessed these routes in more detail and were able to quantify the required measures and the surplus value for both nature and water adaptation.

Identifying locations with synergy between nature and water adaptation measure: We were able to identify many specific locations where water and nature adaptation measures can be combined and have synergy. This may be crucial for realisation, as the support in society for the realisation of "mono functional" measures, especially for extra nature, is limited. Another advantage of combining measure for water and nature is that herewith the Water Board can meet the goals that are set by the Water framework directive (improving water quality, rehabilitation of brooks).

In this case, it appeared that a significant part of the required nature adaptation measures for wetlands can be carried out by smartly planning water adaptation measures. Also it appeared that the joint research of hydrologist and ecologists, scientists and stakeholders resulted in the identification of new locations and solutions where synergy between water and nature adaptation measures could be obtained. Herewith, it broadened the spectrum of possibilities for the realisation of nature and water adaptation.

When we looked in more detail to promising areas for synergy between water and nature, we found also out that in many cases that water and nature measures where not synergetic, or even not compatible. This stresses that it is important to carefully look at the circumstances and conditions at a local level to decide whether synergy can be achieved.

Involving stakeholders in the application of the method: We can conclude that the planning method for climate corridors is well understood and can well be used by stakeholders. The method facilitates constructive debates between experts and stakeholders on ambitions for nature, required measures, and possible synergy with other land use functions. Also, local stakeholder networks were improved

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