



Adapting to climate change in the Netherlands: an inventory of climate adaptation options and ranking of alternatives

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Routeplanner project

- Routeplanner project is part of National Strategy on Adapting Spatial Planning to Climate Change in the Netherlands
- Routeplanner project central aims:
 - to make existing knowledge available
 - to identify knowledge gaps
 - to support the development of an national adaptation strategy for climate-proofing the Netherlands

Outline of presentation

- Introduction to Routeplanner project
- Methodology
- Identification of adaptation options
- Scoring and ranking of options
- Cost-benefit analysis
- Conclusion

Subprojects Routeplanner

- Climate-proofing baseline assessment
- A review (quickscore) of knowledge gaps
- **Formulation of adaptation options**
- **A qualitative assessment of adaptation options**
- **A quantitative assessment of adaptation options**
- Identification of case studies

Project team

Environmental Economics and Natural Resources group – Wageningen University

In co-operation with RIZA, RIKZ, ESA-WUR, Alterra, LEI, PRI, Erasmus University

Funding:

1. BSIK program's Climate changes Spatial planning, Living with Water, Habiforum
2. Ministries: Environment, Agriculture, Transport, Economic Affairs and the Cabinet Office



Methodology

- Literature review and expert-workshops to identify adaptation options: impacts, robustness, resilience, adaptive capacity and vulnerability
- Construction of a database with adaptation options
- Options are attributed with scores for a number of criteria
- Multi-criteria analysis is carried out to categorize and rank options based on ordering and weighted summation
- Validation of scores through expert-workshop
- Preliminary inventory of incremental costs and benefits

Identification adaptation options

- 96 adaptation options identified
- Sectors:
 - Agriculture
 - Nature
 - Water
 - Energy & transport
 - Housing & infrastructure
 - Health
 - Recreation & tourism



Criteria for scoring options

The adaptation options have been given scores with respect to the following criteria:

- Importance – the option has a very high level of importance
- Urgency – the option has a very high level of urgency
- No-regret characteristics – the net benefits are very high, irrespective of climate change
- Ancillary benefits – the option generates a very high level of side effects
- Effect on mitigation – the option has a strong positive effect on mitigation

Criteria for scoring options

- Feasibility criteria
 - Technical complexity
 - Social complexity –
 - Are there different opinions and perceptions about the option?
 - Is it possible to reach consensus?
 - Institutional complexity – are institutional changes and adjustments required?

Ranking of adaptation options

- Options scored on different criteria
- Ranking based on ordered criteria (e.g. 1. urgency, 2. importance, etc.)
- Ranking based on criteria weighting (e.g. 40% importance, 20% urgency, etc.)
- Option to focus on a specific climate impact

→ database

Criteria	Ordering	Weights
Importance	1	40%
Urgency	2	20%
No regret	3	15%
Ancillary benefits	4	15%
Mitigation effect	5	10%

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Environmental Economics and Natural Resources, Wageningen University and Research Center

Adaptation to climate change in the Netherlands

This database refers to the report "A qualitative assessment of climate adaptation options and some estimates of adaptation costs", dated February 2007.

Project
Routeplanner deelprojecten 3,4 and 5 - Nationaal Programma Adaptatie Ruimte en Klimaat (ARK)

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Sorting methods:

- By option number (unranked)
- By ordered criteria
- By weighted criteria

Choose sorting method:

Optional: Focus on one impact

- All
- Temperature
- Precipitation
- Extreme weather events
- Other
- Sea level rise
- River discharge
- Groundwater level
- Storms
- Heat stress
- Drought stress
- Growth stress (plants - species)

Choose filter:

Note: further filtering can be done on the sorted table

Criteria

	Ordering	Weights
Importance	1	40%
Urgency	2	20%
No regret	3	15%
Ancillary benefits	4	15%
Mitigation effect	5	10%

Note on ordering: most important criterium gets rank 1, least important rank 5

Start sorting!

Startscreen | Overview of options | Sorted overview | Institutional complexity | Background information

Table 2. The top ten options based on ranking with criteria weighting

Nr.	Sector	Adaptation option	IIMP	URG	NO-R	ANC-B	MIT	
34	Nature	Integrated nature and water management	5	5	5	5	4	4.9
35	Nature	Integrated coastal zone management	5	5	5	5	4	4.9
40	Water	More space for water:	5	5	5	5	4	4.9
41	Water	Risk based allocation policy	5	5	5	5	4	4.9
65	Water	Risk management as basic strategy	5	5	5	5	4	4.9
68	Water	New institutional alliances	5	5	5	4	5	4.9
87	Housing & Infra- structure	Make existing and new cities robust - avoid 'heat islands', provide for sufficient cooling capacity	5	5	4	5	4	4.8
75	Energy & Transport	Construct buildings with less need for air- conditioning/heating	5	4	5	4	5	4.7
84	Energy & Transport	Change modes of transport and develop more intelligent infrastructure	5	5	4	4	5	4.7
28	Nature	Design and implementation of ecological networks (The National Ecological Network)	4	5	5	5	4	4.5

Indication of the costs and benefits of adaptation options (as far as available)

Sector	Adaptation option	Net Present Value Costs (million €)	Net Present Value Benefits (million €)
Water	More space for water: a. Regional water system b. Improving river capacity	a. 19000 b. >7000	N/A
Water	Risk based allocation policy	0 – 10	N/A
Nature	Design and implementation of ecological networks (The National Ecological Network – NEN)	7000	>7000
Nature	Afforestation and mix of tree species	0.43/ ha	> 0.43/ ha
Water	Widening the coastal defence area (in combination with urbanisation and nature)	1000	N/A
Water	Re-enforcement of dikes and dams, including 'weak spots'	>5000	N/A
Housing & infrastructure	Water management systems: revision of sewer system	3000 – 5000	N/A
Water	Higher water level IJsselmeer	> 500	N/A
Water	Increase sand suppletions along coast	750 – 1500	N/A

Cost-Benefit Analysis

- Difficult to acquire detailed information on costs and benefits
 - Implementation phase of options (in combination with discounting)
 - Interaction between options
 - Benefits of options difficult to obtain
- Need more information to conduct a proper CBA of the adaptation options

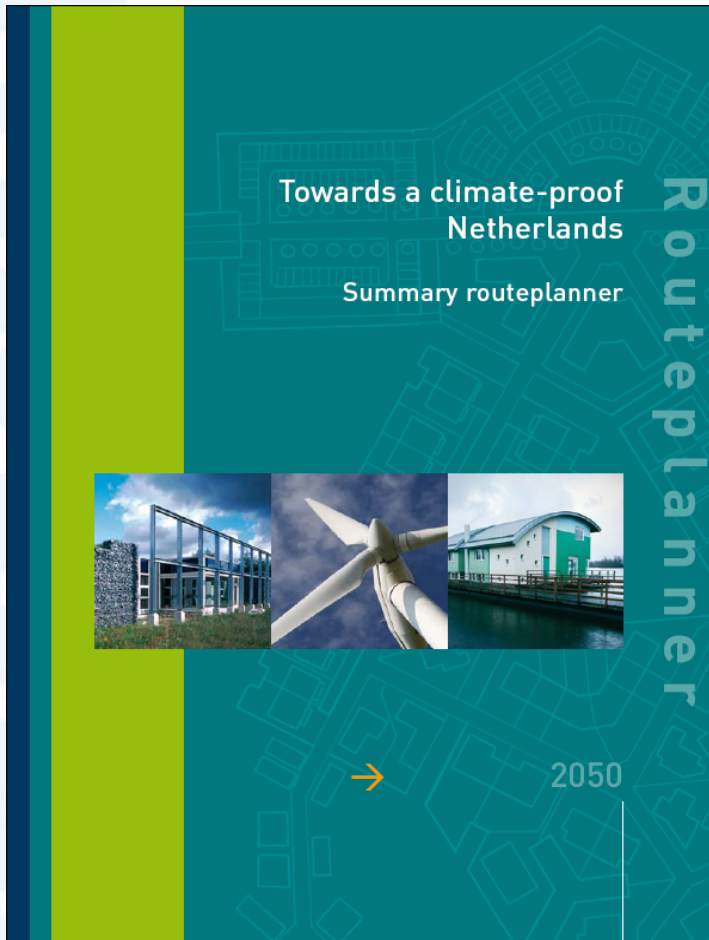
Conclusions 1 of 2

- Inventory of options results in a diverse list; gives good insight in the important aspects
- Water management most important in the Netherlands
- Cost are substantial, but relatively long planning horizon
- Insufficient information for full cost-benefit analysis: Needed additional research on costs and benefits of adaptation options

Conclusions 2 of 2

- Careful analysis of institutions and distribution of tasks and responsibilities over central government, provinces and water boards
- Stakeholder analysis and expert judgment very useful as starting point
- Finally detailed cost benefit analysis is required based on a national adaptation strategy

Thank you for your attention



Subproject reports are available at
www.programmaark.nl

Agriculture																					
Sector	Subsector		Adaptation option	Temperature	Precipitation	Extreme weather events	Other	Sea level rise	River discharge	Groundwater level	Storms	Heat stress	Drought stress	Growth stress (plants - species)	Importance	Urgency	No regret	Ancillary benefits	Mitigation effect		
		nr.	name																		
1	Agriculture	General	01	Adjusting crop rotation schemes and planting and harvesting dates		x	x					x	x	x	x	3	4	5	1	2	Farmers boards, r trading s
2	Agriculture	General	02	Choice of crop variety and genotype	x	x	x					x	x	x	x	3	4	5	2	4	Farmers boards, c governm
3	Agriculture	General	03	Development and growing of crops for biomass production	x	x	x					x			x	2	3	2	4	5	Ministries compani universiti as suppli
4	Agriculture	General	04	Soil moisture conservation practices		x								x	x	4	4	3	3	3	Farmers
5	Agriculture	General	05	Irrigation		x								x		3	3	3	3	2	Farmers boards
6	Agriculture	General	06	Self sufficiency in production of roughage				x							x	1	2	1	2	3	Farmers
7	Agriculture	General	07	Water storage on farmland		x				x				x		3	4	5	4	3	Farmers
8	Agriculture	General	08	Subsoil drainage of peatlands		x					x			x		1	2	1	1	1	Farmers governm
9	Agriculture	General	09	Insurance		x	x		x	x	x	x	x	x	x	3	4	3	2	3	
10	Agriculture	General	10	Changes in farming systems	x	x	x			x		x	x	x	x	4	3	4	4	4	
11	Agriculture	General	11	Water management and agriculture		x	x		x	x	x	x		x		4	3	3	3	3	Water bc
12	Agriculture	General	12	Regional adaptation strategies for the fen meadow area		x					x					3	3	3	3	3	National i involved i
13	Agriculture	General	13	Relocation or mobilization of farms		x	x				x	x			x	1	3	1	1	3	
14	Agriculture	General	14	Floating greenhouses		x	x			x	x	x				2	1	2	2	3	Construc product b water ho

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															40%	20%	15%	15%	10%					
1																								
2																								
3	Nature	Water management	34	Integrated nature and water management	x	x			x	x	x	x	x	x	5	5	5	5	4	4.9				
4	Nature	Water management	35	Integrated coastal zone management	x	x			x	x	x	x			5	5	5	5	4	4.9				
5	Water	Spatial concept	40	More space for water: a. Regional water system b. Improving river capacity		x	x			x	x	x		x	5	5	5	5	4	4.9				
6	Water	Spatial concept	41	Risk based allocation policy		x			x	x					5	5	5	5	4	4.9				
7	Water	Social, policy	65	Risk management as basic strategy	x	x	x		x	x	x	x			5	5	5	5	4	4.9				
8	Water	Social, policy	68	New institutional alliances	x	x			x	x	x	x		x	5	5	5	4	5	4.9				
9	Water	Social, policy	66	Evacuation plans	x	x	x		x	x		x			5	5	5	3	3	4.5				
10	Housing & Infrastructure	Spatial	87	Make existing and new cities robust - avoid 'heat islands', provide for sufficient cooling capacity	x		x				x	x			5	5	4	5	4	4.8				
11	Energy & Transport	Transport	84	Change modes of transport and develop more intelligent infrastructure		x	x			x		x			5	5	4	4	5	4.7				
12	Housing & Infrastructure	Spatial	86	Design spatial planning – construct new housing and infrastructure			x		x	x		x	x		5	5	4	3	4	4.5				
13	Water	Technological solution	55	Re-enforcement of dikes and dams, including 'weak spots'		x	x		x	x	x	x			5	5	3	3	3	4.2				
14	Water	Social, policy	64	Stimulate economic activity in other parts (eastern and northern) of the Netherlands	x				x	x					5	5	3	3	1	4				
	Energy & Transport	Energy	75	Construct buildings differently in such a way that there is less need for air	x	x	x								5	4	5	4	5	4.7				

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Sector	Subsector	nr.	name	Temperature	Precipitation	Extreme weather events	Other	Sea level rise	River discharge	Groundwater level	Storms	Heat stress	Drought stress	Growth stress (plants - species)	Importance	Urgency	No regret	Ancillary benefits	Mitigation effect	Weighted sum
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	Water	Spatial concept	40	More space for water: a. Regional water system b. Improving river capacity		x	x			x	x	x		x	5	5	5	5	4	4.9
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	Housing & Infrastructure	Spatial	87	Make existing and new cities robust - avoid 'heat islands', provide for sufficient cooling capacity	x		x				x	x			5	5	4	5	4	4.8
	Energy & Transport	Energy	75	Construct buildings differently in such a way that there is less need for air-conditioning/heating	x	x	x					x			5	4	5	4	5	4.7
	Energy & Transport	Transport	84	Change modes of transport and develop more intelligent infrastructure		x	x			x		x			5	5	4	4	5	4.7
	Nature	Nature	28	Design and implementation of ecological networks (The National Ecological Network - NEN)	x	x	x			x	x	x	x	x	4	5	5	5	4	4.5
	Water	Social, policy	66	Evacuation plans	x	x	x		x	x		x			5	5	5	3	3	4.5
	Energy & Transport	Transport	82	Development of more 'intelligent' infrastructure that can serve as early warning indicator			x				x	x			5	4	4	4	5	4.5
	Housing & Infrastructure	Spatial	88	Design spatial planning - construct new																

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Institutional complexity provided by Department of Public Administration, Erasmus University Rotterdam Contact person A. van Buuren			Sort by option number								
Sector	Subsector		Adaptation option	Weighted sum criteria	Technical complexity	Social complexity	Institutional complexity	Total complexity	Actors	Region	
		nr.	name								
1	Agriculture	General	01	Adjusting crop rotation schemes and planting and harvesting dates	3.1	3	4	3	3.3	Farmers, contract workers, product boards, retail sector, transport and trading sector	Crop and tillage level Lower parts of the Netherlands, especially peat-grassland area
3	Agriculture	General	02	Choice of crop variety and genotype	3.5	3	4	3	3.3	Farmers, farmer organisations, product boards, consumers, national government, EU and international, national and local research organizations	Crop and tillage level - national
4	Agriculture	General	03	Development and growing of crops for biomass production	2.8	2	4	3	3	Ministry of Economic Affairs (sustainable energy management based on biomass production), business sector, energy companies, research institutes, universities, other ministries, and the DEN-, BSIK- and NEO-programs Agricultural and agri-business are important actors as suppliers of biomass	Crop and tillage level - national
5	Agriculture	General	04	Soil moisture conservation practices	3.6	4	2	2	2.7	Farmers	Crop and tillage level - national
6	Agriculture	General	05	Irrigation	2.9	4	3	3	3.3	Farmers, business sector and water boards	Crop and tillage level - national
7	Agriculture	General	06	Self sufficiency in production of roughage	1.6	3	3	2	2.7	Farmers and product boards	Crop and tillage level - national
8	Agriculture	General	07	Water storage on farmland	3.7	3	4	3	3.3	Farmers, water boards	Polders, farm land near and along open water and rivers
9	Agriculture	General	08	Subsoil drainage of peatlands	1.2	4	4	3	3.7	farmers, water boards, local government	Peat-grassland area
10	Agriculture	General	09	Insurance	3.1	2	3	4	3		National
11	Agriculture	General	10	Changes in farming systems	3.8	3	4	3	3.3		National