

# Integrated cost benefit analysis of climate adaptation options

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Plans for a floating town (Dura Vermeer)

# Routeplanner project

- Scientific input for ARK programme (National Strategy on Adapting Spatial Planning to Climate Change)
- 96 adaptation options -12 nature options
  - Design and implementation of the ecological networks
  - Afforestation and mix of tree species
  - Integrated nature and water management
- Qualitative and quantitative assessment
- Preliminary inventory of incremental costs and benefits (discount rate 4%; time horizon 2050)



## 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
<b>Nature</b>	<b>Design and implementation of ecological networks (The National Ecological Network – NEN)</b>	<b>7000</b>	<b>&gt;7000</b>
<b>Nature</b>	<b>Afforestation and mix of tree species</b>	<b>0.43/ ha</b>	<b>&gt; 0.43/ ha</b>
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

# Routeplanner - CBA

- Difficult to acquire detailed information on costs and benefits
  - Implementation phase of options (in combination with discounting)
  - Interaction between options
- Information missing on indirect, external economic and environmental effects of the options



# Integrated CBA of climate change

- Apply cost-benefit analysis to decision making which is influenced by uncertainty, irreversibility and risk.
- Calculating the NPV of adaptation options (Pearce et al., 1996)
- Including **uncertainty** about future costs and benefits (Pindyck, 2000)
- Incorporating the **implications of uncertain** large impacts with small probabilities and **uncertainty** about the discount rate (Weitzman, 2007)
- The implications of **irreversibilities** which affect **optimal timing** and design of environmental policy (Pindyck, 2000)
- **Option value of waiting** for better information (Ulph and Ulph, 1997 – Ingham et al., 2007– Kolstad, 1996)



# Uncertainty

- Uncertainty about future costs and benefits – option value of waiting for better information
- Uncertainty about the discount rate

- Constant / hyperbolic

- Ramsey equation

$$r = \delta + \eta g$$

$r$  – social discount rate

$\delta$  – rate of pure time preference

$\eta$  – elasticity of marginal utility

$g$  – per-capita growth rate of consumption

- Time horizon (Intergenerational)



# Key questions

- How to deal with uncertainties?
  - valuation
  - discounting
- How to deal with irreversibilities?
  - of climate change
  - of investments in adaptation



# Thank you for your attention

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