What Will the Country Look Like in 2040?

The Netherlands Climate Proof

A maritime island? Dikes 25 metres high, floating houses. How can we make sure the Netherlands is still habitable when looking at the predicted climate changes? Where will we be able to live and work? Which measures do we need to take? The Climate changes spatial planning programme encompasses several institutions that are researching climate change and its effects regarding the use of land in the Netherlands.

by Eric Koomen and Noor van der Hoeven

One of the projects within the Climate Changes Spatial Planning programme is the Attention for Safety project on water safety in the Netherlands.

What will the Netherlands look like in the year 2040? It is hard to get a picture of this since we don't know exactly how many people will live in the Netherlands then, and where they will live. We can speculate on this, but we simply don't know for sure. Not only internal but also external factors that we cannot influence are having impact. Naturally climate plays an important role. But how many metres of sea level rise can we expect? Where will we be able to live and work? What are the consequences for agriculture et cetera?

In this article we are making use of the LANDS research project to get more insight into this problem. We will give an overview of different possible images of the future of the Netherlands. Possible spatial adaptations which can guarantee water safety in future will get special attention.

The Use of Land and Climate Change

What we are focussing on within LANDS is how to make the Netherlands climate proof in future. The target year is 2040. The measures that we need to take in order to prepare for possible consequences of climate change are related to the future spatial patterns in the Netherlands. In turn these patterns depend on the current use of land, the demand for land, population size, economy, climate, et cetera.

In the LANDS project we are using the scenario approach to scout possible future images of the Netherlands. These are not predictions on what the Netherlands will look like in future. In fact these are possible future images which lead us to measures that need to be taken in order to make the Netherlands climate proof. What makes LANDS special is that different sectors are integrated in these scenarios. The Netherlands is conducting a lot of climate research but often this only applies to one sector. We can ask ourselves what impact climate change has on agriculture and which measures we need to take to enable agricultural activities in 2040. By including different sector-specific projects in LANDS scenarios are created that include measures for the different sectors. In the end the LANDS project yields different scenarios with integral adaptation strategies to ensure climate-proofness of the Netherlands. This makes us better prepared for highly or less extreme consequences of climate change.

Future Scenarios for The Netherlands

Starting point in the LANDS project are the G- (moderate) and the W- (warm) scenario by the KNMI (Royal Netherlands Meteorological Institute). These scenarios are describing the expectations concerning several aspects of climate change with a focus on temperature and sea level rise. We are linking these climatic changes to two strongly differing social-economic scenarios including several assumptions regarding the nature and extent of the population, economy, use of land, mobility, energy, et cetera. Making use of a set of opposite future images enables simulation of a broad range of possible spatial developments. It likely that neither of these future views reflects the most probable situation. However combining these views provides an image of the scope of possible future developments. The scenarios are meant to stimulate our imagination and to broaden our look towards the future.

The W-scenario is characterized by a 2 degree Celsius temperature rise between 1990 and 2050. This corresponds with the A1-scenario in the recent Welvaart en Leefomgeving (WLO; Welfare, Prosperity and Quality of the Living Environment) study. This study reveals major growth in population (20 million in 2040), huge economic growth and EU extension towards the east. There is free market trade without political integration. There are no initiatives for international environmental cooperation and rail and road networks are broadly extended.

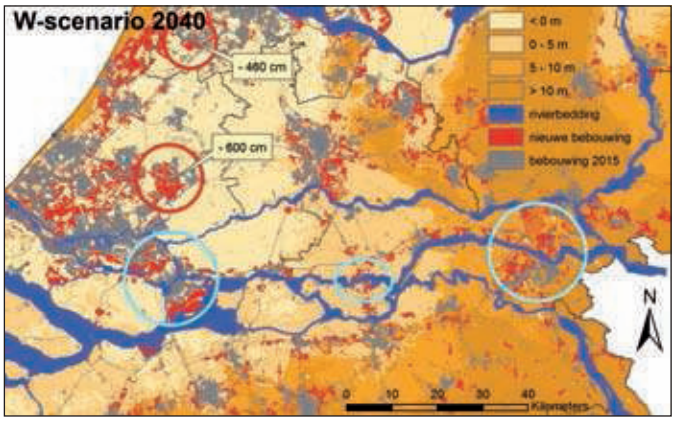
The G-scenario is based on a temperature rise of 1 degree Celsius between 1990 and 2050. This corresponds with the B2-scenario in the WLO-study. The size of the population remains roughly the same (16 million in 2040), there is a slight increase in economic growth and unemployment rate is high. Trade blockades are

imposed and taxes are raised to protect the environment. There is an emphasis on environmental policies and environmental public awareness is growing. Extension of both road and rail networks is also part of this scenario.
Both scenarios are describing different future images of the Netherlands in terms of population, economics, use of land and the climate. Based on these scenarios adaptation strategies are developed to make and keep the Netherlands a climate proof country.

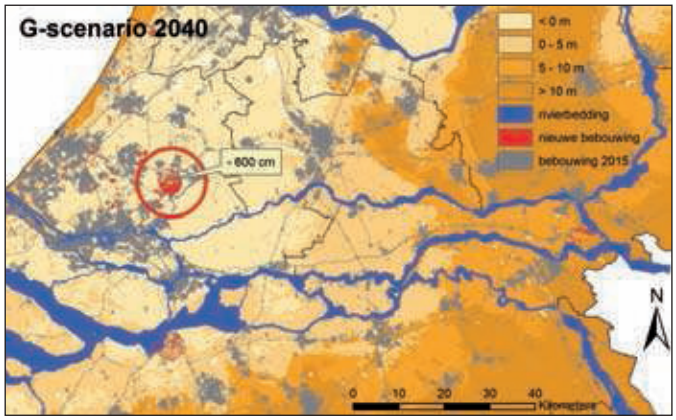
Modelling with the Land Use Scanner

The Milieu en Natuur Planbureau (MNP; the Netherlands Environmental Assessment Agency) has deployed the Land Use scanner to calculate the different scenarios. Accordingly the scenarios were mapped. The Land Use scanner is a land use simulation model based on Geographic Information System (GIS) which simulates future land use. It provides an integrated view on urban, conservation and agricultural use divided into different functions. For example agriculture can be further divided into arable land, grassland, intensive cattle-breeding and greenhouse horticulture. The Land Use scanner divides the Netherlands into 3.3 million cells measuring 100 x 100 metres and assigns different functions to each of them based on actual use of land, current policy, suitability maps and land use claims. The suitability of a location for a certain land use type depends on current use of land, possible policy restrictions, proximity of infrastructure et cetera. The expected land demand for the different sectors comes from specialist institutes.
What is striking in the W-scenario is the big increase in urban use of land. Living areas around the bigger cities in the Randstad, the mid/western part of the Netherlands, are increasing but smaller villages in the rural area are expanding. By deploying more land for economic activities the quality and openness of the landscape are deteriorating.

The G-scenario depicts modest growth of living areas but population size remains the same. This is mainly caused by further dilution of households and the preference for ways of living demanding more land, particularly in the rural area. Expectations are that urban growth will be concentrated in the central and western part of the Netherlands. There is an enormous decrease in agriculture and greenhouses are vanishing in many parts, especially around the Hague. Some of the existing conservation areas are expanding heavily and new conservation areas are developed near rivers like the Waal, the Rhine, the Maas and the IJssel. Clusters of recreation areas will come into being in attractive landscapes, especially in the northern and western part of the Netherlands.



The W-scenario simulated by the Land Use scanner



The G-scenario simulated by the Land Use scanner

Water Safety

The LANDS-scenarios are providing input for different projects within the Dutch Climate Changes Spatial Planning (www.klimaatvoorruimte.nl) research programme. Each project will further analyse these basic scenarios and develop different adaptation strategies. The results from this will be used as input for the LANDS-scenarios. This ensures processing aspects of climate changes in the LANDS-scenarios which enables a more complete and integral view. Results from other projects are processed in the Land Use scanner as land claims and suitability. Accordingly the basic scenarios can be adapted and/or extended.
One of the projects within the Climate Changes Spatial Planning programme is the Attention for Safety (Aandacht voor Veiligheid; www.adaptation.nl) project on water safety in the Netherlands. Based on a number of climate extremes strategies to protect the Netherlands against sea water, the rivers, from the upper to the lower part of the country, have been thought of. For this project the Land Use scanner has been provided with a Damage scanner. This enables calculating economic damage and human casualties at different water depths. These numbers depend on the scenario, the measures that are taken and the actual rise of the sea level.
One of the adaptation strategies in the Attention for Safety project is the Terpenstrategie (Dwelling Mound Strategy). This strategy is based on newly-built quarters being raised as far as +5 metres above the national datum level (NAP). Research shows that there is sufficient sand that can be reclaimed at the North Sea to raise the lower part of the Netherlands (10.000 km2) by 10 metres. About 170 km3 would be needed for this while 200 km3 is available from the North Sea. Further analysis from TNO, the Netherlands Organization for Applied Scientific Research, shows that 100 million m3 sand from the North Sea is needed on an annual base to raise the built area within the dike-rings to such an extent that the impact of sea level rise and ground level decline are minimal. At a price of 5 to 7 euros per m3 hydraulic-fill sand this will cost about half a billion euros, around 2 per cent of the annual building investments. Naturally this leads to higher house prices but the economical damage and the number of victims will decrease in case of flooding. Another strategy, called Business As Usual, highlights the impact of only taking 'normal' measures such as dike enlargement, sand suppletion as a coastal defence system, additional space for rivers, replacement of storm surge barriers and other structures. By putting the different strategies next to each other costs and benefits can be compared and different strategies can be compared. Eventually the Attention for safety project is aimed at producing a Discussion Support System, to stipulate the effectiveness of the safety perspectives for long term developments. Besides the strategies mentioned above a much broader range of measures to protect water safety in the Netherlands are discussed. This makes Attention for Safety and LANDS important in making the Netherlands climate proof.

Eric Koomen ekoomen@feweb.vu.nl is researcher at Vrije Universiteit Amsterdam/Spinlab and Geodan Next in The Netherlands. Noor van der Hoeven Noorvanderhoeven@gmail.com works at Greenpeace Nederland.