

## Phase 2

Continue Phase 2:

**In the case of potatoes**, the consequences of extreme heat include secondary tuber growth, which can cause a damage of up to 75% of the yield. We currently have an average of 8 heat waves in 30 years. The table of the W+ scenario shows that we should be prepared for 27 extra heat waves in 30 years. Measures for the prevention of secondary tuber growth include cooling of rows, for instance by means of trickle irrigation or by using wider rows.

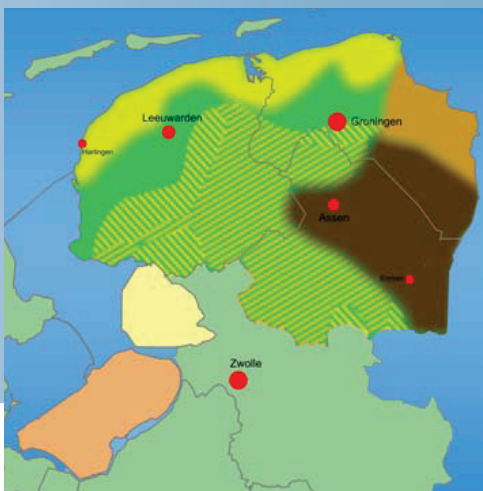
**The study shows** that almost all crops will increasingly be confronted with knockout factors. The potato, lily and onion are especially susceptible. However, a crop that is not easily affected by climate changes, like as grass/milk, will also have to be prepared for changing circumstances.

## Phase 3

### Phase 3: Development of coherent adaptation strategies

Phase 3 is in progress – the final report is expected mid 2010.

**On the basis of area** characteristics and cropping plan, 8 subareas were selected in the north of the Netherlands. It is investigated for each subarea what measures should be taken for the different crops, on which level they should be taken and what this will mean for the other land use functions in the area. These measures are divided into those that can be introduced on farm level and those that should be carried out by the Water Board or local authorities. The measures to be taken in the different subareas will also need to be geared to each other.



Map of selected subareas

### Collaborating parties and financing

**The project was initiated** by LTO Noord (the northern section of the Dutch Federation of Agricultural and Horticultural Organisations) and Grontmij. It was carried out within the framework of the national research and innovation programme focusing on climate adaptation 'Climate changes Spatial Planning' (CcSP). Collaboration with the local authorities (Water Boards and Provinces) and the agricultural sector (primary production, supply companies and processing plants) was explicitly sought. The research programme is 45% funded by the national CcSP programme, while local parties finance the remaining 55%. The research is carried out by two institutes at Wageningen University and Research Centre – WUR-Alterra and WUR-PRI – and Grontmij. The project management is in the hands of LTO Noord.

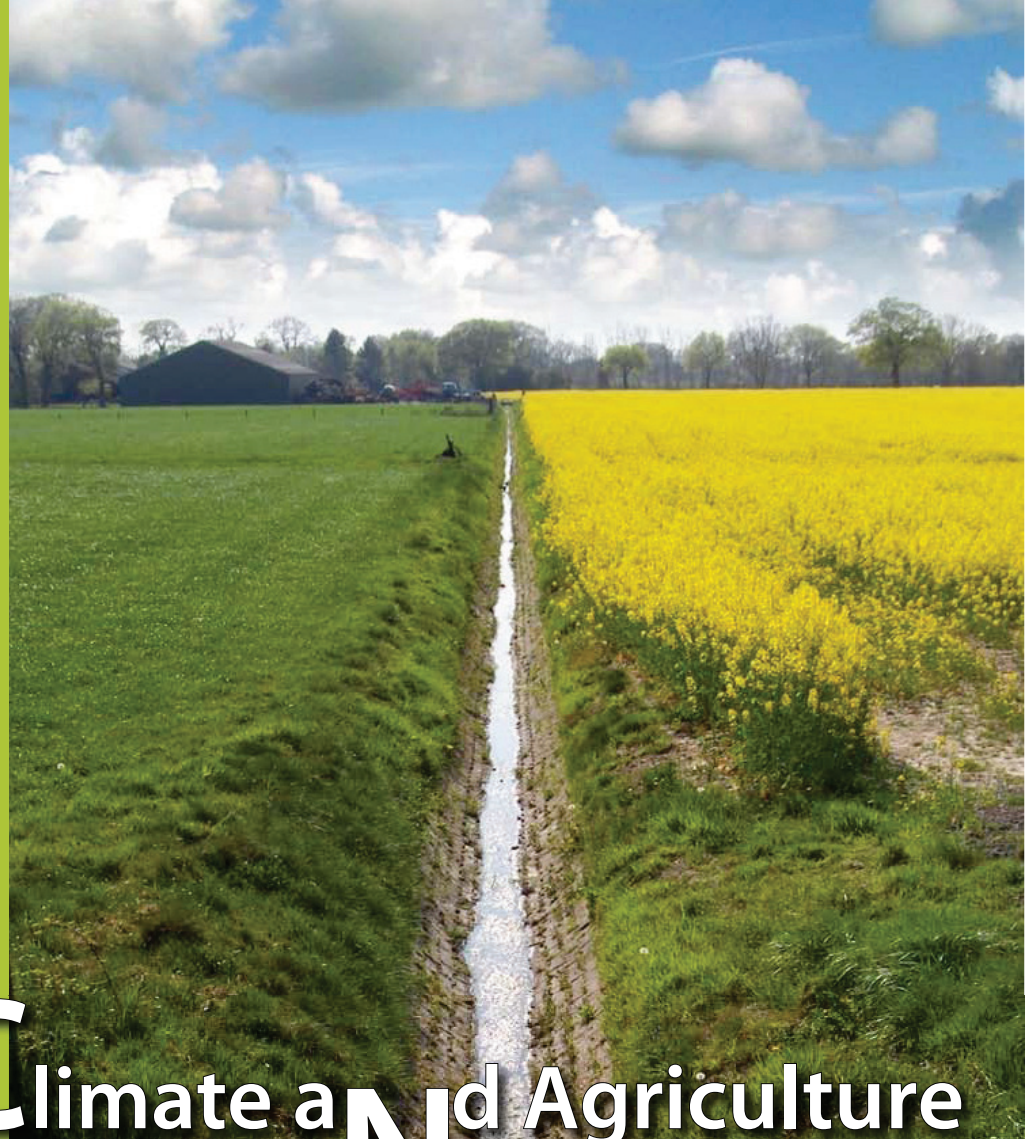
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# Climate and Agriculture Northern Netherlands

Agriculture is a major economic factor in the north of the Netherlands. It is, therefore, highly important to assess in time how global climate change may impact agriculture in this part of the country and what measures could be taken. To gain this insight, the project 'Climate and Agriculture Northern Netherlands' was set up.



# This brochure outlines the scope and the approach of the project as well as the preliminary results of the first two phases.

## Introduction and aim

**Climate change** will inevitably affect agriculture. The temperature rise and the higher CO<sub>2</sub> content will on average lead to higher yields. But that is not all there is to it. Climate change could also lead to a global shift of agricultural areas. Furthermore, the occurrence of extreme weather conditions could threaten harvests. Because especially in the northern Netherlands agriculture is such an important economic factor, the authorities in this part of the country want to be prepared for the possible impacts of climate change on agriculture. They need to know which measures could or should be taken to ensure the future of agriculture.

**Within the framework** of the national research and innovation programme 'Climate changes Spatial Planning', a research project was commissioned by the northern Provinces, the Water Boards, the Ministry of Agriculture, Nature and Food Quality, LTO Noord (the northern section of the Dutch Federation of Agricultural and Horticultural Organisations) and the business community. The aim was to answer basically the following three questions:

- ▶ How will the competitiveness of the agricultural sector in the northern Netherlands develop in view of global climate change and global economic developments?
- ▶ What will be the main knockout factors for agriculture in the northern Netherlands due to extreme weather conditions and what measures could be taken?
- ▶ What consistent adaptation strategies could be used, taking into account other social interests in the northern Netherlands?

**This research project**, called 'Climate and Agriculture Northern Netherlands', is carried out by Grontmij and two institutes at Wageningen University and Research Centre – WUR-Alterra and WUR-PRI – in the period 2006-2010.

## Project Leader Peter Prins

**Integration of science** and practice is a very important aspect of the project. Grass roots meetings are held to present the preliminary results of the various studies and discuss them with representatives from the sector. These meetings are attended by individual farmers, plant breeders, business consultants, representatives from the agricultural industry and the like. The grassroots meetings offer the opportunity to assess scientific results against everyday practical experiences as well as to arouse interest in the issue among the agricultural community and to gain support for possible solutions.'



## Comprehensive research programme

**The project** 'Climate and Agriculture Northern Netherlands' has led to the set up of a comprehensive research programme, consisting of:

1. The original three-phase project 'Climate and Agriculture Northern Netherlands' aimed at answering the above three questions. The first question – about the competitiveness of the sector – has already been answered in a scientific preliminary study in which climate scenarios were superimposed on agro-economic scenarios. This resulted in conclusions about the robustness of agriculture in the northern Netherlands in the light of global climate change. In order to answer the second and third questions, a strongly scientifically based, more regionally and policy-oriented study into opportunities and threats for agriculture in the northern Netherlands and their spatial and policy consequences is being carried out. Its main aim is to create a strong link between science, policy and practice.
2. A separate study within the overall programme, exploring the influence of climate on agricultural production factors in general in more depth. (This study is in preparation.)
3. A special focus on the possibilities for saline agriculture in the northern Netherlands in connection with the possibly growing salinization problems in the northern coastal zone. (This study is in preparation.)
4. And finally, the opportunity to generate and carry out concrete pilot projects.

**The programme** as a whole is led by one Steering Committee. However, each study has its own Project Group. Coordination of the different components is ensured by the Steering Committee and by those who are involved in several of the components.

All stakeholders (the parties that commissioned the project) are represented in the Steering Committee. Research for the Climate and Agriculture project is carried out by Grontmij, WUR-Alterra and WUR-PRI. Overall project management is in the hands of LTO Noord.

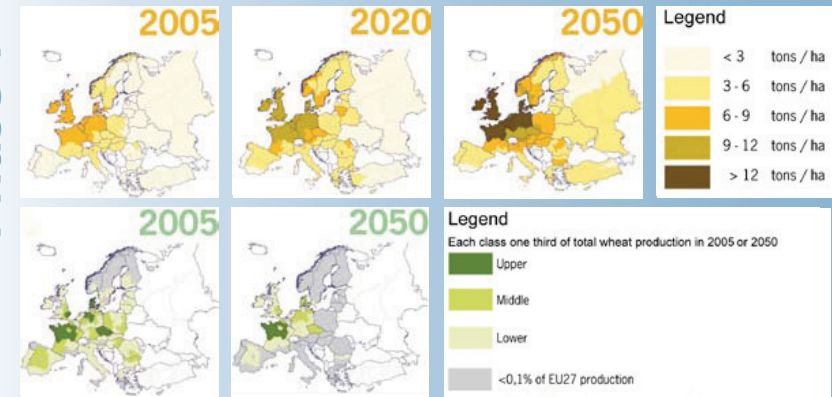
## Initial results and state of affairs research project

### Phase 1: De global influence of climate and market developments on agriculture in the northern Netherlands.

This phase has been completed. The final report 'Spatial Impacts of Climate and Market Changes on Agriculture in Europe' has been published.

**The sectors potatoes**, wheat and grass/milk have been analysed on the basis of factors such as business structure, expected developments with regard to the global market and climate change, and the degree to which companies will still be able to compete with other regions. Several climate and economic scenarios have been studied. The results are presented in maps. Below an example is given for the development of wheat production in scenario A1.

### Phase 1



Development of wheat productivity in scenario A1

Development of wheat production areas in scenario A1

**On the basis** of the preliminary study, it can be concluded that – in spite of the expected shifts in the global role of the agricultural sector in the northern Netherlands – the three crops that were studied will continue to remain very important for agriculture in the northern Netherlands. This is partly due to the strong business structure and the ability of the sector to keep innovating.

### Phase 2: Taking stock of potential knockout factors and possible measures.

This phase is currently being completed. The final report will be published mid 2009.

**For 15 crops/products** that are now grown in the northern Netherlands – or could be grown in the area in the future – it was investigated which weather factors (temperature, humidity, wind, precipitation) impact the crop to such a degree that significant damage occurs. An indication is also given of the extent of the damage and measures that could be taken to prevent this particular damage. On the basis of existing climate models it was investigated how often those particular circumstances will occur.

**The results** are presented in tables. Some results for the potato are presented below as an example:

### Phase 2

| Climate factor   | Number of extra occurrences per 30 years |      |     |     |     |     |     |     |     |     |     |     |
|------------------|--|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                  | Jan                                      | Febr | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| Heavy rainfall   |  |      |     |     | 0   | 0   | 0   | -1  | 1   | 0   |     |     |
| Heat wave        |  |      |     |     |     |     | 12  | 12  | 3   |     |     |     |
| Warm and wet     |  |      |     |     |     |     | 6   | 6   | 2   |     |     |     |
| Extreme heat     |  |      |     |     |     | 0   | 0   | 0   |     |     |     |     |
| Persistently wet |  |      |     |     | -2  | -4  | -5  | -3  | -1  |     |     |     |
| Frost            |  |      |     | 0   | 0   |     |     |     |     |     |     |     |
| Warm winter      | 2  | 3    | 8   |     |     |     |     |     |     |     |     | 1   |

*Climate risk for production of ware and starch potatoes*