2 pages MAXIMUM (including illustration and references)
Shorter or longer Abstracts will not be accepted

Climate change adaptation in agriculture; the use of multi-scale modelling and stakeholder participation in the Netherlands

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Introduction

Agriculture in the Netherlands evolves due to changes in policy, socio-economic and climatic conditions. Over the past 50 years, the overall number of farms decreased by 75%, while the average farm area increased from 6 to 26 ha. Climate change impact and adaptation assessments have largely focused on current farming systems and technologies, and addressed food production mainly (Reidsma et al., 2010). This is remarkable as it is likely that the dynamics in policies, rates of technological advances and farm structural change are at least as important. When looking at 2050 not only the climate will have changed but also farming systems, available technologies and various contextual factors will differ from today (Meerburg et al., 2009). While some farms in rural areas will become more multifunctional, others remain production oriented and change their farm structure. For all types of farming there is a need to identify adaptation strategies that are effective in achieving climate-robust agricultural landscapes, contributing to social, economic and environmental objectives (Verhagen et al., 2009).

Methodology

A methodology is developed to assess adaptation of agriculture to climatic and socio-economic changes at multiple scales (Figure 1), with a first application in the Province of Flevoland, the Netherlands.

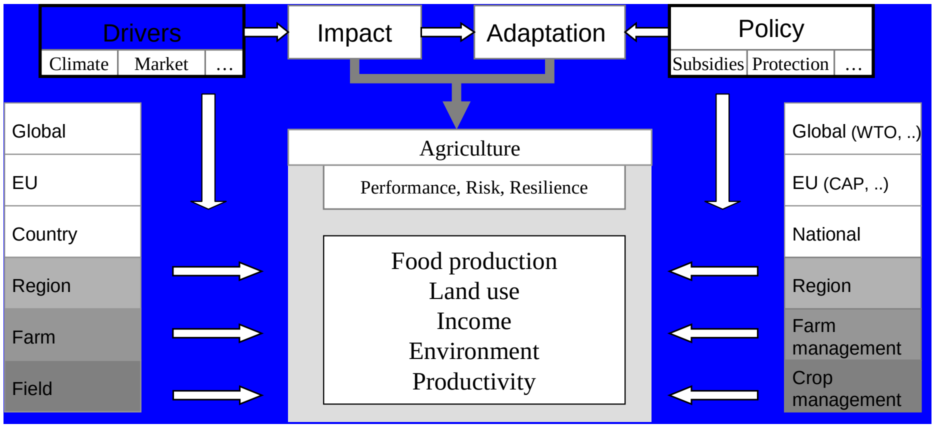

Figure 1. Schematic representation of the multi-scale and integrated approach to assess climate change adaptation.

We use the SEAMLESS – Integrated Framework (www.seamlessassociation.org), which includes a cropping system model, farming system model and a market model (van Ittersum *et al.*, 2008).

The market model provides the European context in terms of changing policies and prices, whereas the cropping system model simulates changes in yields over time due to climatic and technological changes. Both models provide input to the farming system model, which is applied to determine the effectiveness of adaptation strategies to long-term climatic, market and policy changes, to analyse the possible interactions between these changes, and to determine possibilities for sustainable farm types in 2050. The modelling framework is complemented with a semi-quantitative approach, the Agro-Climatic Calendar (ACC) (Schaap et al., 2009). Based on literature review, expert knowledge and stakeholder participation, critical risks related to climate extremes are identified for major current and alternative crops. The frequencies of occurrence of these climate risks are assessed for the current situation (1990) and two climate scenarios for 2050, and adaptation strategies are identified. These adaptation strategies are prioritized using focus group discussions with farmers, local policy makers and experts. The ACC complements the crop model outcomes with respect to timeliness of farm operations, disease pressure and losses, yield quality, etc., aspects that that cannot be handled by the crop model.

Results and discussions

Socio-economic scenarios project that there will be more pressure on agriculture from other sectors. This has consequences for the farm structure in the future. In the vicinity of the still growing Amsterdam-Almere twin city, rural areas are rapidly changing. Not only because of the urban expansion but also because in this new urban setting a different role of agriculture is required, for instance providing other services like day recreation or providing habitat for nature. In the larger part of Flevoland, farmers will still be mainly production-oriented but they will change the structure of the farm; rotation, specialisation and the level of local collaboration arrangements between farms are expected to change.

In Flevoland, the prevailing climate conditions are suitable for agriculture, but changes are already observed by farmers. The ACC showed that farmers will be able to cope with a change in the frequencies of extreme events for most crops in 2040 and that the production of new crops will become feasible. However, risks are projected to increase, such as long dry periods during the summer, which may for example reduce wheat yields and affect potato quality. Possible adaptation strategies are identified at multiple levels. The effectiveness of such strategies will be explored for different farm types and regions, applying the multi-scale SEAMLESS-IF approach, and focus group discussions with farmers, experts and policy makers.

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