

Kennis voor Klimaat

Knowledge for Climate



Theme 8 Decision support tools

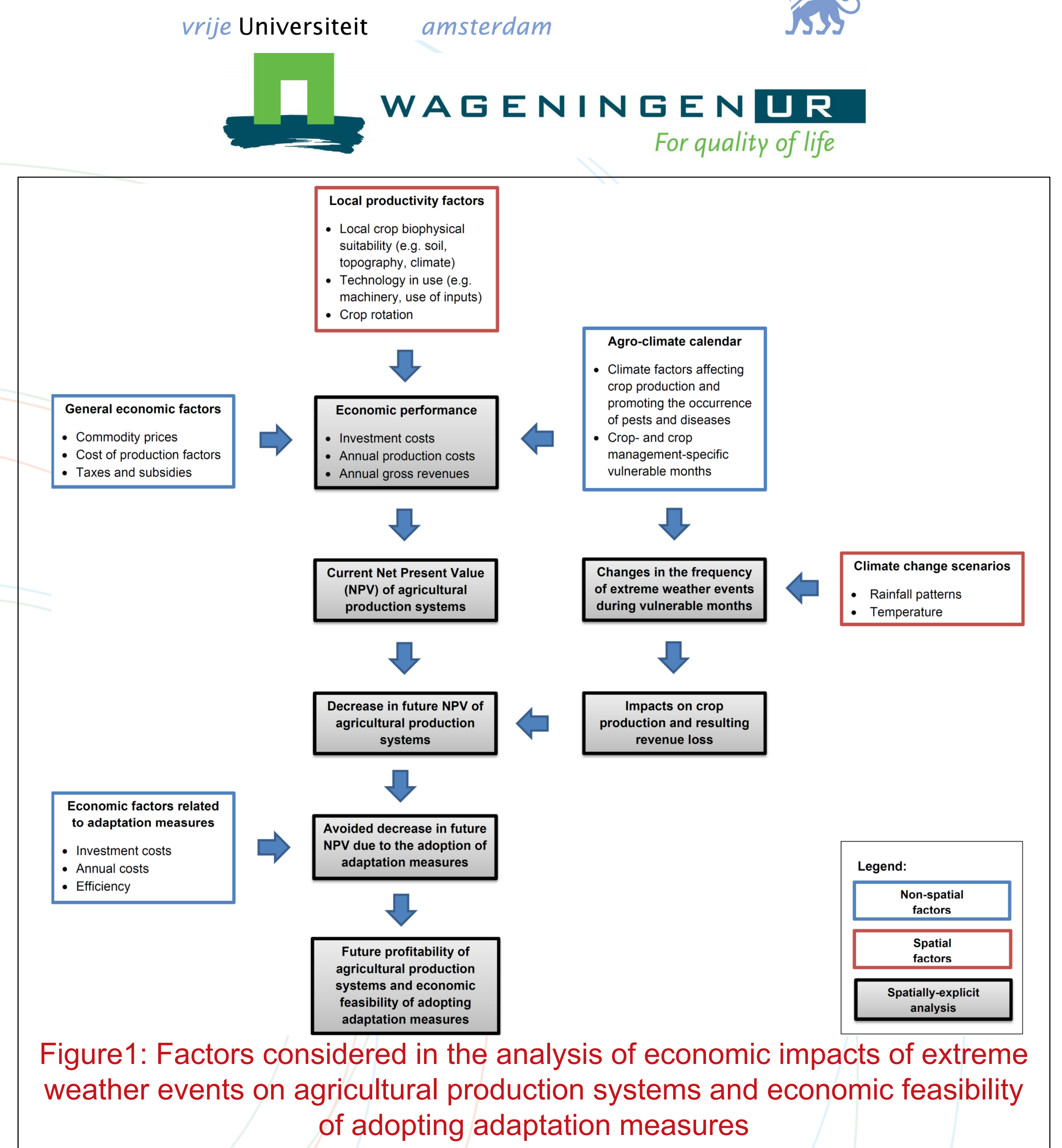
Analysing climate change impacts on local economic performance of Dutch agricultural systems

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The economic profitability of agricultural production systems depends on a complex combination of general economic factors (e.g. commodity prices, cost of production factors) and local productivity factors (e.g. biophysical features determining crop suitability and related technology in use). Since the biophysical environment is spatially heterogeneous, location is a key factor in describing the economic profitability of agricultural production systems. Future climate change impacts are likely to affect crop productivity and, consequently, the economic performance of current agricultural productionsystems. Yet, there is limited understanding of the interplay between local production capabilities, regional climatic changes and more general socio-economic conditions that determine the profitability of agricultural production systems.

A method is hereby proposed to map expected changes in the future profitability of agricultural production systems resulting from the impacts of more frequent extreme weather events. Changes in the expected net present value (NPV) of current agricultural systems are assessed in a spatially explicit way by measuring time series of discounted cash flows, taking into account the impacts on crop production and quality due to the occurrence of extreme weather events during vulnerable periods (Figure1). The economic feasibility of adapting to these events is also assessed, by taking into account the investment and annual costs of a number of adaptation measures and their effectiveness in reducing crop damage.



The Netherlands, a country with an advanced agricultural sector with a high value per hectare, was used as a case study. The proposed method was implemented to study the economic impacts of more frequent extreme weather events on arable farming systems. Changes in NPV of arable farming systems in 2050 were analysed according to the expected damage caused by increased frequency of heat waves, warm winters, long droughts, warm and wet periods, and heavy rainfall on the production of seed potato, consumption potato, starch potato, sugarbeet, winter wheat and seed onion, following the climate projections of the Royal Netherlands Meteorological Institute (KNMI'06 scenarios). As an example, Figure 2 shows the impact of heat waves on the profitability of arable farming systems and related economic feasibility of adaptation in 2050, following G and W+ scenarios.

The proposed method allows:

- mapping the impacts of climate change on the economic performance of current agricultural systems;
- identifying the regions in which agricultural systems are able to remain economically profitable, given current economic conditions;
- exploring the extent to which adaptation measures help limiting the economic impact of more frequent extreme weather events
- identifying the regions that might require the design and implementation of more robust adaptation strategies

Table 1: Heat wave impacts and adaptation measures in arable farming systems

Crop	Vulnerable period	Impact	Damage (% economic loss)	Adaptation measure	Efficiency (% avoided damage)	Annual costs (EUR/ha)	Investment (EUR/ha)
Seed potato	July-September	Secondary growth	Low impact: 25% High impact: 75%	Cooling by dripping irrigation	90%	1000	-
Consumption potato	July-September	Secondary growth	Low impact: 25% High impact: 75%	Cooling by dripping irrigation	90%	1000	-
Starch potato	July-September	Secondary growth	Low impact: 25% High impact: 75%	Cooling by dripping irrigation	90%	1000	-
Sugarbeet	-	No impact	-	-	-	-	-
Winter wheat	-	No impact	-	-	-	-	-
Seed onion	-	No impact	-	-	-	-	-

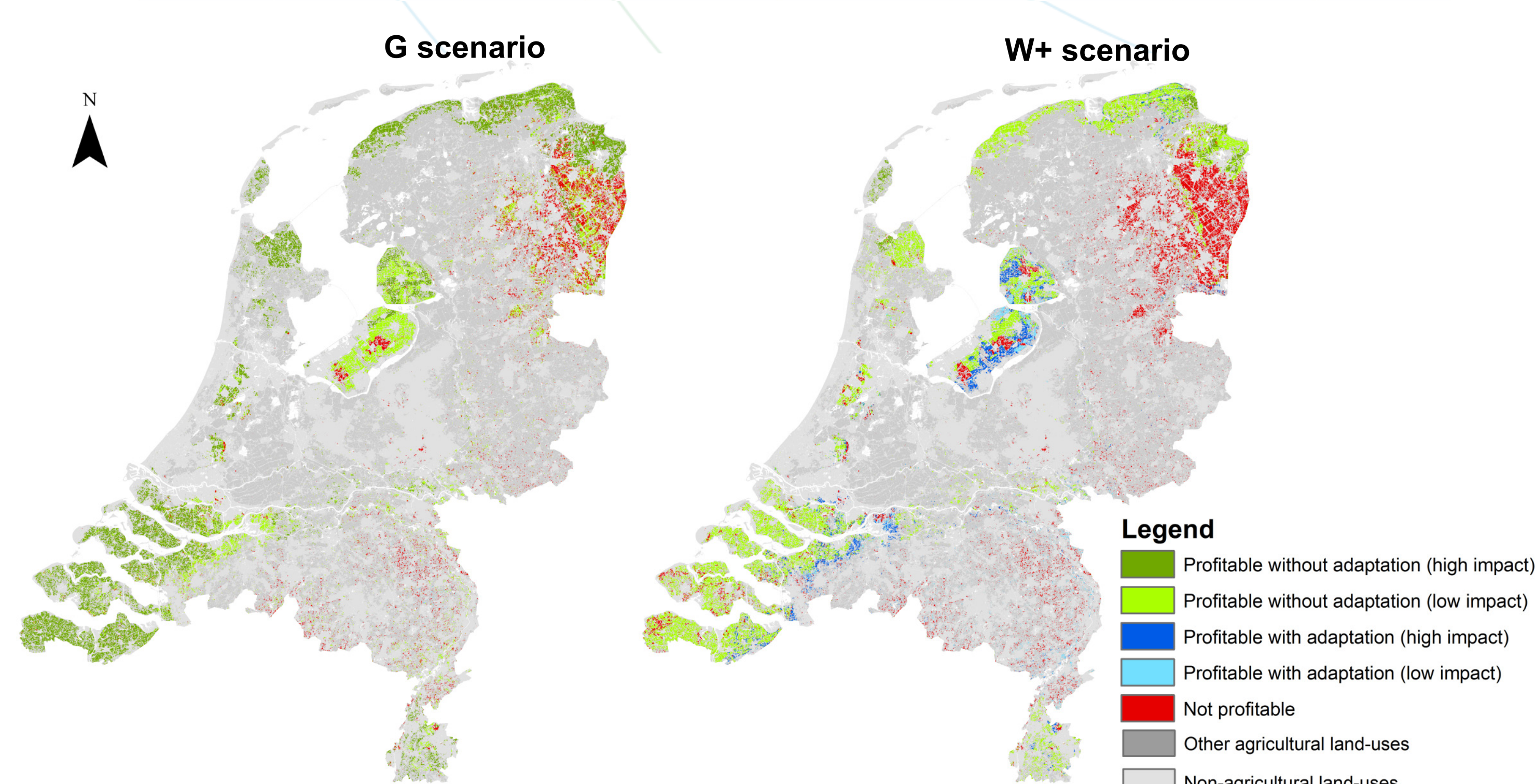


Figure 2: Profitability of arable farming systems in the Netherlands in 2050 taking into account economic impacts of heat waves, and economic feasibility of adopting adaptation measures, according to future climate scenarios and current economic conditions