

Kli **Climate Change and Fruit Growing in Germany**

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The vulnerability of economic sectors to climate change depends on both the expected regional climate change and the sectors' ability to adapt. In Germany, 80 % of the total area of land is used by the agriculture and forestry sectors and they belong to the most climate-sensitive branches. Climate change will have a significant impact on this sector. In comparison to crop production, where adaptation-strategies can be realised relatively fast through the implementation of a wide range of cultivars and species or by using short rotation periods in vegetation, the planting and rearrangement of orchards requires a consideration of the more long-term aspects of climate change impact. The adaptation of fruit plantation to climate change takes time and requires long-term investments. Returns are not realised before 3 to 6 years after the initial investments. Capital recovery can take as long as 25 years. Therefore, a detailed investigation on the impact of climate change on fruit growing is necessary.

Earlier research has shown that the first impact of climate change on certain fruit species can already be observed. For example, since the end of the 1980's the blossoming of fruit trees in Germany has advanced by several days (Fig. 1, Chmielewski et al. 2004). The general growing season in Europe and Germany has been extended by 10 days during the last decades (Chmielewski and Rötzer 2001, 2002). Because of the earlier blossoming of trees, in some regions of Europe the risk of late frost damages has increased (Sušnik und Žust 2001, Zinoni et al. 2002, Anconelli et al. 2004). Likewise, the number of pest populations in orchards has risen, e.g. the occurrence of the codling moth (Palm 2006).

The overall objective of this project is to investigate the possible regional impacts of climate change on fruit-growing in Germany. The main fruit growing regions in Germany are likely to be impacted differently by climate change and therefore these regions will be vulnerable to the impact of climate change in a varying degree. The KliO project intends to develop application-relevant strategies for adaptation and evaluate the impact of these adaptation measures on the sectors profitability and productivity. In this context, different levels of adaptation will be considered. This project should help to maintain the competitiveness and profitability of fruit growing in Germany. In this way, the project contributes to the sustainable development of this economic sector. This is seen as relevant for the impact of fruit growing on land-use, as well as a guarantee to keep employment and a stable income level in this economic sector.

The contributions of the project partners can be summarized as follows:

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- Changes in agro-climatic conditions for fruit growing (growing degree days, soil water budget, hail- and frost risk, occurrence of extreme weather events, etc.)
- Potential shift of fruit growing areas (limits for fruit growing)
- Recent and future changes in plant development (phenology)
- Changes in crop yields, quality parameters for fruits, etc.
- Regional vulnerability of fruit growing areas

Fruit Growing and Consulting Service in Jork (OVB) together with Fruit Growers

- Modelling of pest populations, e.g. codling moth (*Cydia pomonella*)
- Development of new methods for pest control
- Suggestions for the implementation of new fruit species and varieties
- Development of adaptation strategies for fruit growers

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- Estimation of additional costs for fruit-growers by adaptations methods such as irrigation, hail- and frost protection, etc.)
- Cost-benefit analysis of adaptation strategies at different levels of adaptation

Beside risks, climate change also provides new opportunities. By implementing appropriate adaptation strategies, the risks of climate change (frost, hail, extreme weather, water shortage, etc.) must be minimized and the new opportunities given by, for example an extended growing season or a higher temperature level, should be efficiently used. This could be possible by an adequate selection of fruit species and fruit varieties. For example, stone fruits are generally more sensitive to cold, so that they could benefit in case of warming.

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