CLIMATE CHANGE

2007: impacts, adaptation and vulnerability. In: Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J. & Hanson, C.E. (eds). Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, pp. 433–467.
IPCC, 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. [Core Writing Team, Pachauri, R.K. and Reisinger, A. (eds)]. IPCC, Geneva, Switzerland, 104 pp.
Kriticos, D.J., Yonow, T. and McFadyen, R.E., 2005. The potential distribution of Chromolaena odorata (Siam weed) in relation to climate. Weed Research 45, 246–254.
Sutherst, R. W., Maywald, G. F. 7 Kriticos, D. J., 2007. CLIMEX Version 3: User's Guide. Available from www.hearne.com.au. Hearner Scientifc Software Pty Ltd.

Climate change: opportunity or difficulty for farmers?

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The climate is changing. Your business too? This question was asked in three groups of arable farmers and three groups of dairy farmers during workshops in different parts of The Netherlands. We asked them if they already experience effects of climate change on their farms. We also discussed which climate-related difficulties they face now and expect in the near future. Besides difficulties, farmers also see opportunities. As an arable farmer from the province of Groningen stated: "*For Global Warming we farm at the Gold Coast: fertile soil, enough water available, warmer weather and –in Groningen- above sea level*."
Farmers differ in their opinion on the relation between climate change, pests and crop protection. Some dairy farmers relate the increase in flies and insects causing diseases as Bluetongue and Q fever to climate change. Furthermore, they expect more weeds in their crops when temperature rises. Arable farmers expect an increase in fungal diseases and state that they already have more troubles with insects. The consequences for their crops and cattle are uncertain. They expect more pests, but also new natural enemies. Some farmers think pests and weeds will become a bigger challenge, while others think the situation will not change that much. "*As farmers, we are used to changes*." Overall, most farmers think their business eventually will benefit from climate change due to improved climatic conditions for crop growth.

Climate change exacerbates the oak processionary caterpillar problem in The Netherlands

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Since its first observation in the south of The Netherlands in 1991, the geographical range of the Oak processionary caterpillar (*Thaumetopoea processionea*, "OPC" in the following text) has increased steadily over the years, moving in north-eastern direction. Figure 1 shows that it now occurs in the whole southern part of The Netherlands. During its expansion, the observed numbers clearly peaked in 1996 and in 2004. Both peaks were followed by severe decreases in 1997 as well as in 2005. The spreading of the caterpillar causes considerable health problems as each caterpillar has over 1.8 million urticating hairs.
The causes of the observed change in occurrence as well as potential future changes are unknown. The OPC is an egg-overwintering insect, a group of insect species that as a whole has become increasingly successful over the years. As the OPC is mainly found on solitary oaks and then mainly on the southern side of the trees we hypothesise that the OPC prefers warm conditions. Therefore, it is likely that the observed 1°C increase in temperature and the corresponding increase in growing season length in the recent decades have stimulated the spreading.

The first objective of our study was to determine which climate variables could explain the observed changes in the spatial distribution and changing population dynamics of the OPC. Our second objective was to determine the potential future changes in its distribution under different climate scenarios.
We created annual distribution maps of the OPC based on observations gathered by Alterra Wageningen UR, the Dutch Butterfly Conservation and the Dutch phenological network Nature's Calendar. The period covered was 1991 to 2007. We correlated the distribution maps of

Figure 1: Oak processionary caterpillar (OPC) distribution maps of the periods 1991/1993 and 2006/2007 in The Netherlands. The darker dots represent the more recent years. Since the OPC's first appearance in 1991 its distribution area has moved in north-eastern direction, expanded rapidly as well.

the OPC with weather data that were based on data from thirty to fourty MeteoConsult weather stations, comparing the region where the OPC occurred to regions without OPC observations. The large number of weather stations gave us a unique insight in regional climate differences. By combining the found relation between climate and occurrence with the four climate change scenarios of the KNMI, we assessed the potential future distribution of the OPC.
We conclude that the temperatures in May, June, July, September and October are significantly higher in the OPC region. May, June and July are the months in which the eggs hatch and the caterpillars grow, September and October is the period of flight and reproduction of the OPC. The summer temperature in the OPC region currently averages 17.6°C. In the north of the country this is 16.7°C. Our analysis also showed that September on average was significantly drier in the OPC region. This suggests that much rain during the flight period has a negative impact on reproduction.
Our scenario analysis showed that the average summer temperature in the north of The Netherlands will be between 16.6 and 17.6°C in 2020 and between 17.0 and 19,0 in 2050 (depending on the scenario). Therefore, we conclude that the OPC distribution area is likely to expand further; in 2020 the entire country could become an "OPC region".
The need for more detailed information about the OPC and the locations has become clear. By improving the level of detail in the information as well as the cooperation in the management the nationwide risk posed by the OPC could be contained or prevented more efficiently. Moreover, attention must be paid to the distribution of potentially infected oak trees throughout The Netherlands. Important for the management of the OPC (locations) is the coupling between reported observations on the one hand and information about the confirmation and management practices on the other hand.

Additional references

Van den Hurk, B., Klein Tank, A., Lenderink, G., Van Ulden, A., Van Oldenborgh, G. J., Katsman, C., Van den Brink, H., Keller, F., Bessembinder, J., Burgers, G., Komen, G., Hazeleger, W. & Drijfhout, S., 2006. KNMI Climate Change Scenarios 2006 for the Netherlands. KNMI Scientific Report WR 2006-01. De Bilt: KNMI (Royal Dutch Meteorological Institute).
Website 'De Natuurkalender': www.natuurkalender.nl

Climate change and bioinvasiveness of plant pathogens: comparing pathogens from wild and cultivated hosts in the past and the present

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Shifts in the distribution of organisms occur permanently and worldwide, involving organisms from all taxonomic groups. Shifts towards previously uncolonized areas are now commonly referred to as biological invasions. Invasions by pests and pathogens have a huge impact on agriculture. The successfulness of these invaders has been ascribed to absence of their natural enemies, but the successfulness of many invaders is also comfortably explained by lack of sufficient resistance in many crop/pathogen combinations, the area cropped in monoculture, and narrow rotations.
Many plant pathogens of agricultural crops made a great shift in their geographical distribution due to simple enlargement of the area cropped to hosts, mostly in combination with the oblivious transportation of these pathogens in plant material. However, it is also interesting to consider cases where invasion has not yet occurred. This can be due to inability of the pathogen to bridge large distances or to unfavourable climatic conditions. For example, although their