

The Dutch Phenological Network De Natuurkalender; Results of the first two years.

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Background of De Natuurkalender

De Natuurkalender is the phenological monitoring scheme in The Netherlands, which started in 2001. The founder of phenological research in the Netherlands was Carl Linnaeus. In 1751 he described in his journal "Philosophia Botanica" the objectives and methods for recording what was later called "phenology". Systematic phenological observations were made for the first time at the end of the 19th century. The phenological networks were operational from 1894 till 1968. These networks concentrated on wild plants, butterflies, trees, and agricultural plants.

The start of the European Phenology Network in January 2001 was the reason for the Dutch VARA radio program "Vroege Vogels" (Early Birds) to record an issue on phenology. This communication resulted in the joint initiative of Wageningen University and Vroege Vogels to restart the Dutch phenological recording scheme in the Netherlands. De Natuurkalender consortium now also includes Dutch Butterfly Conservation, the Foundation for Sustainable Development, SOVON Dutch Centre for Field Ornithology, the FLORON Foundation, Institute for Environmental Communication, Royal Dutch Meteorological Organisation, World Wildlife Fund, Vogelbescherming Nederland, VOFF and Topshare.

Via the weekly broadcasts on Sunday morning we asked people to participate. As 500 000 people listen to the radio programme we quickly had a few thousand registered observers. They all received an observation manual with instructions on how to participate (Van Vliet et al, 2002). Via an interactive website we offered the observers to submit their observations to the central database from which they also could see all the observations. Since the start of De Natuurkalender Vroege Vogels broadcasts a short overview of the most recent observers submitted to the phenoline. The phenoline is an answering machine on which the observers can record their own observations.

Objectives of De Natuurkalender

The objectives of De Natuurkalender are:

- To collect phenological data from selected plant-, bird- and butterfly species.
- To study the effects of climate on timing of life cycle events;
- To study the ecological and socio-economic impacts of climate induced phenological changes;
- To raise public awareness on climate change impacts in order to increase public support for climate policy.

In order to do this, good communication between scientists and public is necessary. We developed interactive ecological educational programs for children and the general public, and provide observers with information on our website.

Evidence for significant phenological changes in the Netherlands

From 2001 until 2003 we collected thousands of observations of the 57 plant, 25 butterfly and 26 bird species that are included in De Natuurkalender programme. The species were selected because they are relatively easy to recognise or because they have been included in the phenological programmes in the 20th century (Groenendijk, 2001). During the first years it also became clear that a lot of people appeared to have collected phenological data privately for many years in a row. We integrate this data with the new observations.

By linking the new and historic observations with climate data we were able to determine the relation between temperature and timing of life cycle events of many species. The most significant correlations were found between flowering of several plant species and spring temperature. The start flowering for, for example, Ground ivy (*Glechoma hederacea*) and King-cub (*Caltha palustris*) depends on the average temperature in February and March (Figure 1).

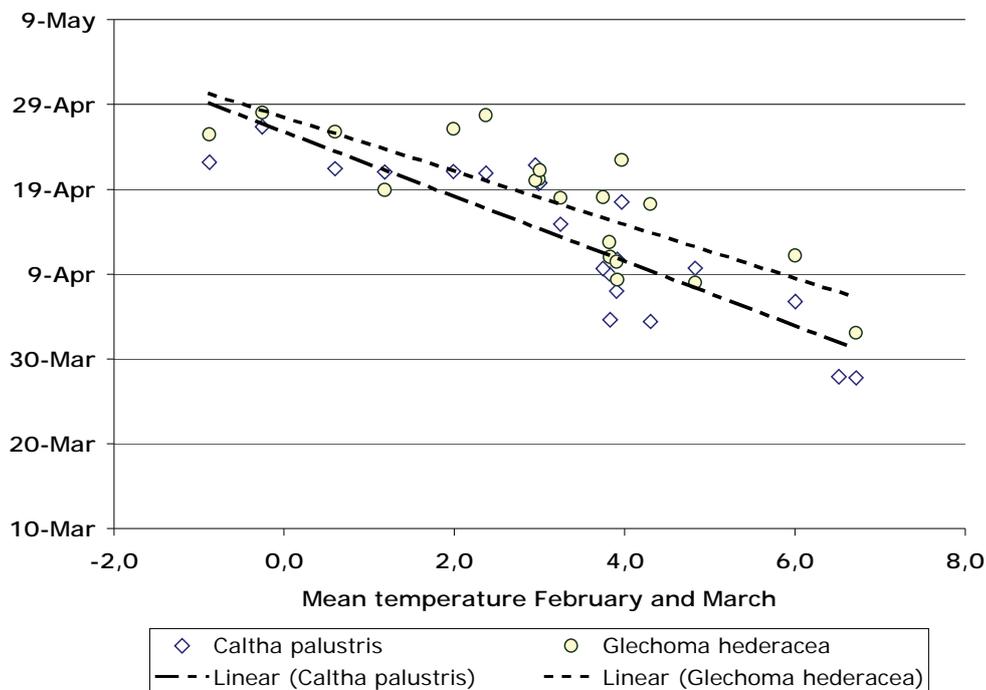


Figure 1: Start of flowering of *Glechoma hederacea* and *Caltha palustris* in relation with the average temperature in February and March.

In the Netherlands spring temperature has risen since the end of the 1980's. Especially the temperature in early spring has increased. Because of this increase, in recent years, plants showed a significant advance in flowering in the period after 1990 in comparison with the period 1940 till 1968. In comparison with the mean flowering date in the period 1940-1968 the flowering of Ground ivy (*Glechoma hederacea*) and Sweet violet (*Viola odorata*) showed an advance of 14 and 20 days respectively. There was also a clear difference in flowering date between 2001 and 2002. Especially in 2002 plants flowered early which was mainly caused by the very high temperatures

in the end of January and in February. The average temperature for February 2002 was for example 7.1°C while 3.0 °C is normal. In 2001, only early spring flowering species showed advance in flowering date while mid-spring flowering species showed no or little advance. While there was a significant difference between the flowering dates of spring flowers between 2001 and 2002, the arrival dates of migratory birds like for example Chiffchaff (*Phylloscopus collybita*) showed little difference. As the migratory birds spend the winter in Southern Europe and in Africa, it is very likely that weather conditions in these areas caused this difference. As we currently lack historic phenological observations of bird species, we are not able to determine the changes in timing of phenological events like migration for the species included in De Natuurkalender. Other data, however, suggest a continuous advancing trend of breeding date in The Netherlands during the 1990s for several species (see e.g. Majoor et al. 2001, Pilzecker, 1998).

In 2002, the first generations of butterflies flew earlier than in 2001. Butterflies that hibernate as butterflies appeared on the first days with high temperature. Brimstone (*Gonepteryx rhamni*), Peacock (*Inachis io*) and Comma (*Polygonia c-album*) are examples of those butterflies. Butterflies that hibernate as pupae like for example Small Copper (*Lycaena phlaeas*) were also early in 2002. Migratory butterflies like the Red Admiral (*Vanessa atalanta*) and Painted Lady (*Vanessa cardui*) were early in both years. Normally we would have expected the first observation of these species at the end of April and in May but in both years these species were already observed in February and March.

The difference in phenological responses to the increased temperature in the Netherlands will undoubtedly have an impact on species interactions. The impacts are however difficult to quantify and our research will focus on this issue in the coming years.

Improved communication: Interactive website

Communication is an important issue within De Natuurkalender project. It is our opinion that observers should be well informed about what is going on in nature, what they can expect to see outside at a certain time of the year and how they have to make their observations. Furthermore, observers are interested to know what we are doing with the data that they collect. By providing this type of information we increase the motivation of observers to continue to participate in the monitoring network. Not only the observers are interested in the results of De Natuurkalender. Especially the media are an important customer for this type of information.

The weekly broadcast of Vroege Vogels played a central role in this communication during the first years of De Natuurkalender. However, to further facilitate the dissemination of information to the observers, to the media and to other interested persons we are continuously developing our website (<http://www.natuurkalender.nl/>). In 2003 we launched a new version of our website. The most important new features of the website were the forms to submit observations and the tool to visualise all observations from the current year and all previous years in maps and graphs (see Figure 2).

The maps give a spatial representation of the locations where the observations have been made in The Netherlands. The colour of the dots represent the week of the year when the observation have been made. The graphs give an overview of the number of observations made per week and the maximum temperature from day to day. The maps and graphs always give a live update as all new observations submitted via the website are directly added to the maps and the graphs. With this tool on the website people can clearly see the change of the seasons during the year. This part of the site will be further developed in the future.



Figure 2: Start of flowering of Small selandine (*Ranunculus ficaria*) in The Netherlands in 2003. The colour of the dots on the website give an indication of the week of the year in which the observation has been made.

Attention in the media

De Natuurkalender has been very successful in generating media attention during the first years of its existence. Over 50 news paper articles in national and regional newspapers addressed the network and its results. Sometimes the articles made it to the headlines or covered almost an entire page in newspapers. In addition to the newspaper articles, several television and radio programmes paid attention to De Natuurkalender. With all the publicity we were able to inform an equivalent of over 50 million people during the first two years.

Conclusions

Because of the thousands of observations gathered, the analyses made, the improvement of the website, the attention in the media, and the good cooperation between a large number of institutes we consider De Natuurkalender as a successful project. We have been able to demonstrate that cooperation between, scientific organisations, Non Governmental Organisations, the media and the public can result in a valuable contribution to the monitoring and analysis of climate change impacts.

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