

AN INTERNATIONAL OUTLOOK ON PHENOLOGY

IL PANORAMA FENOLOGICO INTERNAZIONALE

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Abstract

This paper illustrates the most important and recent phenological activities at international level. About the national networks, the youngest is the phenological network of the United States: after two years of preparatory period, in the 2007 it started its activities. The UK and the Netherlands networks are two good examples of web-based phenological surveys. We report also the up-to-date situation of the International Phenological Gardens network. In the COST research network, there are two actions in progress in the field of phenology: one on phenological data platform for climatic applications, the other one on allergenic pollens. Finally we examine the UE 7th framework programme in order to evaluate the chances to present projects about phenology.

Key words: phenological garden, pollen, indicator plant, BBCH scale, climatic change.

Riassunto

Viene mostrata una panoramica su alcune tra le attività fenologiche più importanti e recenti a livello internazionale. Tra le reti di rilevamento nazionale, ultima nata è la rete fenologica degli Stati Uniti, che si sta strutturando adesso, della quale si illustrano le caratteristiche. Riferimenti importanti sono costituiti anche dalle reti del Regno Unito e dei Paesi Bassi. Viene riportata la situazione attuale della Rete dei giardini fenologici internazionali, che finalmente vede presente anche un giardino italiano. Fra i progetti internazionali, ne vengono illustrati due in ambito COST, uno relativo alla costituzione di un database europeo di dati fenologici per applicazioni climatologiche e l'altro sui pollini allergenici in Europa. In conclusione si esamina il 7° programma quadro dell'UE per verificare i possibili spazi per la presentazione di progetti fenologici.

Parole chiave: giardino fenologico, polline, pianta indicatrice, scala BBCH, cambiamenti climatici.

Introduction

In the last decade (after the ISB Phenology Symposium in Boston, March 1998) a lot of activities were carried out in the field of phenology, particularly in Europe and North America. This growth of activities is strictly connected with a change of scale in phenology: from the field to the globe. The traditional botanical and agricultural phenology, based on local scale events, is being supplanted by the importance of phenological information, at global scale, for climate change studies.

In this paper we examine some significant and recent activities about national networks and international projects, with a “phenological” look also at the 7th Framework Programme of the European Union.

To roughly measure our field of interest, if we utilize Google (www.google.it) for a search on the Web, we obtain about 1.750.000 results for the word “phenology” and the first reference is an encyclopedia: en.wikipedia.org/wiki/Phenology. If we made the same in Italian, the word “fenologia” has 598.000 references (and the first reference is a dictionary: www.demauroparavia.it/43007), the words “fenologia + agricoltura” have 14.100 references and the word “agrofenologia” only 81 references. If we utilize Scholar Google (scholar.google.com), a tool to search on the scientific literature on the Web, we obtain 90.100 refer-

ences for “phenology”, 18100 for “phenology+agriculture”, 10.600 for “fenologia”, 194 for “fenologia+agricoltura”, 100 for “phenological network” and 11 for “rete fenologica”.

USA-NPN

As regards national phenological networks in the world, the more interesting and important novelty is the birth of the National Phenological Network of the USA (USA-NPN). It was born just during 2007, after a preparation period started in 2005. The task of USA-NPN is to facilitate systematic collection, dissemination and sharing of phenological data from across the United States to support global change research.

The project (Betancourt *et al.*, 2007) has been organized to engage multiple federal agencies, numerous environmental networks and field stations, educational institutions at every level, and mass participation by citizens.

An implementation team was set up to plan and implement core aspects of the network; the members of the team come from the involved organizations (U.S. Geological Survey, NOAA, U.S. Department of agriculture, NASA, U.S. Fish and Wildlife Service, U.S. National Park Service and several universities).

The initial phase is establishing a functional continental-scale phenological monitoring network of stations, observing selected regionally appropriate native plant species and nationally appropriate indicator plants.

The NPN framework is based on four tiers (Fig.1), each representing an increasing level of spatial coverage and decreasing quality and quantity of phenological and environmental information:

- 1) networks of locally intensive sites focused on process studies (e.g., Long-Term Ecological Research Sites, AmeriFlux, Organization of Field Biological Stations);
- 2) spatially extensive environmental networks focused on standardized observations (e.g., National Weather Service Cooperative Observer Network, National Park Service Inventory and Monitoring sites);
- 3) volunteer and education networks (Fig. 2) (e.g., garden clubs, plant-, bird- and butterfly-monitoring networks, college campuses); and
- 4) remote sensing products that can be ground-truthed and assimilated to extend surface phenological observations to the continental scale.

The USA-NPN has implemented a data model and infrastructure for the acquisition, management and dissemination of existing and newly collected phenology observation data.

The main goals of this infrastructure is to ensure that phenological data are (I)

- **available:** that computing systems employ appropriate best practice and operate continuously, and that location and content of data can be readily identified;
- **usable:** data are stored in a stable, reliable, and interpretable data retrieval system;
- **reliable:** the network includes a process for quality control of data, ensures that data are not inadvertently changed, that all changes are logged, and that users have tools to verify the integrity of data which they have entered;
- **shareable:** data products are complete, subjected to quality assurance, formatted for use and documented for interpretation by others;
- **easily integrated:** data and products are consistent with data exchange standards and mechanisms are in place to ensure interoperable with related data sets and information systems;
- **interpretable:** the data are routinely summarized, transformed into useful information, and reported in formats designed for specific clients.

Dr. Jake Weltzin, associate professor at the University of Tennessee, is the first Director of USA-NPN, assuming this position on August 2007.

In October 2007 an information and discussion list, called "Phenolog-I", was created to provide information and facilitate communication regarding all aspects of phenology, as part of the mission of the USA-NPN. This list is moderated by M. Schwartz of the University of Wisconsin-Milwaukee and it is open to anyone interested in phenology.

Web references:

<http://www.usanpn.org/>

http://www.windows.ucar.edu/citizen_science/budburst/

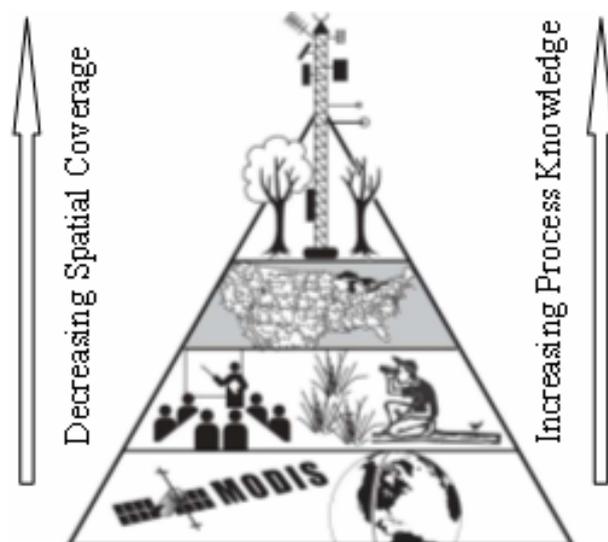


Fig. 1 - The four tiers of the NPN framework

Fig. 1 - I quattro strati della USA-NPN

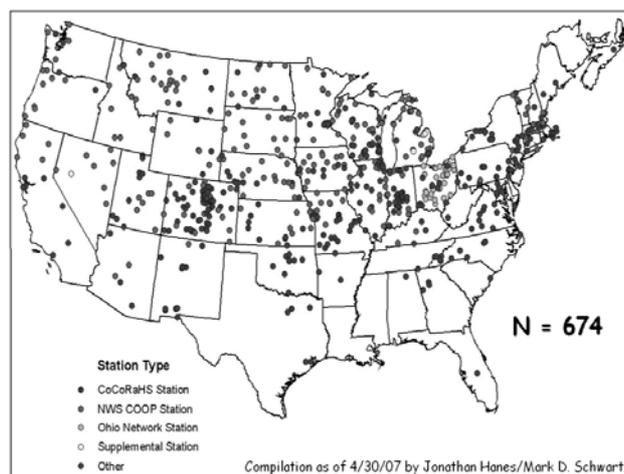


Fig. 2 - Individuals that have registered to make observations for USA-NPN as of 30/4/07

Fig. 2 - La rete degli osservatori della USA- NPN al 30/4/07

<http://www.uwm.edu/Dept/Geography/npn/index.html>
<http://listserv.uwm.edu/mailman/listinfo/phenolog-l>

UK PHENOLOGY NETWORK

Another important reference is the United Kingdom phenology network and its Web site Nature's Calendar (Fig. 3).

From 1875 until 1947 the Royal Meteorological Society coordinated a nation-wide network of recorders to examine the relationship between meteorological events and the natural world. In 1899 there were 155 phenological observers contributing records. They were asked to record the flowering of 13 plants, and the appearance of birds and insects.



Fig. 3 - Nature's Calendar home page.
Fig. 3 - La pagina iniziale del sito Nature's Calendar

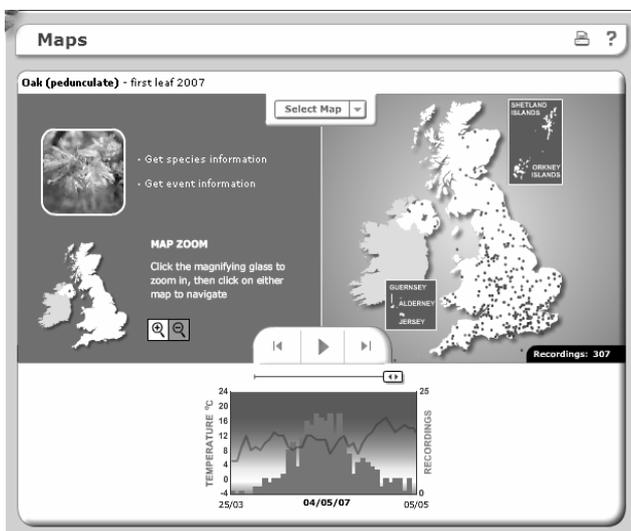


Fig. 4 - Example of map: oak (pedunculata) - first leaf 2007.
Fig. 4 - Esempio di mappa: comparsa della prima foglia nelle querce - 2007

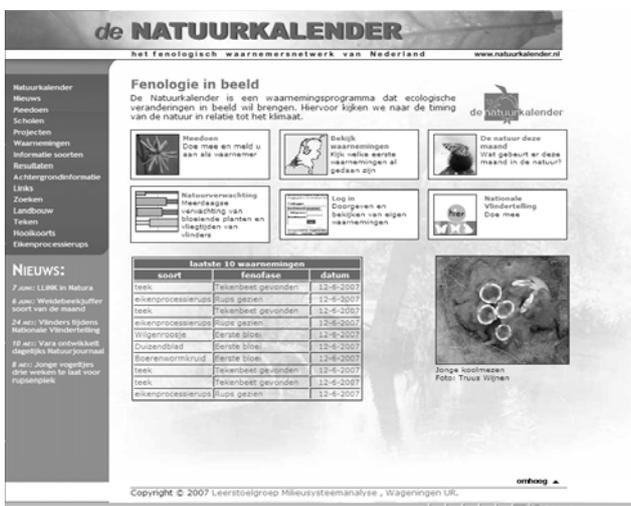


Fig. 5 - Natuurkalender's home page
Fig. 5 - La pagina iniziale del sito Natuurkalender's

The current UK phenology network, started as a pilot scheme in 1998, is coordinated by Woodland Trust and Centre for Ecology and Hydrology, and is geared to participation from the public as "recorders" of phenological events. The species chosen for recording observations (trees, flowers, birds, insects, butterflies, and amphibians) are those considered as potential indicators of climate change.

The UKPN's aim was to become the definitive national database of the impact of climate change on the timing of natural events. The database includes a large number of historic datasets extending back to 1736. It also had another important aim: to provide a simple, fun and meaningful way of getting as many people as possible involved with the natural world, particularly trees and woodland, and to involve them in the issues surrounding climate change.

The UK phenology network has become well-known thanks to BBC Television's "Springwatch" programme. Thousands of volunteers take part now in the survey via the network's website, many of them contributing records from their own back gardens.

Visitors to the site are invited to become recorders and, after registration, recorders can enter observations online or send results in off-line. Advice on making observations is provided including a recording form and species identification information.

Interesting features of the Web site are the option to view animated maps of phenological events (e.g., oak leaf emergence, bird migration – Fig. 4) recorded over long periods of time and the section "Nature detectives" dedicated to children.

Web reference:
<http://www.naturescalendar.org.uk/>

NATUURKALENDER

Among various initiatives is not possible to leave out these one of the Netherlands, because they are very active in this field, particularly thanks to A. van Vliet of the Wageningen University who is one of the promoters of a lot of international phenological activities.

In the Netherlands, systematic phenological observations have been made from 1869 till 1968. In 2001 this Dutch network was revived under the name "Natuurkalender" (Nature's Calendar), in the framework of European Phenology Network (see below).

Since the beginning, thousands of volunteer observers have submitted their own phenological observations on plants, birds and insects. Among the partners there are the University of Wageningen, The Royal Netherlands Meteorological Institute, the Floron foundation and the radio programme "Vroege Vogels" (Early birds). The radio call for phenological observations (Fig. 5) on flowering plants has contributed to raise the number of volunteers who submitted phenological data. The web site has many points in common (beginning from the name) with the British site.

Web reference:
<http://www.natuurkalender.nl/>

INTERNATIONAL PHENOLOGICAL GARDENS (IPG)

The **International Phenological Gardens (IPG)** is a Europe-wide network that now ranges from Norway to Italy and from Ireland to Romania (Fig. 6). During the last 40 years (1959-1998) more than 65.000 observations of 23 plant species with different varieties and provenances have been collected: the database of IPG, thanks to inspiring principles and to length of some of the data series, is a highly valued tool to study phenology and climatic change in Europe.

The establishing of an international phenological observation programme was decided at the first meeting of the "Agrometeorological Commission" of the WMO in 1953. In 1957 Schnelle and Volkert made concrete this idea, founding the International Phenological Gardens. In 1959 the first phenological observations started at Offenbach a. M. (Chmielewski, 1996). The idea of the International Phenological Gardens was to make large-scale and standardized phenological observations; in all gardens genetically identical trees and shrubs are planted in order to make large-scale comparisons among the timing of different developmental stages of plants. The coordination of the network changed several times. In 1996 the Humboldt-University at Berlin took on the coordination and management of the IPG.

The original IPG programme, which was fixed in 1957 by Schnelle and Volkert, included 23 plant species. Because some plant species are very difficult to propagate, the new Standard-Observation-Programme is concentrated now on a subset of 18 plants: *Larix decidua*, *Picea abies*, *Pinus sylvestris*, *Betula pubescens*, *Fagus sylvatica*, *Prunus avium*, *Quercus robur*, *Robinia pseudoacacia*, *Sorbus aucuparia*, *Tilia cordata*, *Ribes alpinum*,

Salix acutifolia, *Salix smithiana*, *Salix viminalis*, *Sambucus nigra*, *Corylus avellana*, *Forsythia suspensa*, *Syringa vulgaris*.

At the moment the network consists of about 50 sites. The only Italian garden in the IPG network is San Pietro Capofiume (BO); this situation depends first on the vicissitudes of Italian phenological gardens, and secondly on the relationship, not always simple, with the coordinators of the network.

As regards the IPG's web site, unfortunately it is difficult to browse and it is poor of information and appeal, particularly in comparison with Nature's calendar or Natuurkalender. The access to the phenological data is restricted to registered users.

Web reference:

<https://www.agrar.huberlin.de/struktur/institute/pfb/struktur/agrarmet/phaenologie/ipg>

EUROPEAN PHENOLOGY NETWORK (EPN)

The EPN project ran from January 2001 to October 2003 and was funded by the Fifth Framework Programme of the European Commission. The chair of the project was A. van Vliet of the University of Wageningen; the other partners were Deutscher Wetterdienst, Institute for Environmental Communication/Globe (NL), Potsdam Institute for Climate Impact Research, University of Bern, München Technische Universität, National Environment Research Council (UK).

The European Phenology Network aimed to improve monitoring, assessment and prediction of climate induced phenological changes and their effects on biodiversity, agriculture forests and human health in Europe. Its overall objective was to increase the efficiency, added value and use of phenological monitoring and research, and to stimulate the practical use of phenological data in the context of global change.

To achieve these objectives and thus to realize a Phenological Thematic Network, the EPN project focused on the following four activities:

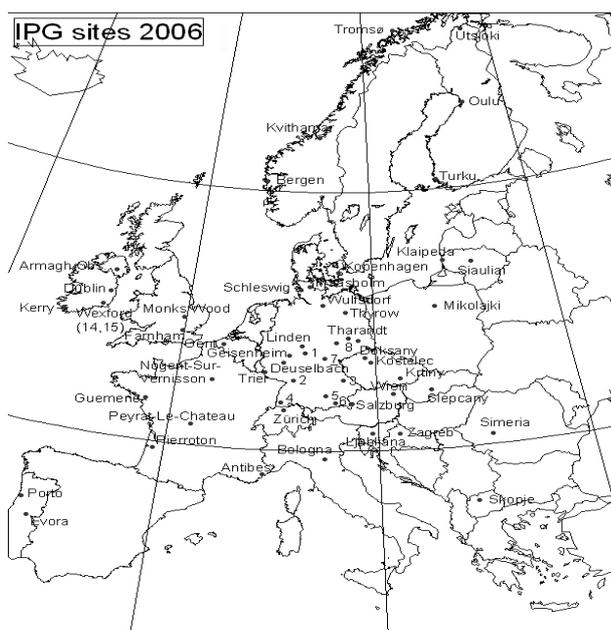


Fig. 6 - IPG sites in 2006
Fig. 6 - I giardini fenologici nel 2006

No	Network Name	Network Organisation	Country of the Organisation	Monitored Region	Monitored Timeframe	P	B	F	Q	R	S	T	U	V	W	X	Y	Z
Europe																		
1	BASIS	Istituto Agrario S. Michele all'Adige	Italy	Trentino/Italy	1996 to 2000	X												
2	Russian (European part)	Ecological center "PASVA" Institute for a global climate and ecology	Russia	20 regions on the European part of Russia	1960 to 2002	X	X											
3	Bird spring annual phenology	Institute of Ecology	Lithuania	Lithuania	1960 to 2002	X	X											
4	CONTROLLO ECOSISTEM FORESTALI	Ministry for Agriculture and Forestry Policy	Italy	Italy	2001 to -	X	X											
10	Highland Birds Zoonstation	German Centre for Marine Biodiversity in Senckenberg	Germany	German Bight/North Sea	1974 to -				X									
11	Data Phenological Observations	University of Oslo	Norway	south-east of Norway	1996 to -	X												
12	UK Environmental Change Network	AERC Centre for Ecology and Hydrology	UK	UK	1993 to -	X	X	X	X									
14	Climatological network	Slovak Hydrometeorological Institute	Slovak Republic	Slovak Republic	1923 to -	X	X	X										
15	Convention in Long Range Transportation, Air Pollution International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests and Land	Bayer Landesanstalt für Wald und Forstwirtschaft	Germany	Europe	2000 to -	X												
17	European Aerosol Research Network	European Pollen Information Unit	Austria	Europe	1974 to -													
20	Robina variability of phenophases	Potsdam Institute for Climate Impact Research	Germany	Potsdam / Brandenburg / Germany	2001 to -	X												
21	International Tundra Experiment	Göteborg University	Sweden	Lapajärvä Field Station / Ruskola / Iceland	1990 to -	X	X	X	X									

Fig. 7 - The EPN metadatabase
Fig. 7: - Il metadatabase della EPN

- 1) coordinating the integration, cooperation, and further expansion of phenological networks in Europe (including: network management, clarifying definitions used, establishing links with educational programmes, non-European networks, international organisations, and potential funding organisations).
- 2) establishing an on-line phenological metadatabase (Fig. 7) and a phenological bibliographical database.
- 3) organizing specialist workshops on essential topics (modelling, use of earth observation data, phenology and human health, phenology and agriculture, bird migration, and communication, dissemination, and capacity building).
- 4) organizing two international conferences on phenology involving data providers, scientists, international organizations, commercial enterprises, policy makers, and educational organizations.

This project is an important milestone in the development of an operational phenological monitoring, modelling and Fig. 7: The EPN metadatabase

Il metadatabase della EPN forecasting network in Europe, because it has proved to be very useful in creating a community of phenologists with common vision and shared standards; therefore it was been the base for many of the later phenological initiatives in Europe and elsewhere.

Web references:

<http://www.dow.wau.nl/msa/epn/index.asp>

<http://www.pikpotsdam.de/~rachimow/epn/html/frameok.html>

COST 725

Founded in 1971, COST is an intergovernmental framework for European Cooperation in the field of Scientific and Technical Research, allowing the coordination of nationally funded research on a European level. In the domain ESSEM (Earth System Science and Environmental Management), in 2004 started the action 725 “Establishing a European Phenological Data Platform for Climatological Applications”. The chair of the action is E. Koch of Zentralanstalt für Meteorologie und Geodynamik, Wien. The end of the activities is scheduled on April 2009 and the budget is about EUR 4 million. The countries involved are 27, including Italy.

The main objective of the Action is to establish a European reference data set of phenological observations, that can be used for climatological purposes, especially climate monitoring, and detection of changes.

Secondary objective is the harmonisation of techniques for :

- the definition of species and phases, that shall be observed in a harmonized way
- developing recommendations for monitoring and collection procedures (methodologies, sampling density and frequency, etc.)
- selection criteria of data for further consideration
- the quality control of observations
- commonly used formats of archiving and distribution of data
- mapping techniques of phenological information and other application methods

- increasing the knowledge concerning relations between climate and phenological phases.

Scientific activities are divided into 3 main levels and carried out by 3 working group (WG):

- 1) Ensuring comprehensive, dedicated and integrated collection of data and information to generate a quality controlled and transparent database (WG1: Inventory of data and metadata; chair J. Nekovar);
- 2) Developing best practices for further harmonization of the database and for its future enlargement and extension (WG 2: Guidelines for data selection, observations and archiving; chair W. Lipa);
- 3) Developing various applications and techniques (e.g., mapping) to extract added-value information from the database (WG 3: Applications with phenological data; chair A. Menzel).

WG 1 is identifying, searching and collecting information about phenological data that are stored in national archives. This search includes meta-data on the location and procedures, under which phenological observations have been performed. An essential part of the meta-information is the observational rules and the performed quality checks prescribed by the agency responsible for the data.

WG 2 is setting guidelines for the selection of phenological data from national data sets. It will perform assessments on which parts of national data sets maybe combined with those from other countries and become part of the common final data set that will be recommended for climatological purposes in Europe.

WG 3 is testing and developing further several application activities on how to use phenological data and especially the reference data set, resulting from the Action. The methods under consideration are primarily

- mapping of phenological phases (including interpolation)
- trend analyses (including uncertainty tests)
- correlations between phenological phases and other climate elements.

The present status of the common database comprises 7.687.248 data in total from 15 countries plus IPG, from 7285 observation sites (Koch *et al.* 2007). The reference period is of about 10 years of continuously observed phenological phases, using the BBCH code.

The selected species are: 29 native plants, 6 fruit trees (*Malus x domestica*, *Prunus avium*, *Vitis vinifera*, *Prunus domestica*, *Pyrus communis*, *Ribes rubrum*) and 9 agricultural crops (*Hordeum vulgare*, *Secale cereale*, *Triticum aestivum*, *Avena sativa*, *Beta vulgaris*, *Helianthus annuus*, *Solanum tuberosum*, *Zea mays*, meadow); in addition there are 8 “northern” plants (*Calluna vulgaris*, *Cornus suecica*, *Epilobium angustifolium*, *Fragaria vesca*, *Geranium sylvaticum*, *Juniperus communis*, *Vaccinium myrtillus*, *Populus tremula*) and 4 “southern” plants (*Laurus nobilis*, *Olea europaea*, *Prunus amygdalis/dulcis*, *Rosmarinus officinalis*).

The action 725 is also cooperating with the WMO working group on a “Guide for Practices in Phenology” and with regards to this some participants of COST 725 have wrote the paper “Guidelines for plant phenological observations” (Koch *et al.*, in press). This paper, in the

short version (10 pages), will be the chapter on phenology in the new edition of the "Guide to climatological practices" published by WMO.

Web reference:

<http://topshare.wur.nl/cost725>

COST ES0603 EUPOL

Within the COST framework, another phenological action has been recently approved, the COST ES0603 EUPOL project "Assessment of production, release, distribution and health impact of allergenic pollen in Europe". The chair is Mikhail Sofiev of Air Quality Research Finnish Meteorological Institute, Helsinki. The project started last April and will finish in June 2011. In the Management committee there are T. Torrigiani Malaspina and L. Cecchi, both of the University of Florence, Department of Agronomy and Land Management. The main objective of the Action is to set up a multi-disciplinary forum for critical review of existing information on allergenic pollen in Europe and its representation in assessment and forecasting systems. The economic dimension of the activities is approximately 10 million EUR, with an overall duration of 4 years.

The Action will concentrate on:

- identification of the critical gaps in the current knowledge;
- better coordination of on-going research;
- development of a comprehensive strategy and specific action plan for improving the scientific knowledge and converting the findings into integrated assessment systems;
- strengthening the dialogue with end users.

These main objectives are structured along three main lines reflecting the pollen lifecycle: (1) pollen production and release, (2) pollen distribution in the atmosphere, and (3) impact assessment, links with end users and applications.

A specific scientific impact of the Action will be:

- a list of strengths and weaknesses of the existing knowledge-base,
- establishing or strengthening communication between different fields of pollen-related environmental science,
- establishing or strengthening connections with end users and key beneficiaries of pollen integrated
- assessment and forecast systems, and
- a mid term and long term common research agenda for the future.

The timetable of the activities is:

Phase 1: Inventory (1st year);

Phase 2: Development, Assessment, Applications (2nd – 3d years);

Phase 3: Synthesis and Dissemination of Action results (4th year).

Web reference:

<http://cost.esf.org/>

EUROPEAN AGROPHENOLOGY NETWORK (EAgPN)

Also the European Union, through its Joint Research Centre (JRC) at Ispra (Va), is involved directly in

phenological activities. In the last years it has organized some meetings among European phenologists, in particular in December 2005 proposed to set up a European agrophenology network (EAgPN) in order to facilitate harmonization, systematic collection and access to agrophenological data across Europe, crop parameters and cropping practices, give support to foster related scientific knowledge exchange, develop and share common applications.

The JRC should have had the following tasks at his own cost:

- provide the common data base infrastructure,
- act as secretary of the network,
- organize workshops and meetings and keeping communications,
- maintain a web site allowing access to the data and to the value-added products,
- calls for phenological data sets,
- 1 detached national expert from the participants to act as secretary of the network in JRC.

Each member would have contributed by transferring to the EAgPN common infrastructure agro-phenological data and participated to the harmonizations and scientific knowledge exchange. The participants would have benefited from additional data on their area of interest, scientific works, results and applications developed within the EAgPN, participated to scientific meetings organized and sponsored by JRC on the subject and have accessed to European related data sets such as: European data base on satellite vegetation indicators, interpolated meteorological data updated in near real time, MARS data set, agro-phenology and farming practices data at European level.

The EAgPN was synthetically cited also in the JRC Multi Annual Work Programme 2007-2013, in the framework of project MARSSTAT.

Therefore JRC has afterwards changed its strategy and restricted its interest only to obtain phenological data by a call for expression of interests, issued in July 2006 (Suppl. to the Official Journal of the European Union 8/7/2006, 128/2006). At the moment the funds are expendible in 2007 and, maybe, in 2008 although the call will expire in 2009. Unfortunately the expressions of interest which arrived (March 2007) are very few.

Web references:

<http://www.jrc.cec.eu.int/download/mawp2007-2013.pdf>

<http://ted.europa.eu>.

This, briefly, is the international panorama of the recent or in progress main phenological activities. If we want to have a look also to the future, we can't leave out of consideration the 7th UE Framework Programme, to check if there are chances for phenological proposals.

THE SEVENTH FRAMEWORK PROGRAMME FOR RESEARCH AND TECHNOLOGICAL DEVELOPMENT (2007-2013)

The Seventh Framework Programme for Research and Technological Development (FP7) is the EU's main instrument for funding research in Europe and it will run from 2007-2013.

The broad objectives of FP7 have been grouped into four categories: **Cooperation, Ideas, People** and **Capacities**. For each type of objective, there is a specific programme corresponding to the main areas of EU research policy. The non-nuclear research activities of the Joint Research Centre (JRC) are grouped under a specific programme with individual budget allocation.

The maximum overall amount for Community financial participation in this Seventh Framework Programme is EUR 50.521 million. That amount will be distributed (European Parliament and Council, 2006) among the activities and actions as follows (in EUR million):

<u>Cooperation</u>	32.413
Ideas	7.510
People	4.750
Capacities	4.097
Non-nuclear actions of the Joint Research Centre 1	751

The specific programme on '**Cooperation**', the core of FP7 and its largest component, supports all types of research activities carried out by different research bodies in trans-national cooperation, according to ten key thematic areas (amounts in EUR million):

1) Health:	6.100
2) Food, Agriculture and Fisheries, and Biotechnology:	1.935
3) Information and Communication Technologies:	9.050
4) Nanosciences, Nanotechnologies, Materials and New Production Technologies:	3.475
5) Energy:	2.350
6) Environment (including Climate Change):	1.890
7) Transport (including Aeronautics):	4.160
8) Socio-economic Sciences and Humanities:	623
9) Space:	1.430
10) Security:	1.400

The thematic areas more close to our interests are:

1) Health

The objective is to **improve the health of European citizens and boost the competitiveness of health-related industries and businesses**, while addressing **global health issues** such as anti-microbial resistance, HIV/AIDS, malaria, tuberculosis and emerging pandemics.

In this area maybe there is chance for proposal on pollen, particularly with regard to allergenic aspects.

2) Food, Agriculture and Fisheries, and Biotechnology

Objective: building a European knowledge-based bio-economy by bringing together science, industry and other stakeholders, to exploit new and emerging research opportunities that address social, environmental and economic challenges: the growing demand for safer, healthier, higher quality food and for sustainable use and production of renewable bio-resources; the increasing risk of epizootic and zoonotic diseases and food related disorders; threats to the sustainability and security of agricultural, aquaculture and fisheries production; and the in-

creasing demand for high quality food, taking into account animal welfare and rural context. Research will focus, among other things, on threats to the sustainability and security of food production, including climate change.

6) Environment (including Climate Change)

Objective: sustainable management of the environment and its resources through the advancement of knowledge on the interaction between the climate, biosphere, ecosystems and human activities, and the development of new technologies, tools and services, in order to address global environmental issues in an integrated way. Emphasis will be placed on prediction of climate, ecological, earth and ocean systems changes, on tools and technologies for monitoring, prevention, mitigation and adaptation of environmental pressures and risks, including risks to health, and on tools and technologies for the sustainability of the natural and man-made environment. EU-wide cooperation in this field is needed in order to attain critical mass, given the scale, scope and high level of complexity of environmental research. This will facilitate common planning, the use of connected and interoperable databases, and the development of coherent and large scale observation and forecasting systems. Research should address the need for data management and information services and problems related to data transfer, integration, mapping.

From this quick look at 7FP, I think there is a chance of proposing phenological or agrophenological projects (particularly in the areas "Health" and "Environment"), but we have to start immediately to organize the design ideas, to prepare projects and to contact partners so as to be ready when specific call of proposals will be issued.

Web reference:

<http://cordis.europa.eu/it/home.html>

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