



**European Cooperation  
in the field of Scientific  
and Technical Research  
- COST -**

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**Secretariat**

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**Brussels, 13 December 2006**

**COST 331/06**

**MEMORANDUM OF UNDERSTANDING**

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Subject : Memorandum of Understanding (MoU) for the implementation of a European Concerted Research Action designated as COST Action ES0603: Assessment of production, release, distribution and health impact of allergenic pollen in Europe (EUPOL)

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Delegations will find attached the Memorandum of Understanding for COST Action ES0603 as approved by the COST Committee of Senior Officials (CSO) at its 166th meeting on 20/21 November 2006.

**MEMORANDUM OF UNDERSTANDING  
FOR THE IMPLEMENTATION OF A EUROPEAN CONCERTED RESEARCH  
ACTION  
DESIGNATED AS**

**COST ACTION ES0603**

**Assessment of production, release, distribution and health impact  
of allergenic pollen in Europe (EUPOL)**

The Signatories to this ‘Memorandum of Understanding’, declaring their common intention to participate in the concerted Action referred to above and described in the ‘Technical Annex to the Memorandum’, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 299/06 "Rules and Procedures for Implementing COST Actions", or in any new document amending or replacing it, the contents of which the Signatories are fully aware of.
2. 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.
3. The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at approximately 10 million EUR in 2006 prices.
4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.
5. The Memorandum of Understanding will remain in force for a period of 4 years, calculated from the date of the first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of the document referred to in Point 1 above.

**COST ACTION ES0603**

**Assessment of production, release, distribution and health impact  
of allergenic pollen in Europe  
(EUPOL)**

**A. ABSTRACT AND KEYWORDS**

Diseases due to aeroallergens are among major causes of a growing rate of morbidity and demand for healthcare. The overall prevalence of seasonal allergic rhinitis in Europe is about 15% and increasing. Adequate protective and pre-emptive measures require both the reliable assessment of production and release of various pollen species, and the forecasting of their atmospheric dispersion. The World Health Organization has therefore recommended new studies in the area.

The pollen-related research is currently conducted within several scientific disciplines, countries and targeted activities; however, their coordination could be substantially improved. Several poorly understood complex biological, meteorological and climatic factors can significantly affect the timing and strength of pollen seasons. Their proper investigation requires an integrated approach. The proposed concerted Action will establish a multi-disciplinary forum for (i) the critical review of existing information and its use in current assessment systems, and finding out the gaps of knowledge; (ii) the improved co-ordination of on-going research; (iii) the development of a strategy and an action plan that aim to bridge the gaps of knowledge; (iv) strengthening the dialogue with end users. Specific research directions will be: Pollen Production and Release; Pollen Transport, Transformation and Interaction; Applications and collaboration with End Users.

**Key Words:** pollen; aerobiology; phenology; allergic season forecasting; air quality

**B. BACKGROUND**

Diseases due to aeroallergens, such as rhinitis and asthma, are among major causes of loss of productivity and demand for healthcare. The prevalence of seasonal allergic rhinitis in Europe is ~15% and steadily increasing in many countries. Pollinosis mounts up to 45% of all allergy cases. Some studies show that exposure to high levels of birch pollen in infancy increases the risk of sensitization to birch pollen allergens and the risk of allergic asthma. Similar results are received for a number of other pollen types. The reason to the increase in allergic rhinitis is largely unknown but several factors are being discussed: hygienic 'western lifestyle', indoor and outdoor air pollution, general increase in pollen loads reported in most European countries, potential role of allergen exposure in development of allergic diseases, and increasing awareness on allergic symptoms.

The adverse health effects of allergens can be significantly reduced by either pre-emptive medical measures or behavioural adaptation of the outdoor activity. However, their planning requires reliable allergy-related forecasts several days ahead. Such forecasts should include the start time of pollen season, expected pollen concentration, area of exposure to a particular pollen type, timing of the peak concentrations and durations of the high season. The World Health Organisation (WHO) has recently stressed the importance of the timely forecasting of pollen seasons and recommended new research in this area ("Phenology and Human Health: Allergic Disorders", WHO, 2003).

Scientific activities and information related to pollen production, release, distribution and impact are spread between several disciplines and between various regional, national and international organizations, networks and projects.

Actual pollen concentrations in air (so-called pollen counts) are obtained from aerobiological observations performed by many European countries, which supply the information to a common database of European Aeroallergen Network (EAN, <http://www.univie.ac.at/ean/>). This well-coordinated European network also possesses the electronic system for the remote data submission, handling and acquisition, which has proved to be useful for near-real-time forecasting of the pollen distribution.

Information about timing of phenological phases, in particular, of the offset of pollen seasons needed for the pollen evaluation and forecasting is deduced from phenological monitoring mainly performed by national phenological networks. More than 30 such networks over the globe are partners of the European Phenological Network <http://www.dow.wau.nl/msa/e pn/index.asp> that holds a metadatabase of national observations (not the data themselves, however). The on-going COST-725 Action is aiming at improved co-ordination in this field and creation of a European phenological database with a primary application to climate studies.

A complementary effort is made by the International Phenological Garden project (IPG, [http://www.agrar.hu-berlin.de/pflanzenbau/agrarmet/phaenologie\\_en.html](http://www.agrar.hu-berlin.de/pflanzenbau/agrarmet/phaenologie_en.html)) established in 1957 and working on a voluntary basis. With a limited number of stations operated over long time period, the IPG network has its primary objective to monitor the influence of climate change on phenological processes in Europe.

Indirect information, which value is just being discovered, comes from satellites in a form of various leaf-area indices (e.g. Normalised-Difference Vegetation Index NDVI and microwave-based index). Research studies in Nordic countries have proved usability of this information for evaluation of the phenological phases over large territories. However, distinguishing between the different taxa remains difficult. Potentially useful are also direct measurements of aerosol optical thickness but their current sensitivity is insufficient for accurate pollen monitoring, except for extreme cases.

Analysis of the above information at various spatial scales showed that characteristics of pollen seasons (i.e., the start time and duration of high pollen concentrations) can be drastically influenced by the long-range atmospheric transport of pollen, which redistributes the grains over the whole European continent at a timescale of few days. These processes are important and in some episodes dominating in many regions, especially in Northern and Eastern Europe, where the flowering takes place later. This transport causes unforeseen and sudden increases of pollen concentrations that can occur up to a month before the start of the local pollen season. Last-spring outbreak of the pollen concentrations over large parts of Europe (May 2006), for example, was caused by transport of grains from Central Russia towards the west in such quantities that caused near- or exceeding the record levels counts up to Iceland.

Both the pollen abundance and its large-scale redistribution can potentially grow with changing climate, posing a significant risk to society.

Many countries produce pollen assessments and short-term forecasts for the needs of general public awareness, action planning by health-related authorities, medical organizations and hospitals. However, today they are based solely on local observations and do not consider the exchange of pollen between different regions. More integrated approaches based on dynamic atmospheric transport models and aimed at including all main parts of pollen life cycle, from production to release, transport and deposition, are under development in several countries, i.e. Finland, Denmark, Germany, and France. One example is built within the scope of the on-going POLLEN project (Finland, <http://pollen.fmi.fi>). A prototype of the system (Figure 1) was developed and set to operations in 2005 with a more extensive emission module introduced in 2006. More regional-to-local scale approach was accepted in the ASTHMA project (France, <http://www.enviport.com/>, completed in 2002) that involved dispersion models and neural networks for emission evaluation aiming at regional short-term forecasts during the flowering period in Southern Europe. Local-to-country scale integrated-modelling development is on-going in ENVIRO-HIRLAM project

(Denmark, <http://www.pollenprognose.dk>) and local to city/farm scale - with OML system (Denmark, <http://www.oml.dmu.dk>). In the US, the regional-scale forecasts are produced for several cities in Oklahoma and Texas (<http://pollen.utulsa.edu/mcforecast.html>) by means of trajectory analysis.

However, presently there is no modelling system in Europe or the US that can simulate in a comprehensive manner the whole chain starting from pollen production, release characteristics including the timing, transport and transformation in the atmosphere, and the impact on public health. Information for the development and evaluation of such a system is also spread between different disciplines, countries, and projects.

A concerted action is therefore urgently needed that would bring together scientists from various disciplines and allow for a detailed discussion, information gathering, exchange and analysis. Its final aim is a comprehensive synthesis of the current state-of-the-art, available and about-to-be-available datasets and tools, analysis of strengths and weaknesses of the current knowledge, as well as filling the gaps in the knowledge. The proposed concerted Action should provide a flexible forum for horizontal and vertical multi-disciplinary scientific integration by reviewing the existing methodology and data, comparing, harmonizing and suggesting new approaches, improving the data availability and cross-compatibility and facilitating the collaboration of scientists and end users.

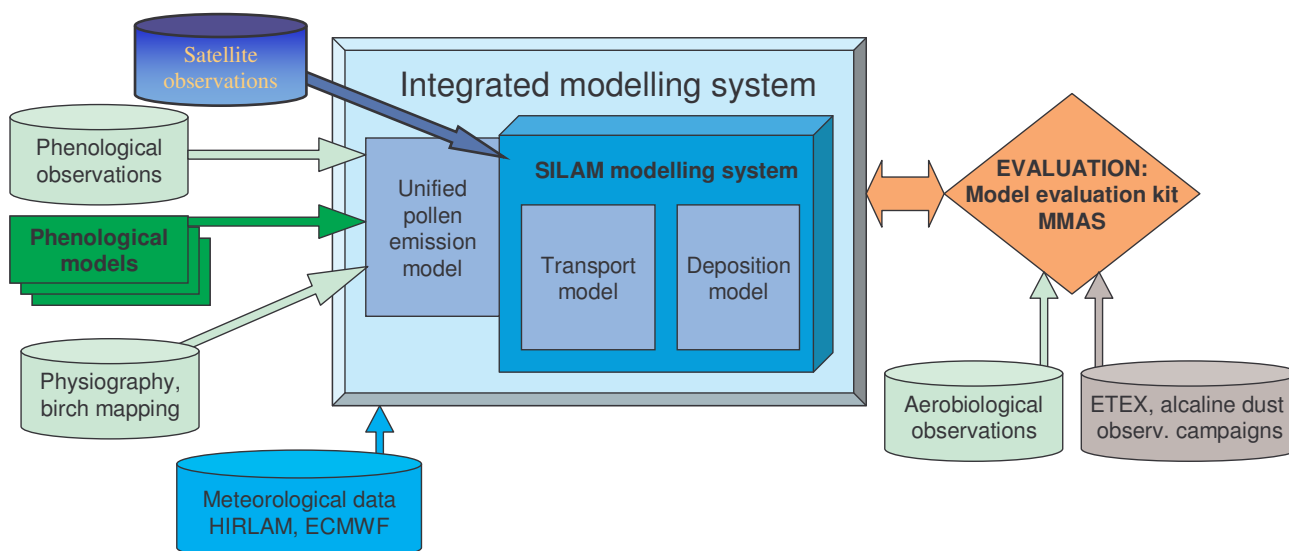


Figure 1. A schematic diagram of an integrated assessment system being developed within the POLLEN project (<http://pollen.fmi.fi>)

## C. OBJECTIVES AND BENEFITS

### C1. Objectives

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 Action will concentrate on:

- identification of the critical gaps in the current knowledge;
- better co-ordination 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 can be structured along three main lines reflecting the pollen lifecycle: (i) pollen production and release, (ii) pollen distribution in the atmosphere, and (iii) impact assessment, links with end users and applications. In these three main areas the specific objectives are:

Pollen production and release:

- to review and harmonise the existing direct and indirect information on distributions of key pollen species from local to European scales
- to review and evaluate against available observations the existing and developing models of pollen emissions over Europe, their strengths and weaknesses;
- to utilise in a comprehensive manner the semi-qualitative phenological descriptions of pollen production and release, as well as their dependence on short- and long-term external forcing
- to analyse the strengths and limitations of satellite observations and possibility of their near-real-time assimilation for pollen analysis and forecasting

Pollen distribution in the atmosphere:

- To review the existing models of pollen dispersion at various spatial and temporal scales
- To analyse the physical and chemical characteristics of pollen grains and to suggest a coherent descriptions of their atmospheric dispersion, transformation and deposition
- To assess existing evidence of pollen inter-action with atmospheric pollutants and to suggest the means of quantitative description and evaluation of such processes

Impact assessment, user links and applications:

- to evaluate the main characteristics of pollen distribution in Europe – historical records, spring pollen seasons, current trends – and their impact on society;
- to strengthen the dialogue with end users, identify their requirements, needs and quality criteria for pollen information systems;
- to identify target users groups, their specific needs and to evaluate the existing or developing systems against these criteria

Cross-cutting issues:

- to involve the key actors into the assessment work, strengthen the horizontal and vertical interactions between the research and application organizations and activities
- to encourage and promote the mutually-beneficial flexible data exchange across the regions, organizations and disciplines
- to evaluate the links between the different research areas (biology, meteorology, applied mathematics and medical science) and find out the complementarities of the available information, possibilities for evaluation of the existing or developing methodologies and areas where the synergy between the disciplines would bring the maximum added value.

## ***C2. Benefits***

The current Action will constitute an important element in a cross-disciplinary coordination of pollen-related research and applications. The planned comprehensive reviews of achievements and gaps, both within specific research areas and at their inter-connections, will lead to a strongly improved understanding of variety of processes determining the production, release, distribution and impact of allergenic pollen. It will highlight existing gaps in knowledge, help identifying the key areas for future studies and suggest a mid-to-long-term research agenda towards integrated assessment and forecasting systems for allergenic pollution.

Outcome from the Action will include benefits for:

- scientific community via (i) better integration of research from very different areas of natural science; (ii) bringing together the existing developments aiming at mutual enrichment and cross-validation; (iii) identifying important areas for future research and (v) providing a flexible forum for planning the future activities
- existing and potential end users of the allergenic pollen assessments and forecasts (public health authorities, researchers of clinical allergology, medical companies, practicing doctors, hospitals, etc.) via (i) creating a possibility for significant improvement of existing systems, (ii) promoting new comprehensive developments, and (iii) their integration across regions and scientific disciplines
- society and general public via (i) promoting the public-health related services and practices, such as publicly available forecasts of harmful episodes, and timely recommendations of behavioural adaptations, and individual medical treatments for mitigating the negative health impact, (ii) identification of targeted user groups and corresponding service needs.

A specific scientific impact of the Action will be

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

#### **D. SCIENTIFIC PROGRAMME**

The scientific programme of the Action will be defined along the three main directions responding to the specific objectives.

WP1 will be dedicated to pollen production and release and their quantitative descriptions. It will include analysis of observational (both in-situ and remote-sensing) and modelling (with various types of models) information for revealing key characteristics of these processes.

WP2 will concentrate on pollen atmospheric dispersion at various scales, its transport and removal mechanisms, physical and chemical transformations and inter-actions with other atmospheric constituents

WP3 will deal with applications of existing systems, their correspondence to state-of-the-art knowledge (WP1 and WP2) and challenges of the impact assessment tasks, as well as to the needs and requirements of the user community, which will be identified and involved in the dialogue. A special attention will be paid to dissemination of pollen-related information to various users – in accordance with their needs and existing or planned functionalities of the pollen information services.

The Action will focus on species that are important in various European regions, have substantial adverse health effects, and for which the scientific information exists thus allowing their assessment by a concerted Action. Examples are: olive trees (Mediterranean region), birch (Central and Northern Europe), ragweed (invading taxa, presently over Southern and partly Central Europe), various grass species (the whole of Europe), etc. The scope of the action will include local-, regional- and continental-scale dispersion.

Formulated along these lines, the Action will, for the first time, provide a flexible forum for exchange of pollen-related information between all scientific and user communities from all interested countries. Its cross-cutting activity will include coordination with existing thematic

networks, such as EAN and European Phenological Network EPN and corresponding regional and national networks, IPG, European and national meteorological and environmental institutes, European Space Agency (ESA), as well as with national and international projects, such as PROMOTE (ESA project combining several monitoring and forecasting activities, including one pollen-related service) and POLLEN (Finnish Academy project aiming at European-scale pollen forecasting system). Such integrated approach is new and will provide unprecedented possibilities for promoting complex research of allergenic pollen pollution.

### **D.1. Pollen production and release**

The WP1 will review and harmonise the existing information regarding the sources of atmospheric pollen. An integrated description of pollen emission includes several key parts, which will be addressed by the current WP.

The first pre-requisite for quantitative description of pollen production and release is an adequate mapping of the distribution areas of the corresponding taxa. The existing information strongly varies from species to species. For example, the olive tree is human-planted and thus its distribution is quite well-known at least at national or municipal levels. For such types of species the main task would be to aggregate the information from different European countries using both agricultural inventories and satellite maps. For some other species, such as birch, part of the data can be obtained from forest inventories mainly conducted at regional and national levels. However, in some countries, the birch species are not considered as important for forestry and thus not included into such inventories. In Western and Southern Europe, birch trees are scattered and sometimes planted as decorative elements or, to the opposite, eliminated from cities as highly allergenic ones. For such cases, the combination of in-situ information with social data and satellite observations becomes nearly the only way to obtain viable European inventory. Similarly, the mapping of grass vegetation requires combination of agricultural inventories, national floras and remote sensing information (pastures, clear-cut areas, rushes). Another example can be ragweed, an invading species, which inventories are practically non-existent but would be highly important for understanding and monitoring the distribution of such plants. For such cases, the main information will probably come from various campaigns and local observations combined with modelling activities (first of all, inverse dispersion and ecological modelling). A particularly challenging will be the situation with grasses as there are several hundred species with different phenological behaviour contributing to the allergenic mass of grass pollen in Europe.

The second set of problems is connected with description of the pollen production and release in each specific region and their forecasting both before the flowering starts and during the main season. The relations between the amount of pollen and meteorological factors during the formation of inflorescens have been considered for several plant taxa but so far the information is insufficient for quantitative assessments of the actual amount of pollen expected for specific year for specific region. Cross-comparison of the existing information and data and harmonization with qualitative descriptions used in biological studies (classes, such as “low”, “moderate”, and “abundant”) will constitute the second set of tasks for the WP1

The third task for the WP1 will include the analysis and harmonization of models and descriptions of flowering seasons and their dependence on external forcing. Numerous studies have shown that the most important parameter determining the start and progress of flowering is the accumulated heat usually represented as an integral of daily or hourly temperatures exceeding the species-specific threshold. However, such models developed for one region are practically never applicable already for the neighbouring area. It points out on either some missing phenomena that significantly affect the plant reaction to heat (e.g. the genetic differentiation between the regions) or to mathematical deficiency of such empirical approaches (for example, over-fitting to local data). An extra complexity is introduced by a very wide variety of features of pollen seasons of different

plants – from sharply starting and ending seasons of most of central- and northern-European trees to more than half-year pollinating of some southern-Europe taxa.

The final set of problems included into the WP1 concerns the pollen release from anther and its response to external (first of all, meteorological) forcing. The key target will be to determine the relationships between such forcing and response of vegetation in terms of seasonal pollen production and daily variations of release rates, specific for different regions. Numerous qualitative and semi-quantitative descriptions exist and their comparison for different plant species within this WP will finally aim at a confined list of the most important processes affecting the pollen release and quantitative descriptions of their influence. This part of the WP1 is very closely connected with the local-scale part of WP2.

The key deliverables of the WP1:

- state-of-art inventory of distribution of the key pollinating species across Europe, as compiled from all available national and international data, its quality assessment, gaps in the knowledge and recommendations for their closure
- comprehensive review of qualitative and quantitative descriptions of pollen production, release and distribution processes, and recommendations addressing the weak parts of the current knowledge-base
- review of existing approaches and suggestions towards combining the satellite-derived information with models and in-situ data for assessing the characteristics of pollen production and release parameters

## **D.2. Pollen atmospheric distribution and interaction**

The WP2 will respond to the second set of specific Action objectives related to description of pollen lifecycle after the release from anther.

From the atmospheric modelling point of view, pollen grains belong to a group of very coarse but comparatively light aerosols with limited atmospheric lifetime. Typical concentrations in air very rarely allow remote-sensing observations because the optical thickness of pollen cloud is usually well below the detection limits of the corresponding instruments. The pollen monitoring network in Europe is well-coordinated but the number of measurement sites is lower than that of “classical” air quality networks. Therefore, in addition to the pollen-specific information, the vast amount of available data regarding the behaviour of “standard” anthropogenic and natural atmospheric constituents can significantly help in assessment of pollen distribution with air masses.

The first set of tasks of the WP2 will be the review of available information on local-scale processes taking place immediately after the grain release from anther. This part of work will be closely coordinated with WP1 as these local-scale processes are strongly linked with the release itself and thus should be considered together. The key features to be quantified are the fraction of pollen locally deposited shortly after the release and the external parameters determining this fraction. In particular, the meteorological variables, such as wind speed, humidity and turbulence, will be among the first considered.

At larger scales, it has been shown that, despite the large size of grains, pollen can still be considered as semi-stable suspension in air streams with just moderate sedimentation velocity. However, these theoretical considerations are to be cross-verified with available observations and model calculations. Scavenging with precipitation is the most-important mechanism depositing grains from the air but the corresponding processes are poorly known because of very limited information on pollen behaviour in clouds. The task of the WP2 will be to collect all data in this regard and compare them with characteristics of other (better studied) atmospheric constituents with similar physical features. Regarding the pollen transformations during the atmospheric transport, it is currently accepted that the only important process is an exchange of water and the grain content (allergens and bioactive lipid mediators) with the surrounding air. It can significantly alter the

physical characteristics of the grain and its transport features, as well as the allergen content and potential health effects, therefore the WP2 will take these processes into account in close coordination with WP3.

The third task for the WP2 will be to collect available and emerging information on cross-interaction of pollen with other atmospheric pollutants. This is probably the most challenging and the least known part of the pollen behaviour in the atmosphere. Considerations will distinguish between the combined health effect of multi-pollutant contamination (included into the WP3) and the physical processes initiated by pollen or happening with the grains due to presence of other pollutants. Examples are accumulation of some toxic pollutants on the grain surface, agglomeration of pollen grains absorbing various species to these large particles, and release of allergens from the grains catalyzed by fine aerosol. Collection and analysis of the information will aim at qualitative ranking the corresponding processes to reflect their importance for overall pollution levels and impact assessment studies (with a link to WP3). Wherever the amount of information is sufficient, the quantitative parameterizations will be targeted.

The key deliverables of WP 2:

- analysis of existing models of pollen dispersion at different spatial scales and recommendations for their further developments
- preliminary conclusions and recommendations concerning the inter-action of pollen and air pollution and research needs in the area

### **D.3. System application, utilization, health impact, and collaboration with end-user community**

A set of tasks for the WP3 will address the current applications of the knowledge-base studied by WP1 and WP2 and establish/strengthen the links with existing or potential users and stakeholders of pollen assessment and forecasting systems.

Currently, it is widely accepted that the key differences between pollen and most of other atmospheric pollutants are: (i) direct and immediate influence on public health, (ii) limited means of abating the negative impact. The second peculiarity, in particular, reduces the interest of potential beneficiaries to comprehensive pollen assessment systems because their action plans and means of utilization of the pollen information are not straightforward in comparison with “classical” air pollutants where numerous short- and long-terms abatement scenarios have been developed and implemented since 1970s. However, there are existing mitigation strategies and practices (admittedly, not common so far) that may significantly reduce the consequences of allergenic episodes and even affect the episodes themselves. For example, the possibilities of behavioural adaptations are not yet fully explored and utilised. There is also a set of interesting but barely analysed actions undertaken by some countries and municipalities in controlling and/or reducing the allergenic content within cities and regions by plant-controlling actions. The efficiency of such measures is practically unknown and cannot be evaluated without close interactions with the scientific community, which can provide also some recommendations on the measures themselves.

The key task of the WP3 will be to collect the existing experience and initiate a broad discussion regarding the practical side of pollen information systems going beyond the public warnings currently practiced in many European countries. This will include contacts with European Federation of Asthma and Allergy Associations (EFA, <http://www.efanet.org>), which brings together the national associations of asthma and allergy patients, public health authorities, medical companies and hospitals with questionnaires and surveys regarding their existing or potential demands on pollen information as well as brainstorming the possible ways of adaptation and mitigation. A dialogue with these key groups of users will be aimed at formulating key requirements for pollen assessment and forecasting systems (specific products, their content and timeliness, target groups, means of delivering, etc.) and the corresponding action plans from the user side. It will help the users to recognise the existing potential and possibilities in this area and

can eventually catalyze the new developments or adjustments of existing allergy-treating programmes and practices.

The second task of the WP3 refers to a harmonized assessment of the strength of the pollen episodes across Europe. At present, there is little harmonisation between the threshold values applied for different species in different countries (thresholds are useful for communicating the pollen information to end-users). This is partly connected with objective variability of the people sensitivity to specific allergens and partly has to be attributed to a lack of coordination. Wherever possible, the WP3 will collect and compare the existing methodologies for assessing the threshold levels for allergenic species in different European regions and, in close coordination with end users, elaborate the recommendations towards the methodology unification.

Finally, the WP3 will collect and analyse the information regarding the multi-pollutant effect on human health where pollen can play a role of just one of ingredients in a mixture of harmful substances whose combined impact may in some cases significantly exceed a sum of contributions of individual pollutants. Albeit such studies are very scarce, the evidence of mutually-enforcing interactions of pollutants is mounting and its complex review will be timely and may strongly contribute to the mid-to-long-term research agenda, cooperation with clinical research groups working with air quality subjects, and public health studies.

The key deliverables of the WP3:

- identification of the user target groups and specific pollen-related products best-fitting the needs of each group
- an analysis of the current satisfaction of the existing user groups and recommendations for developments of the pollen assessment systems
- recommendations for the potential users with regard to best practices of using the pollen information
- preliminary assessment of multi-pollution impact and the role of pollen in it.

#### **D.4. Cross-cutting activities within the Action and with other organisations and projects**

Cross-cutting activities of the current Action will consist of (i) ensuring synergy and information exchange between the above WPs, (ii) establishing and maintaining the links with key actors outside the Action – European and national aerobiological and phenological networks, research projects, end-user communities, in particular, with European Federation of Asthma and Allergy Associations EFA, public-health authorities, medical companies, doctors, etc.

The WP1 and WP2 mainly analyse the aspects of the pollen stress and means of its evaluation and forecasting, while the WP3 deals with consequences of this stress and considers the mitigation strategies thus being one of the key users of the WP1 and WP2 findings. From the other side, the end-user demand identified and harmonised within the WP3 will be communicated to and discussed with WP1 and WP2.

Connections with the main European networks, projects and other activities are comparatively straightforward as representatives of most of them expressed their willingness to be involved in the Action directly as Management Committee members or as invited experts. Such arrangement, being very beneficial for the information exchange and coordination, will particularly simplify the problem of the data availability across Europe and across specific consortia, which is currently an issue due to certain organizational and commercial restrictions. The issue will be given proper attention via dedicated agreements, organizational and technical measures (see Organization section below) in order to ensure that the Action work is not constrained by the limited data access.

## E. ORGANISATION

A structure with three Working Groups (WG) is envisaged following the above Work Packages: (1) Pollen Production and Release; (2) Pollen Transport, Transformation and Interaction; (3) Applications, Impact Assessment and Links with Users.

A three-phase schedule of the Action with dedicated milestones for the WGs activities is envisaged:

- Phase 1: Planning, operational arrangements, establishment of WGs and inventories (year 1);
- Phase 2: Main assessments, benchmarking and design work to be conducted by all WGs (years 2- 3);
- Phase 3: Final conclusions and recommendations; reports and final publications (year 4).

A preparatory phase will be implemented during the first year and will help building an initial inventory of existing activities in various European countries. Much of the compilation work will be conducted using participants' networks and national arrangements. These preliminary inventory results will be assessed to establish the detailed work programme, activities and the membership of WGs. To support this, the opinions of the wider community will be sought through the first Action's Workshop.

During the main phase 2, interactions between the WGs will be firmly established and maintained, so that they will work in synergy, eventually coming together in the final phase (last year) during which the results will be completed, integrated, reviewed and published. Aspects of the activity will be also presented in workshops, meetings, etc., and published at national and international level during the intermediate period.

During the final phase, joint recommendations of the WGs will be compiled in the final report for wide dissemination. Particular attention will be paid to the dissemination of results towards end users via technical and practical publications and workshops (see the Dissemination section).

The Management Committee (MC) and WGs will meet twice a year, usually in conjunction with each other. A rapporteur from the DC will be appointed to monitor the planned activities and outputs. WG and expert meetings may be organised in different occasions, according to specific aims. Each WG will be coordinated by a chairperson who will report to the MC. A leader will also be allocated for each sub-area of the WGs. When required, external experts will be invited to MC and WGs meetings to seek advice and/or enlarge the application basis of the Action.

The MC will supervise the overall progress of work against the listed objectives. It will link and coordinate WG-activities so that the knowledge, needs and results of each WG will serve as input to the others, and will ensure wide dissemination of the results. The MC-chair, vice-chair and the three WG-chairpersons will constitute the leading structure of the Action.

The short-term scientific missions (STSM) will be used to maximise the exchange of experience among the participants. Young scientists and female participants will be particularly encouraged to use the STSM mechanism for their broader networking and advancing their career.

A Web site will be created within the first six months of the Action. It will be updated in a timely and continuous manner to serve as an information management and working tool, act as a focus for information exchange and as a medium for disseminating the results of the Action.

Care will be given to involving all key actors in the field including the international networks listed in the background section. Their representatives will be either involved as invited experts or national delegates from the hosting countries (see the list of interested scientists).

Necessary technical and organizational support will be given to the problem of data exchange as a part of cross-cutting activity D.4. These will include, for example, the dedicated protected data exchange services at the Action Web site, encouraging the information exchange via the STSM or other mechanisms, and involvement of the data producers and owners into the Action work and publications. The MC will pay special attention to the issue and form, if this appears necessary, a Task Force for the data exchange involving all data producers and owners to elaborate the mechanism of making the state-of-the-art data available for the Action and, to the largest possible extent, to a wider communities.

It is foreseen that the Action will have an active female scientists' participation since the list of potential participants already includes about 40% of women. The allergy- and biology-related studies in general are also popular among the female scientists. According to preliminary survey, nearly all participating teams actively involve the young researchers, which will be further supported by the Action via STSMs and other mechanisms (e.g. publication or meeting attendance support).

WGs will include a wide spectrum of experts with the main aim to produce a comprehensive review of existing information and foreseen studies, as well as to prepare guidance for future developments. By its nature, such work requires flexible and dynamic consortium, which can easily incorporate new participants with their specific contributions developed elsewhere. The most appropriate form is then a concerted action with strong networking capabilities, such as the COST Action.

All organizations and scientific groups involved in the current proposal have their own funding for their activities coordinated by the current Action and thus do not count on this Action for supporting the actual developments.

The scientists involved in the current Action will specify their contribution and goals in a form of Expression of Commitment, similar to the practise of former Meteorological COST Domain. This will ensure the efficient kick-start of the Action, speed-up the formation of the Working Groups, and then largely simplify monitoring of the progress by the WG leaders and the chairman of the Management Committee against the proposed contributions. This mechanism will also ensure involvement of all Action participants to the work in the corresponding WGs.

## **F. TIMETABLE**

The overall duration of the Action is 4 years during which the work will be arranged in three phases. Workshops with invited experts (national phenological and aerobiological networks, EAN, IPG, IBS, etc) will be organized every year during the Action. The final workshop for wrapping up conclusions for the final report will be held during the last half a year with invited external experts and scientists and broad presentation and discussion of the Action results.

Phase 1: Inventory (1<sup>st</sup> year). Specific tasks:

MC: Establish WG's membership and their work plans, as well as the contacts with existing and identification of new end users and major stake holders.

WG1: Inventory of existing information, networks, data specifics, quality and availability

WG2: Inventory of knowledge of the pollen processes in the atmosphere, their parameterizations

WGs 1&2: joint inventory of the modelling requirements to the observational data

WG3: Starting the dialogue with end users, collecting the initial feedback, needs and specific requirements, support of the MC with the end-users contacts.

All WGs: - joint determination of horizontal links and cross-group information flows

- Report to MC. Preparation of the 1<sup>st</sup> Workshop.

At the end of phase 1, preliminary inventories of the knowledge and user communities are expected. Phase 2 starts from preparation on their basis of the detailed work plan until the end of the Action.

Phase 2: Development, Assessment, Applications (2<sup>nd</sup> – 3<sup>d</sup> years)

- MC:
- Finalising the WGs and preparing the detailed work programme based on outcomes of phase 1 (first 6 months of the Phase 2).
  - Planning and executing Short Term Scientific Missions as appropriate.
  - Monitoring the WGs activities and advances outside the Action.
  - Dissemination of results through publications and participation in international workshops and in Action Workshops (1<sup>st</sup> and 2<sup>nd</sup>).
  - Preliminary definition of final report structure (year 3).
  - Starting the preparation of the final Action Workshop (year 3).

- All WGs:
- Regular WG meetings for planning, implementing, reviewing and synthesising the work
  - Report to the MC every 6 months on the progress of work
  - Supporting and extending the cross-WG links ensuring the horizontal integration of the information
  - joint analysis of the Action stakeholder needs and means of their satisfaction by the emerging systems

Phase 3: Synthesis and Dissemination of Action results (4<sup>th</sup> year)

- All WGs: - Finalisation of the expected outputs.

- Contributions to the final report

- MC:
- Final Workshop: presentation of the Action conclusions, especially to end-users.
  - Completion of the final report.
  - Dissemination of results through reporting and participation in international workshops and committees.

	Year 1				Year 2				Year 3				Year 4			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Phases	1	1	1	1/2	1/2	2	2	2	2	2	2	2	2/3	3	3	3
MC-meetings	X		X		X		X		X		X		X		X	
WG-meetings			X		X		X		X		X		X		X	
WG reports					X		X		X		X		X		X	
Reports to TC				X			X				X				X	
Final report																X
Workshops							X				X				X	
Web site		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

## G. ECONOMIC DIMENSION

This Action is aimed at covering most of European countries. The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: Austria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Italy, Lithuania, The Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, UK. An interest to the Action was also expressed by two Russian institutes and one from Belarus (Russia and Belarus are very important source areas for various types of pollen). According to these involvements, it is expected that more than 15 COST member countries will participate in this Action.

On the basis of national estimates, the economic dimension of the activities to be carried out under the Action has been estimated over 10 Million € (including ca. 100 person-years) for the total duration of the Action. This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.

## H. DISSEMINATION PLAN

The results of the Action are of specific interest for various actors involved in atmospheric environment issues, both on the scientific and environmental applications sides. The direct users of the deliverables are (i) scientific institutes and laboratories working in the related areas, (ii) organizations coordinating European and national research programmes, (iii) medical research institutes and companies, public health authorities at various levels, (iv) hospitals, practicing doctors and medical companies.

Several partners of this proposal hold the national or regional pollen season forecasting duties. They also have mandates to inform the public on the developments in the area. The Action will utilise this channel to disseminate the results and explain the benefits to the widest possible audience. It is also expected that improved quality of the pollen information due to synthesising work of the Action will provide additional benefits to the public.

Dissemination of the results will be performed by:

- a web-site continuously updated during the Action including reports on the progress of the Action and selected results,
- scientific papers in peer-reviewed journals and reports;
- Scientific and application meetings, conferences and workshops organised, co-sponsored or otherwise supported at various levels by the Action (see the list below)
- Information provided to relevant international organisations concerning the process, solutions and outreach in order to achieve a broader impact, e.g.: European Federation of Asthma and Allergy Associations (EFA), the European and Nordic Aeroallergen Associations, the International Society on Biometeorology (ISB), and the World Health Organization (WHO).
- existing participating or collaborating phenological and aerobiological networks and their channels of dissemination of the information;

Special efforts will be deployed to have contacts with as many key players and stake-holders as possible. Links will be established with the European Commission (DG-Environment), relevant European networks and bodies, and also with World Meteorological Organization and UN Economic Commission for Europe (UN-ECE). Links will also be established with international societies interested in problems of air quality and allergenic pollution. During the meeting of the MC and WGs, international agencies involved in the fields of this COST Action, and representatives of the users, will be invited for exchange of information, coordination, and developing synergies and collaborations.

At least one model (SILAM, Finland) developed by the Action participant is a public-domain system freely available through the internet, which will further strengthen the dissemination outreach and provide wider opportunities for promoting the COST and specifically the Action work around the global communities.

Organised workshops will also be a mean for disseminating the results especially among potential users and for promoting COST activities in Europe and worldwide. Wherever possible the Action will host workshops jointly with other international meetings. These will include:

- The International Symposium on Biometeorology
- The International Congress on Aerobiology
- The 4<sup>th</sup> European Symposium on Aerobiology
- The NATO International Technical Meeting series on Air Pollution Modelling and its Application
- The Clean Air Congress
- International Conference on Urban Air Quality - Measurement, Modelling and Management;