

Executive summary



Background

In recent years, several vector-borne, parasitic or zoonotic diseases have (re)-emerged and spread within Europe which has had major health, ecological, socio-economical and political consequences. Most of these outbreaks are linked to global and local changes caused by either climate change, human-induced landscape changes or the direct impact of human activities. The EDEN Project (Emerging Diseases in a changing European eNvironment) offers a unique opportunity to prepare for uncertainties about the future of the European environment by exploring the potential impact of environmental and other changes on human health.

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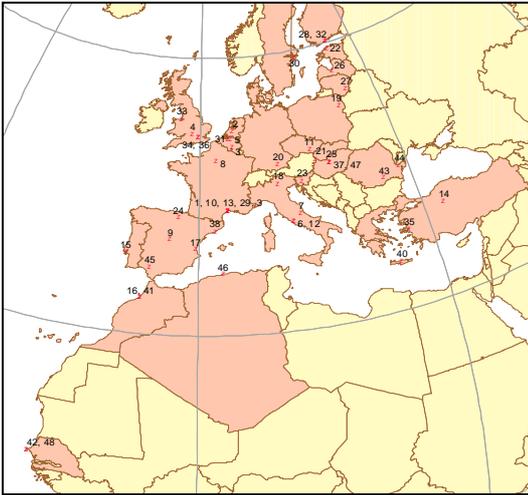
Objectives of EDEN

EDEN's aims are to identify, evaluate and catalogue European ecosystems and environmental conditions linked to global change, which can influence the spatial and temporal distribution and dynamics of human pathogenic agents. Through a co-ordinated approach, the project will develop and co-coordinate, at the European level, a set of generic methods, tools and skills such as predictive disease emergence and spread models, and will identify requirements for early warning, surveillance and monitoring tools and scenarios, which can be used by decision makers for risk assessment, decision support for intervention and public health policies at either the EU, the national or regional level. Part of EDEN's innovation will be to combine spatial data (earth observation data, GIS etc) with epidemiological data.

Recognition that the environment may affect the risk of both infectious and vector borne diseases is not new, but over the past decade a better understanding has been reached of the mechanisms that underlie the complex interactions between infectious agents, the hosts and the biological and physical environments. Vector-borne zoonoses tend to be the most ecologically complex infectious diseases in which environmental change may have the greatest number and diversity of effects, some promoting transmission and others diminishing it. Habitat and species losses may reduce the normal buffering within ecosystems leading to disease outbreaks. Finally, the juxtaposition of new vectors, hosts and parasites within disturbed ecosystems provides a potential for the evolution of novel transmission pathways and thus new 'emerging diseases'.

Scope of EDEN

EDEN integrates research in 48 leading institutes from 24 countries (see map) with the combined experience and skills to reach the project's common goals. The eco-geographical diversity of the project area covers all relevant European eco-systems from the Arctic Circle in the North to the Mediterranean basin and its link with West Africa in the South, and from Portugal in the West to the Danube delta in the East.

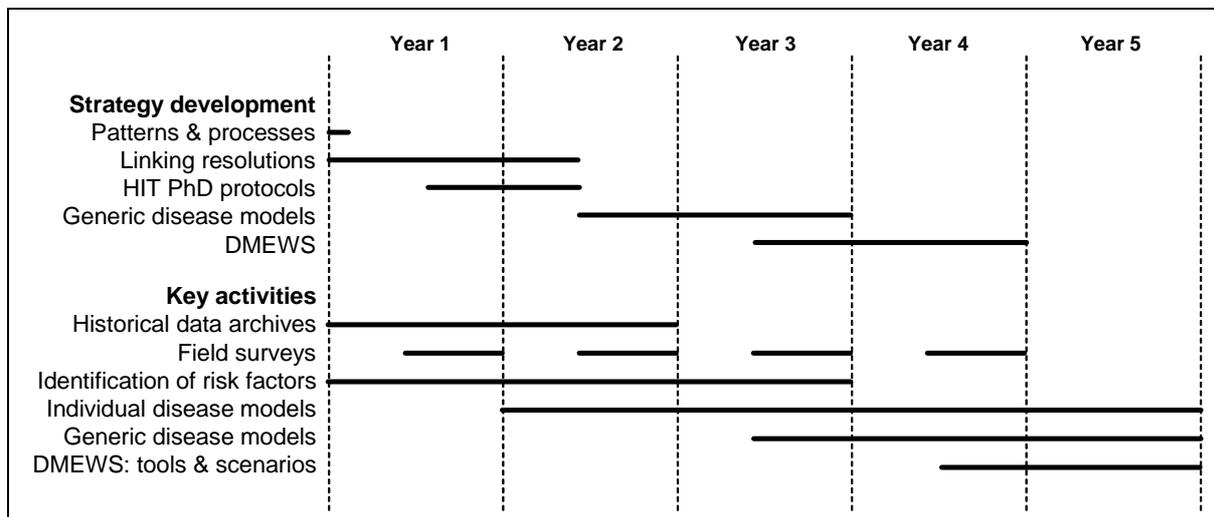


Algeria: Institut Pasteur d'Algérie (46). **Belgium:** Euro-AEGIS EEIG (5), Université catholique de Louvain (3), University of Antwerp (31), Agro-veterinary Information and Analysis. **Czech Republic:** Academy of Sciences of the Czech Republic (11). **Estonia:** National Health Development Institute (22). **Finland:** Finnish Forest Research Institute (28), University of Helsinki (32). **France:** Université de Montpellier I (39), Entente Inter-Départementale pour la Démoustication du littoral méditerranéen (10), Institut National de Recherche Agronomique (29), Institut de Recherche pour le Développement (13), Institut Pasteur de Paris (8), Centre de Coopération Internationale en Recherche Agronomique pour le Développement (1). **Germany:** Ludwig-Maximilians-Universität Muenchen (20). **Greece:** University of Crete (40). **Hungary:** "Johan Béla" National Centre for Epidemiology (25), Faculty of Veterinary Science (37), MTA Állatorvos-todományi Kutató Intézet (47). **Italy:** Istituto Superiore di Sanità (12), IZS dell'Abruzzo e del Molise "G. Caporale" (7), University of Rome "La Sapienza" (6), Centro di Ecologia Alpina (18). **Latvia:** Public Health Agency (26). **Lithuania:** Centre for Communicable Diseases Prevention and Control (27). **Morocco:** Institut Agro-Vétérinaire Hassan (41), Institut National d'Hygiène (16). **Netherlands:** University of Utrecht (2), **Poland:** Medical Academy, Białystok (19), Universidade Nova de Lisboa (15). **Romania:** Danube Delta National Institute for Research (44), The National Institute of Research and Development for Microbiology and Immunology "Cantacuzino" (43). **Senegal:** Institut Supérieur de la Recherche Agronomique (42), Institut Pasteur de Dakar (48). **Slovakia:** Slovak Academy of Sciences (21), **Slovenia:** Medical Faculty of Ljubljana (23), **Spain:** University of Barcelona (38), Instituto de Salud Carlos III (9), Instituto Vasco de Investigación y Desarrollo Agrario (24), Universitat de Valencia (17), Consejo Superior de Investigaciones científicas (45). **Sweden:** Swedish Institute for Infectious Disease Control (30). **Turkey:** Ege University Medical School (35), Hacettepe University Faculty of Science (14). **United Kingdom:** London School of Hygiene & Tropical Medicine (36), Natural History Museum (34), University of Liverpool (33), University of Oxford (4).

Strategy and timeframe

EDEN has selected for study a range of indicator human diseases that are especially sensitive to environmental changes and are studied within a common scientific framework (involving Landscapes, Vector and Parasite bionomics, Public Health, and Animal Reservoirs). Some of these diseases are already present in Europe (Tick- and Rodent-borne diseases, Leishmaniasis, West Nile fever), some were present historically (Malaria) and so may re-emerge, whilst others are found on the fringes of Europe (Rift Valley Fever) in endemic regions of West and Northern Africa. The diseases are studied in so-called "vertical" subprojects (SP). The integration of epidemiological studies which leads to the development and application of generic tools is achieved through a series of horizontal activities (Horizontal Integration Team, HIT) including: (i) Data-management and information systems, (ii) Remote sensing tools, both High resolution environmental change and Low Resolution spatial modelling (iii) Disease transmission modelling, and (iv) Biodiversity monitoring and assessment. New concepts are then explored in EDEN, the "horizontal" activities on biodiversity, for example providing intellectual and logistical support to the Sub-Projects in the general field of evolutionary epidemiology and ecosystems analysis.

From the general timeframe of the project shown below, it is clear that studies on specific disease processes and patterns (health-environment research) conducted during the first half of the project will enable in the second half, the development of integrative models which can then be translated to tools to assist decision support and to feed dissemination will become increasingly important later in the project lifetime.



Results after one year

During the first months of the project, the partners involved in vertical SP's have selected some contrasting study areas to allow a comparative approach and have collected and collated all the information available for the description of the chosen ecosystems. In addition, historical data on disease distribution, incidence and public-health activities have been collected. Epidemiological field surveys have been initiated, including the sampling of vectors, reservoirs, and hosts, so as to describe the local processes of transmission and the environmental parameters which influence it. Trapping protocols and diagnosis methods have been harmonised within each SP before the start of the activities.

The HIT have been requested to advice on the choice of the study areas. Then, diachronic high resolution remote sensing data have been acquired for the assessment of environmental changes. In addition a time-series of pan-European low-resolution satellite imagery describing various aspects of the vegetation and climate are now being processed to extract eco-climatic seasonality signals and habitat seasonality 'signatures' of relevance to emerging diseases. An EDEN standardised data archive of raw and processed remote sensing imagery has been made accessible through a central data management system. This web-based, user-friendly data management tool also provides the partners with data-storage standardised guidelines, and will finally include a central database where sub-project data archives are progressively expanded in accordance with agreed intellectual property rights.

To generic predictive models

The ultimate use of all these data is to test and feed disease-specific mathematical models which simulate the impact of environmental changes and human activities on the dynamics of vectors/pathogens populations and on the spread of emerging disease, as well as the efficiency of control policies. While some of these models, for example the basic reproduction rate (R_0) model, are well-known by the EDEN community, they have never been used so widely and with such a practical perspective.

Since such an innovative integrative approach doesn't as yet exist, the Steering Committee has discussed and written, during the first year of the project, the first chapters of the EDEN strategy document. See also the part on 'strategy development' in the general time frame figure to illustrate the chosen stepwise approach. The global approach developed in this document is as follows: Through the studies of selected diseases, risk indicators and individual diseases, generic models are made available to users. The R&D innovations are also combined with external knowledge flows (other projects outputs, existing models, published sources) to develop larger integrated health-Environment models.

Both inputs are designed to underpin a Disease Monitoring & Early Warning System (DMEWS). Most of the deliverables are GIS-based and will be publicly accessible on the Internet at a later stage of the project. Many methodological details for the different levels of integration are given in the strategy document.

The first part of the strategy document has been discussed by the Steering Committee and submitted to the Advisory Group for evaluation. It will be further discussed during the forthcoming annual meeting in January 2006 and a specific workshop is planned in month 16 in order to finalise the current chapters. More particularly, the horizontal PhD students funded by EDEN have been requested to submit scientific manuscripts illustrating their respective study protocols for inclusion.

Training and dissemination in EDEN

The involvement of PhDs is also part of the training strategy of EDEN, as are some horizontal standardisation workshops. Three have been organized during the first year on the following topics: i) data standards, GIS and remote sensing ii) mathematical modelling, iii) ethical issues and standardisation of laboratory activities. In addition, Sub-project leaders have been asked to address field work standardisation issues within their sub-projects.

Though slightly delayed, dissemination activities are now well underway. The first version of the EDEN Website (<http://www.eden-fp6project.net>) went live three months after the start of the project and a final 'professional' version with a new EDEN design was online in month eight. It includes both public and restricted access sections for partners to read pages for internal discussion and information, and provides links to the EDEN data archive and its associated utilities and links.

A newly designed leaflet has been printed and is disseminated with an additional document: "EDEN in 3 pages", available in English and in French, which gives more detail about the project. The three first newsletters have been distributed together with the EDEN leaflet and an external user questionnaire in December.

More details on the achievements of the 1st year

A brief overview of the project early successes is summarised below:

- A great deal of hard time-series data relevant to the changing epidemiology of selected diseases have been acquired and archived, from many contrasting ecosystems and countries within Europe. Moreover, these data come at regional scales within each country, allowing analysis of the considerable spatial heterogeneity of epidemiological patterns and the causative factors. This is the first time these valuable data have been extracted from national archives and collected together in such a way.
- All the areas for focussed work have been identified and some of them have already been investigated with the help of appropriate Horizontal Integration Teams. Field sampling sites have been selected on the basis of epidemiological patterns, taking into account the availability of climate and vector/hosts records and the accessibility of the sites from the partner's institutes.
- Each partner has searched for available data on changes in vector populations, disease incidences and public-health activities from 1970 to the present. Not all data sets are yet complete, in some cases because the data just do not exist, and in other cases because the process of extraction has proved to be more difficult and prolonged than anticipated. Continuous records for the whole or even part of the 30-year period can prove to be very scarce. National records of historical trends in changes in relevant public health activities have been explored, and in some cases, suggest that the impact of the development of improved methods of diagnosis may give a false picture of increases in annual numbers of registered cases.

As was anticipated from the start, the study of sociological indices of behaviour is one of the most difficult topics to be explored, and as expected this sort of information has proved to be scattered and

heterogeneous in both nature and quality. The data are extracted from a range of different sources; and include, for example, information on employment, industrial pollution and agricultural productivity.

- For most of the SP, the sampling protocols were discussed and defined before the start of field activities. Some topics have still to be discussed - for example the conclusion of the lab security and standardisation workshop. For some teams, new advanced molecular diagnostic techniques are required and are currently being developed. However, most of the partners have been able to organise the field activities very quickly and routine monthly sampling of mosquitoes, ticks, birds, rodents and so on have largely started on schedule.
- In each SP, the data are being compiled into standardized forms and are being prepared to send to the central data management archive. Statistical analyses have already started in some sub-projects, though only if the data is validated and checked. Clearly, analysis of the epidemiological patterns must precede any search for causal factors, so this will start in earnest in the coming months when the data are available.

In conclusion, the EDEN Steering Committee is confident with the respect of the objectives and with the programme of the next period.

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