DEVELOPMENT OF A HEALTH AND ENVIRONMENT GEOGRAPHICAL INFORMATION SYSTEM FOR THE EUROPEAN REGION

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DEVELOPMENT OF A HEALTH AND ENVIRONMENT GEOGRAPHICAL INFORMATION SYSTEM FOR THE EUROPEAN REGION

Report on a WHO Consultation

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Abstract

A geographical information system combining data on both health and the environment would facilitate policy development, implementation and management, as well as research, in the fields of public health and environmental quality in Europe. A WHO consultation therefore met to verify the usefulness and technical feasibility of creating such a permanent information management system. The issues discussed were its areas of application in the health and environment field, the administrative infrastructure required at both national and international levels, the usefulness of pilot studies, the data sources and requirements, the choice of indicators, the software and hardware specifications and the training of appropriate personnel. It was recommended that the European Centre for Environment and Health, Bilthoven, be considered as the coordinating point for launching the initial programme, to be based on pilot studies chosen according to well defined criteria, and that the Centre should seek the help of qualified technical collaborating centres (such as the Dutch National Institute of Public Health and Environmental Protection, Bilthoven) and other national and international organizations engaged in the use of geographical information systems for environment and health management.

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Introduction

The WHO Consultation on a European Environment and Health Information System (held in Berlin (West), 21-25 November 1988) noted that:

> Geographical Information Systems (GIS) are of value in the compilation and presentation of data at national and regionwide levels, particularly environmental data and health outcome data related to the impact and use of health services.

In this context, and aware of parallel developments in other multinational and nongovernmental agencies in Europe, the participants at the Berlin (West) consultation recommended that discussions be held with the Commission of the European Communities (CEC) to evaluate the possibility of using the CEC concerted action programme for Coordination of Environmental Information (CORINE) as a basis for a European health and environment geographical information system (GIS). They also recommended that the need for, and specifications of, such a GIS should be kept under review.

Later discussions with the CEC confirmed the potential of GIS in the area of environment and health, but also revealed the limited role (in terms of scope, timing and administration) that the CORINE system could play in such a development. At the same time, discussions were held with research institutions and national authorities in a number of Member States to assess the current status of GIS in the field of environment and health in the European Region and to evaluate the possibility of building on these systems. It appears that there are an increasing number of GIS centres in at least 16 Member States, a continuously expanding body of associated data, and a growing need for regionwide coordination of the various systems.

As a result, the National Institute of Public Health and Environmental Protection (RIVM) in Bilthoven was asked to take the lead in assisting the Regional Office to develop a GIS programme for environment and health in the European Region. To this end, a planning meeting was convened at RIVM on 13-14 December 1989, to help verify the need for and define the scope of such a GIS system and to point to relevant information sources. This planning meeting recommended the convening in Bilthoven of the consultation that is the subject of this report. Descriptions of the other activities that resulted from the recommendations of the 1988 Berlin (West) consultation are to be found in the report of a WHO Consultation on Data Requirements and Methods for Analysing Spatial Patterns of Disease in Small Areas, held in Rome, 22-24 October 1990[a] and the report of a WHO Consultation on a European Meta-database on Environment and Health Information Sources, held in Munich, 8-10 May 1989.[b]

The main aim of the Bilthoven Consultation was to justify the need for and define the potential uses and specifications of a spatial information infrastructure (i.e. GIS and its supporting facilities) to support the research and policy implementation of the Regional Office. Towards this goal the Bilthoven Consultation was requested to: (a) verify the usefulness of GIS, as a permanent information management system with the focus on the state of public health and environmental quality, for the Regional Office and other European and national agencies dealing with public health and environmental policies and research; and (b) evaluate the technical feasibility of creating a GIS that contains both health and environmental data in a single relational (or object-oriented) database.

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[a] Unpublished document ICP/CEH 087/A.

[b] Unpublished document ICP/CEH 074/B.

The Consultation brought together European professionals with wide experience in the fields of public health, environmental quality, spatial information systems and the development of suitable indicators of the state of environmental health and environmental quality. They consisted of 29 experts from 12 countries, 6 observers, 2 staff members from the Regional Office, 2 from WHO headquarters in Geneva, and one each from the United Nations Economic Commission for Europe, CEC, the International Institute for Applied Systems Analysis (IIASA) in Laxemburg, Austria, the Baltic Marine Environment Protection Commission - Helsinki Commission (HELCOM) - and the United States Environmental Protection Agency. Professor M. Maroni was elected Chairperson and Professor H. Scholten Vice-Chairperson. Professor D. Briggs was the Rapporteur.

Discussion

Having established the mandate and role of the Regional Office in providing information on the local status of environment and health within the Region, and in developing and implementing policy guidelines for achieving the regional targets for health for all, the participants discussed the following issues:

- information planning and analysis, including indicators on public health and environmental quality and the spatial resolution required;

- information infrastructure, including the functional and technical design of databases and user interfaces, and the requirements for hardware, software and communications;

- meta-information systems as a catalogue of data sources for environment and health;

- the organizational aspects of a large-scale environment and health information system;

- the added value offered by a health and environment GIS.

In addition, papers were presented to illustrate existing international, national and local GIS programmes and provide examples of their potential or actual application in the analysis of the relationship between the environment and public health. A demonstration of the GIS systems available at RIVM was also provided, reinforcing the suggested role of RIVM as a potential Regional Office collaborating centre for GIS activities.

Throughout the discussion, there was a consensus on the opportunities that separate programmes on environmental GIS (EGIS) and health GIS (HGIS) and a joint health and environment GIS (HEGIS) could offer to research and policy implementation in the European Region. In particular, it was noted that a combined HEGIS would add considerable value to such activities by allowing a wide range of relevant data to be integrated in a consistent spatial framework.

At the same time, the many difficulties involved in designing, establishing and using HEGIS were noted. Any successful GIS would require not only adequate computer hardware and software, but also reliable data, an efficient organizational structure and well trained personnel. Each of these is a potentially limiting factor in the development of any GIS programme and especially a HEGIS programme. Experience with GIS programmes has established that special problems are likely to include: the availability of relevant and consistent data; the high operational and organizational costs of establishing and maintaining the system; the scarcity of adequately trained staff; the varied spatial scales of the data and applications involved; and the wide range of user needs.

To solve or minimize these problems, it was agreed that the system to be developed by the Regional Office should be kept as small and simple as possible, commensurate with its intended use and users, be developed step by step, and involve potential users from the earliest possible stage. In this context, developing and using pilot demonstration systems to inform potential users was considered especially valuable. The development and use of meta-databases were also proposed as an effective way of improving access to and completeness of data. It was argued that the analytical capabilities of the system should be developed not only for mapping, spatial modelling and information retrieval, but also for relevant statistical and relational analysis.

It was noted that the ultimate added value of HEGIS, compared with HGIS and EGIS, could only be established after HEGIS had been developed and tried; there was almost no national or international experience with HEGIS as such. It was clear that HEGIS was most likely be useful for answering "What if?" questions on public and environmental health, for seeking temporal and spatial patterns in health outcome, and for the preliminary generation (and under some circumstances testing) of hypotheses about relationships between environment/demography and health. There was also, however, a significant risk of the misuse of such systems that must be guarded against. This potential risk is exacerbated by the persuasiveness of mapped output. A final understanding of health outcome and especially the origin of local variations thereof, using available spatially referenced public health data, can only be obtained from more detailed and appropriately designed ad hoc analytic epidemiological studies or exposure monitoring exercises.

Within these constraints, the clear consensus of the Consultation was nevertheless that HEGIS would make a valuable contribution to health and environment research and policy implementation in the European Region. In

particular, throughout the discussion, participants from the countries of central and eastern Europe expressed their wholehearted agreement on the appropriateness of the programme to their subregion, their enthusiasm for developing and taking part in pilot studies, and their support for the Regional Office's HEGIS concept.

General conclusions and recommendations

The participants recognized that an urgent need exists for information on environment and health, at appropriate levels of disaggregation, to support policy development, implementation and management as well as research related to public health and the environment in the European Region.

They also stressed that the provision of this information at any level is likely to be most cost-effective where the system provides for multiple applications and meets the varied needs of different user groups. In this context, a clear prerequisite is to facilitate access to, and improve the availability of, relevant information (health, environmental, geographical, demographic, etc.). Likewise, it is important that the information be available in an integrated and comparable form, so that the links and relationships between different phenomena and different observations can be examined, analysed and illustrated. To handle and store this information, facilitate its analysis and effectively communicate the results creates an overriding need to adopt modern information system approaches, using international databases and information management standards, built on a stable integrated database.

Much of the information required has an important spatial component, which is valuable in the analysis and explanation of spatial and temporal patterns of health outcome. It also provides the basic framework for the

integration of the wide range of environmental and health information required. Incorporating this spatial dimension in environmental and health information adds considerable value to the information and greatly strengthens its use in policy implementation.

To provide the capability to collate and use environmental and health information in an effective manner, an information infrastructure must have the capacity for data capture, integration, storage, manipulation, spatial analysis, statistical analysis and presentation of results. GIS technology has now reached the stage of development where it can efficiently provide such an operational infrastructure.

The participants concluded that the Regional Office has a mandate to document and inform Member States about the local status of environment and health. They therefore recommended that the Office encourage the development of national EGIS and HGIS as part of a wider environment and health information system, to support public policy implementation on issues of environment and health in the European Region. The Regional Office should also develop a combined environment and health geographical information system or HEGIS, with technical help from appropriate collaborating centres. (HEGIS is the name adopted to describe an integrated information system where data from different sources and sectors (such as health, environment and demography) are related to each other through a common standardized geographical reference, and maintained in a geographical information system environment.)

To develop an operational HEGIS, it will be necessary to:

- be aware of and liaise with existing national and international agencies involved with health and the environment, and integrate their relevant activities, such as data collection sources and

networks, GIS development and application, and the need for and development of standards;

- identify and recommend standards and guidelines specifically appropriate to HEGIS;

- provide accessible training and educational facilities and staff;

- create an organizational network of national focal points and specialized collaborating centres in the Region;

- rapidly develop a working demonstration or prototype that is capable of showing the potential of HEGIS, acting as a test-bed for system development, and serving as a pilot model towards which other developing systems can converge.

Meeting these objectives will require the creation of a structured organization that can provide both central coordination and technical support, as well as encourage the development of a collaborating network among the Member States in the Region. On this basis, the participants recommended that consideration be given to incorporating the HEGIS project development into the programme of work of the WHO European Centre for Environment and Health. This Centre has been established with offices in Bilthoven and Rome with a view to strengthening collaboration in the health aspects of environmental protection, with special emphasis on information systems, mechanisms for exchanging experience and coordinated studies. To support the technical development of HEGIS in the Centre, especially at the Bilthoven office, the participants also recommended that RIVM Bilthoven enter into a formal agreement with the Regional Office to become a collaborating centre for the development of GIS methodology.

The criteria and procedures for implementing these general recommendations are described in detail below and are addressed to the Regional Office and the proposed GIS collaborating centre at RIVM; they also apply to the relevant activities that will be developed as part of the programme of the European Centre.

Areas of application

Conclusions

1. Environmental data usually have a spatial or geographic reference, are available with a wide range of spatial resolution and have been used in a variety of geographical information systems for various purposes.

2. Public health data can be spatially referenced with varied spatial resolution. The recent WHO Consultation on Data Requirements and Methods for Analysing Spatial Patterns of Disease in Small Areas (held in Rome, 22-24 October 1990) recommended increasing the collection and availability of public health data with the highest possible degree of spatial resolution. GIS can be used as a retrieval tool for spatially referenced public health data.

3. Both environmental and health data show spatial variation. Numerous potential causal factors could relate local environmental conditions to health; a large number of non-environmental factors which are geographically related can also potentially affect public health. A spatial reference system provides a common reference framework for integrating these different types of data. In addition, analysis requires the use of non-spatial data, such as toxicological and chemical inventories, and certain types of population-related data such as occupational exposures.

4. The Regional Office has a mandate to document and demonstrate the extent of geographical variation in public health and environmental status in the European Region.

5. The purpose of integrating health and environmental data is to promote research, the monitoring and management of national environment and health policies and, in particular, the implementation of the WHO health for all policy.

6. GIS can play a very useful role in making environmental and health information available to policy-makers, managers and the public in a more readily accessible form and thus in raising their awareness of the issues involved. A GIS programme can greatly aid policy implementation and management as well as research relating public health data with environmental data. Nevertheless, its scope and power is limited by the data available, the user's knowledge and the explanatory models that can be used.

7. GIS must be applied with care, however, and the dissemination of results, especially for public information and political decision-making, must be conducted within a properly conceived context.

8. In this context, GIS is likely to be of particular value in the following types of application: risk management in both localized and large-scale disasters; the early warning of hazards; the prioritization of health problems; the design of environmental sampling and monitoring systems; the development of management support systems for the health for all campaign.

9. Given these objectives, HEGIS can, with combined health and environmental information:

- be a set of tools to manage the environment as a resource for health;

- identify and highlight spatial patterns of health status;

- help mitigate the consequences of catastrophic events on a local as well as on an international scale;

- assist in the optimal design of networks for the monitoring of environmental quality in the allocation of health care services.

Recommendations

1. A HEGIS should be developed under the aegis of the Regional Office in collaboration with the European Centre for Environment and Health at Bilthoven and Rome, specialized WHO collaborating centres, national focal points, subnational specialist institutions in the Member States and other supranational organizations such as the CEC, the International Agency for Research on Cancer and the United Nations Economic Commission for Europe.

Administrative infrastructure

Conclusions

1. National HGIS and EGIS, and national and international HEGIS programmes could and should be used to aid Member States in implementing health for all policies.

2. A clear statement of the tasks and responsibilities of the main participants in any international HEGIS programme will be required.

Recommendations

1. A clearly defined organizational structure should be developed that establishes the relationships between and responsibilities of all organizations involved in HEGIS.

2. The European Centre for Environment and Health at Bilthoven should be considered as the coordinating point for HEGIS.

3. The Regional Office should develop one or more specialist international collaborating centres to provide technical support for HEGIS and its components.

4. The RIVM in Bilthoven should be designated as the first WHO collaborating centre for GIS; additional, complementary collaborating centres should be identified and recruited with the help of RIVM.

5. Member States should be encouraged to develop national EGIS, HGIS and, if feasible and appropriate, HEGIS programmes with the help of national focal points (especially in the countries of central and eastern Europe).

6. The WHO collaborating centres for GIS should have the prime responsibility for developing standards and keeping the HEGIS coordinating point up to date with developments in all aspects of HEGIS and its components.

7. National focal points should have the task:

- of identifying specialist subnational institutes and coordinating collaboration between them;

- of providing support for national EGIS, HGIS and HEGIS programmes;

- of being prime movers in initiating national or subregional debate or research on policy issues;

- of acting as a point of address at the national level for the technical GIS service provided by the Regional Office;

- of facilitating access to the training and educational programmes initiated by the Regional Office.

8. The tasks of the HEGIS coordinating point should be to:

- develop and support the development of methods for policy implementation and policy-related research;

- provide technical support for participating organizations;

- foster the dissemination of relevant methods, standards and applications through training and educational programmes;

- provide support for the development of national infrastructures by the national focal points, especially within the countries of central and eastern Europe.

9. The HEGIS coordinating point must maintain strong relationships with, and assign specific tasks and responsibilities to, the supranational bodies, WHO collaborating centres and national focal points involved in HEGIS.

Advantage should be taken of subregional organizations (such as CORINE, EUROSTAT and HELCOM) to provide subregional GIS focal points for local GIS and HEGIS networks.

Development of pilot studies

Conclusions

1. Pilot studies or demonstration projects are likely to be extremely useful in ensuring the success of HEGIS. Such studies or projects would demonstrate the potential of HEGIS and would allow potential users critically to evaluate opportunities for their further application.

2. In this context, the demonstration programme would provide an efficient and rapid illustration at the national level of the ability of HEGIS to carry out: data capture, supply and exchange; data structuring, cleaning and formating; data integration; data storage; spatial modelling and data analysis; spatial querying and retrieval; presentation of results.

3. In addition, demonstration programmes would appear to be the most efficient way of addressing the critical and as yet unresolved issues of: data availability; data quality; maintenance and updating of the information system; data confidentiality and ownership; data release and dissemination.

4. Many environment and health programmes currently in existence at the international, national and subnational level throughout the European Region contain elements appropriate for incorporation in a HEGIS programme and have gathered experience that would be useful for the development of the Regional Office pilot HEGIS project.

5. Similarly, a great deal of experience in the field of environment and health has been built up in existing and developing GIS centres throughout Europe that can be used in the development of HEGIS.

Recommendations

1. The Regional Office should consider selecting possible candidates for pilot studies or demonstration projects on the basis of a subset of models that illustrate the following different features of HEGIS and their potential advantages:

- GIS techniques can make better use of existing databases to deal with specific subregional problems, identified by networks of several local or national users with common interests (for example environment and health in the Baltic states using the HELCOM network);

- the development of the GIS methodology for a particular local site or sites can then be extended to similar applications throughout the Region (for example, siting and monitoring of municipal waste incineration plants);

- GIS technology can be applied to deal with different levels of spatial resolution (for example, the use of large-scale GIS to assist the countries of central and eastern Europe in developing priorities for environmental and health data collection);

- HEGIS has the potential to observe clusters of disease in sensitive populations which might be environmentally related and for which an extensive data network already exists (for example, congenital malformations).

2. Critical criteria for the selection of pilot studies and demonstration projects should include:

- the relevance of the question to be answered to the spirit of the European Charter on Environment and Health;

- the extent to which interested parties are able to participate actively in the work programme;
- the existence of international, national or local programmes, preparatory studies and/or databases;
- the clear, demonstrable added value of a GIS application;
- possible additional benefits of such work in the form of sponsorship from other organizations.

3. Pilot studies and demonstration projects should be designed in such a way that their findings and results can be properly evaluated, especially with respect to questions of environmental health management and applicability at other sites.

4. A comprehensive work plan should be drawn up for each pilot study or demonstration project in consultation with the user communities. The work plan should contain a clear indication of what data input and evaluation criteria are required from the user communities.

5. The Regional Office should ensure that proper use is made of existing health, environment and GIS experience within various agencies and institutes in the European Region.

6. The Regional Office should consider identifying a network of centres of excellence in the application of GIS to health and environment, to provide additional support for HEGIS activities at the European regional and subregional level.

Data requirements and indicators

Conclusions

1. An overwhelming number of potential indicators and variables exist, from which a subset needs to be selected for incorporation into HEGIS. This subset should be based on a broad consensus about the usefulness of the indicators for the purposes of HEGIS.

2. Not all the indicators in the initial subset will be universally available, and additional ad hoc indicators will occasionally be needed for specific purposes.

3. Local and national boundaries can create discontinuities of spatial data.

4. For analytical purposes, data will be most useful at the lowest level of aggregation.

5. The dissemination of information to the public is an important function of HEGIS. Nevertheless, past experience has shown that maps showing disease incidence and other spatially referenced health and environment parameters may lead people to misunderstand the health risks.

Recommendations

1. The Regional Office should initiate the preparation of an inventory of existing data sources relevant to health and environment, including their content, format, quality and availability.

2. The Regional Office should develop appropriate procedures (such as a Delphi study) to reach a consensus on the selection of a minimum core set of indicators from the available databases, based on the following guidelines: their relevance to the suspected impact on

the health of populations; the potential for intervention or prevention; the availability of spatially referenced data at an appropriate aggregation level; the degree of coverage of the population or area of the indicator.

3. Some indicators should be included only for purposes of quality control.

4. In the short term, only data from available registers for which there is a high degree of quality control should be used for indicators.

5. In the long term, additional indicators should be chosen or developed when needed for ad hoc purposes and as appropriate for any specific pilot programmes, taking into account the recommendations from previous WHO consultations. These could include indicators specific to sensitive population groups and indicators of ecological quality.

6. National HEGIS programmes, especially those participating in pilot studies, should be required to maintain the minimum core subset of indicators. Additional indicators of local interest may be developed at the discretion of the national programme managers. Procedures should be developed to harmonize and standardize indicators throughout the Region.

7. Care should be taken to minimize discontinuities at national boundaries and, where unavoidable, to consider their effects in interpretation.

8. Quality control measures and the definition of terms must be standardized among the Member States and introduced at the national level to facilitate the international use of data.

9. All efforts must be made to ensure data are collected on confounding variables (such as smoking, nutritional and alcohol consumption habits, gender) and known risk factors must be taken into account before any attempt is made at interpreting patterns of disease; the recommendations of the Rome Consultation (held on 22-24 October 1990) should be followed in this respect.

10. Member States should be encouraged to make data available at the lowest levels of aggregation, within the constraints of spatial referencing, data quality and confidentiality. Health and environmental data should, however, be at consistent levels of resolution, taking into account their respective scales of spatial variation.

11. Information from HEGIS that has sufficient detail to satisfy researchers should be digested and packaged before being presented either to policy-makers or to the general public.

12. The Regional Office should develop guidelines for the harmonization of national HGIS, EGIS and HEGIS databases and infrastructures.

13. The Regional Office should develop stringent quality control requirements for any indicators incorporated into HEGIS. Member States should be encouraged to assist in implementing these controls.

14. The indicators and quality control of the system should be re-evaluated periodically and modified at appropriate intervals.

Hardware specifications

Conclusions

1. Developments in GIS methodology have reached a sufficient level of maturity for the concept of HEGIS, available at international, national and subnational levels, to be realizable.

2. The use and development of HEGIS requires a level of computer hardware and software that is generally available in all European countries.

3. The difference between international, national and subnational systems is essentially one of scale and aggregation, rather than one of principle.

4. The operation of HEGIS in a multi-user environment relies on a network of work stations and servers to provide local processing and centralized data management. A local area network is therefore an essential requirement of HEGIS.

Recommendations

1. The HEGIS coordination point should have access to the hardware, software and personnel necessary to fulfil its required functions.

2. Any HEGIS system should have an interface that is user-friendly to both the non-computer literate and the specialist, as well as ergonomic, interactive and customizable, with on-line help and access control mechanisms.

Data access, storage and standards

Conclusions

1. The integration of data into HEGIS will involve bringing together data from many different sources and with different characteristics, requiring accurate and detailed documentation.

2. A meta-database is also necessary and should be closely coordinated with HEGIS.

3. Relational software of the database management system (DBMS) type, for the storage of attributed data in health and environmental applications, is widespread in European countries.

Recommendations

1. The database system should include the standard capabilities of storage, manipulation (including updates), retrieval, support for integrity constraints, access controls, distributed processing and remote access.

2. Support for meta-databases should include data dictionaries for local information, data content, data quality, etc., with code lists, thesaurus components and a catalogue of relevant external databases. Meta-database coverage should go beyond the data contents of HEGIS and should extend beyond data in the strict sense: the report on the Munich Consultation (held on 8-10 May 1989) should be used as a guide.

3. Any database that is part of the system should provide proper links between the digital-cartographic elements and their associated attributes and other related data.

4. Data sets used in support of research, monitoring and analysis functions should be derived from the most disaggregated data available.

5. HEGIS should adopt standardized boundary files (both current and historic), where available. If not, they should be developed with the help of national focal points who have the prime responsibility for providing accurate updated source data at standardized projections, etc.

6. The HEGIS coordinating point should provide access to metadata and information-support materials. Access to metadata should take into account developments in network communications and multimedia databases (such as CD ROM).

7. GIS systems used as part of HEGIS should allow for the analysis of both raster and vector data and provide an integrated environment for the storage of vector data, which include the topology of digital cartographic elements.

8. The development of HEGIS should take full account of the development of standards in a wide range of related areas, including: the ISO standard for user interfaces; cataloguing standards for digital databases and digital cartographic data sets; the ISO/ANSI standard for SQL as a database query language. At the application programming level, the use of forthcoming standards on the import/export of data from databases, data dictionary interchange and interconnection of heterogeneous DBMS are expected to be most important.

9. WHO should address the subject of standards in coordination with the various national, international and nongovernmental organizations working in the field.

10. Where appropriate, the Regional Office should produce new data standards and provide continuing support for them (in the form of documentation and convenience software) and in particular is encouraged to develop procedures to enable national organizations to reach a consensus on the standardization of the logical database design for time series and other kinds of HEGIS data, to facilitate data interchange.

Software specifications

Conclusions

1. A general assumption is that a system for health and environment using geography would include the capability for statistical techniques and methods, simulation, spatial operation and visualization (including mapping).

2. The analytical part of a system is also expected to allow the preliminary testing of hypotheses (for example, in relation to pattern identification, hazard identification and risk prioritization).

Recommendations

1. Software for the compilation of spatial statistical measures, including the comparison of maps, and for the modification of standard statistical tests in the presence of spatial autocorrelation, should be made more widely available. Researchers in the fields of health and environmental analysis should be made more aware of the effects of spatial autocorrelation and multiple testing on tests of significance.

2. Research should be undertaken to evaluate the role of expert systems in HEGIS.

Training and personnel

Conclusions

1. The development and implementation of HEGIS will require a large number of professionals with multidisciplinary expertise and training. Current personnel resources in this area are probably not sufficient in the Region to meet the immediate or long-term needs of an extended HEGIS programme.

Recommendations

1. The Regional Office, together with national focal points and collaborating centres, should promote multilevel training in the use of HEGIS and the interpretation of results from HEGIS. A task force should be created to examine the personnel resource requirements of the programme and to prepare support material and programme outlines so that the necessary training facilities can be developed and the required staff can be trained at international, national and subnational levels.

Annex 1

WORKING PAPERS AND BACKGROUND DOCUMENTS[a]

Working papers

ICP/CEH 090/A/6	Organizational aspects of the implementation of HEGIS in Hungary, by E. Orosz
ICP/CEH 090/A/7	Public health impact of environmental hazards, by T. Kjellstrom & F. Sartor
ICP/CEH 090/A/8	European metadatabase on environment and health information sources: Finland, by K.M. Savolainen
ICP/CEH 090/A/9	Approaches to an information system on individual hazardous occupational and environmental exposures, by B. Terracini
ICP/CEH 090/A/10	Environmental health monitoring: the use of official statistics and data in Hamburg, by W. Thiele
ICP/CEH 090/A/11	Environmental information system "Sinus", by M. Baranowski

[a] Copies are available from the Risk Management Systems unit, WHO Regional Office for Europe, Scherfigsvej 8, DK-2100 Copenhagen O.

ICP/CEH 090/A/12	Indicators in health and environment information, by M. van den Berg
ICP/CEH 090/A/14	Development of an environmentally based health information system for Austria, by G. Fülöp
ICP/CEH 090/A/15	Epidemiological surveillance of the environment. A system based on the monitoring of perinatal health problems, by L.M. Irgens
ICP/CEH 090/A/16	Geographic information systems in organisations: some conditions for their effective utilisation, by I. Masser
ICP/CEH 090/A/17	Geographical software applications for health sector planning: experiences from a study for famine management, by D. Guma-Sapir
ICP/CEH 090/A/18	Environmental information systems: design of user interfaces, by K. Fedra
ICP/CEH 090/A/19	Spatial and temporal resolution of information for geographical epidemiology, by A. Westlake
ICP/CEH/090/A/20	An information system for small area health statistics, by I. Kleinschmidt
ICP/CEH 090/A/21	A geographical mortality information system for Norway, by A. Aase
ICP/CEH 090/A/22	Outline for the establishment of a European-wide HEGIS, by O. Güntzel
ICP/CEH 090/A/23	Use of GIS for small area epidemiological studies, by U. Ranft

ICP/CEH 090/A/24	Geographical information in environmental epidemiology - some case studies and prospects, by O.L. Lloyd
ICP/CEH 090/A/25	The application of a geographical information system in public and environmental health, by H.J. Scholten and M.J.C. de Lepper
ICP/CEH 090/A/26	Case studies in GIS: the Newcastle experience of health and environment related GIS, by S. Raybould
ICP/CEH 090/A/27	The added value of HEGIS: where are the risks versus what are the risks?, by L.K.J. van Romunde
ICP/CEH 090/A/28	Database management for a health and environment GIS: functional and technical design considerations, by R.G. Healey
ICP/CEH 090/A/29	Indicators of public health and environmental quality, by E. Lebret
ICP/CEH 090/A/30	International project in regional environmental geoinformatics - Baltic Europe, by S.V. Victorov
ICP/CEH 090/A/31	Environmental data collected by HELCOM, by E.-L. Poutanen
ICP/CEH 090/A/32	Some experiences with information dissemination and the HST Information Centre, by J.L. Duppenthaler
ICP/CEH 090/A/33	Meta-information system for environmental sciences, by J.A. Bakkes

Background documents

Environment and health data in Europe as a tool for risk management: needs, uses and strategies.

Consultation on Data Requirements and Methods for Analysing Spatial Patterns of Disease in Small Areas (Draft summary report on a consultation, Rome, 22-24 October 1990, ICP/CEH 087/A).

Strategy and programme for development of European environment and health information systems. (Unedited draft, 5 December 1990).

Annex 2

PARTICIPANTS

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