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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

2nd Draft

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

17967

High-level Expert Group Meeting
on computer-aided tools of environmental impact assessment
for industrial planning;

Kiev, USSR, 23 - 27 October 1989

FINAL REPORT

CONTENT

INTRODUCTION

The UNIDO High-level Expert Group Meeting on Environmental Impact Assessment for Industrial Planning was held in Kiev, USSR, from 23 to 27 October 1989.

The meeting was organized by UNIDO, the Glushkov Institute of Cybernetics, Ukrainian Academy of Sciences and the USSR State Committee of Science and Technology.

The purpose of the meeting was to make a first approach to the introduction by UNIDO of environmental considerations in industrial planning activities in developing countries.

CONDUCT OF THE MEETING

The meeting was opened on 23 October 1989 with the welcoming speeches by Academician V. KUKHAR, Vice-President of the Ukrainian Academy of Sciences and Academician V. MIKHALEVICH, Director of the Glushkov Institute of Cybernetics, and they welcomed all participants.

Mr. B.O. KARLSSON, Head of the Industrial Planning Branch of UNIDO, expressed the appreciation of UNIDO to the hosting institute and the Ukrainian Academy of Sciences. Mr. Karlsson outlined UNIDO's expectations of the Expert Group Meeting and wished all participants success in their deliberations.

The meeting elected the following officers for corresponding functions:

Mr. Ulf WAHLGREN	Chairman
Mr. Alexander BAKAEV	Vice-Chairman
Mr. Mohamed EL-BORENI	Rapporteur

The meeting went on with presentations of various environmental models by the participants until 25 October.
General discussions were held on 25 and 26 October.
The Final Report of the meeting was adopted on 27 October at the closing session. Mr. A. Bakaev held the closing speech.

On behalf of UNIDO, Mr. A. JERNELOV thanked all participants for their valuable contributions, the elected officers for their sincere efforts and hard work, and the hosting institute for its kind hospitality.

On behalf of the participants, Mr. GRUBER expressed appreciation of UNIDO and the Glushkov Institute of Cybernetics for organizing this meeting.

PURPOSE OF THE MEETING

The meeting was convened to assist UNIDO in selecting computer-aided planning tools for environmental impact assessment (EIA) in industrial planning.

As a guide for the meeting, the UNIDO Secretariat presented:

1. UNIDO planning applications;
2. tasks for which UNIDO needs environmental models; and
3. UNIDO requirements and preferences with regard to model characteristics.

The planning applications discussed are:

- individual industrial projects
- industrial sectors
- overall industrial development planning.

The geographic scale could be:

- local
- regional
- national
- transnational.

The tasks for which environmental models were required are:

1. environmental impact assessment (EIA)

2.a cost-benefit analyses

2.b cost-effectiveness analyses

3. sustainability assessment.

UNIDO requirements and preferences with regard to model characteristics are:

- models should be for industrial applications;
- input data must be easy to obtain;
- models should be user-friendly;
- models should be easily adaptable to different computer systems including PCs (AT);
- limited expert need;
- models should be applicable to different cases (e.g. geographical regions, climate and morphologies).

The meeting was asked to view these criteria as preliminary ones, to review, add to, amend and utilize them in the revised form for screening the models that would be presented during the meeting.

SUMMARY OF PRESENTATIONS

1. BULGARIA

Activities of Industry Development Institute, Sofia, as Focal Point of UNIDPLAN Programme in Bulgaria:

The Industry Development Institute in Sofia is a national coordinating centre (Focal Point) of UNIDPLAN Programme in Bulgaria, and by now it is the second year in which it develops its activity in the sphere of computer-oriented methods and software tools for planning.

The structure of IDI and the activities which it performs are a good ground for the implementation of its functions as a Focal Point and for the attainment of the aims of UNIDPLAN Programme.

IDI operates on the following guidelines:

- strategic planning, resource, market and investment policy;
- technology development, production and labour organization;
- information systems and Computing Centre;
- Training Centre;
- Consulting Centre.

The above structure is prospective in view of the complex covering the forecasting and industrial planning by means of computer-aided methods and software tools on the basis of contemporary PC and mainframe.

The first project named 'Development and Introduction of Computer-Aided Tools for Industrial Planning in Bulgaria' revealed the abilities of our country and coordinated its efforts for the implementation of the aims of UNIDPLAN Programme. After a thorough analysis of the state of the existing software

from the point of view of the demands of computer-oriented tools for industrial planning we fixed our choice on FORECASTER modelling and forecasting system.

At the present moment IDI elaborates within the frames of UNIDPLAN Programme an interregional project named 'Transfer of Advanced Methodologies and Computer-Aided Planning Tools to Selected Developing Countries (Cuba and Yugoslavia)'. The main advantage of the elaborated project is that the latter considers the specific conditions of management and industrial planning in the above countries on the principles of the methodology and software of the basic version of FORECASTER system supplemented and enlarged in accordance with the new necessities. Thus for example the new version of the system intended for Cuba will contain the graphic interpretation of the obtained forecasts and planning variants.

The activities of our Institute as an important factor of strategic planning the development of industry determines our research and development undertakings in the sphere of the relation of industrial development to the environment protection and reproduction. Our activities so far were directed into two guidelines:

- grounding the expedience of the choice of industrial technology form the point of view of its ecological fitness;
- elaboration of strategies for economic development of the areal industrial complexes in view of protecting the ecological equilibrium in the given region.

Within the frames of the first guideline IDI has developed an expert system for establishing the expedience of choice of production-of-articles and acquisition of technologies licences including the ecological estimation of the fixed capital assets. At present we have separately at our disposal a short description of the expert system and a demo-version of the software.

Within the frame of the second guideline IDI operates on the basis of specific assignments signed with the local authorities taking into consideration the domestic conditions and requirements. Our aim is to harmonize the industrial development with the surrounding natural environment, and in that relation, to estimate the influence of the investment projects on ecology.

The future activities of our Institute concerning the solution of ecological problems would be closely linked to the National Environment Protection and Reproduction Programme up to the year 2000. At the end of the present year this national programme would be adopted by the National Assembly of the People's Republic of Bulgaria, and IDI would set apart a considerable share of its intellectual and technological potential for effective participation in its implementation.

2. CSSR

Several Decision Support Systems (DSS) - individual and group DDS - were briefly presented, among which two were discussed and demonstrated.

General comments:

1. User interface is unified as much as possible among all applications.
2. A common graphic package is also used whenever possible.
3. Common data structure using BBIII.
4. An open methodology is adopted in the design of BSS.
5. A wide range of applications is possible by BSS:
   - selection of projects based on certain criteria;
   - selection of industrial technology;
   - selection of planning techniques;
   - time-series analysis in various fields.

General problems faced:

- Data collection and up-dating;
- Micro- mini-main;
- Communication of infrastructure.

Packages demonstrated:

1. SAK ZPD

SAK ZPD is a consulting expert system to evaluate the impact of a traffic system on the environment in a city. The system is a technology for a large information system about territory (IST).
The system consists of two data bases:

- special purpose data base
- mathematical models for calculation of traffic noise and pollution.

The expert system evaluates the impact of traffic on the environment primarily from 3 aspects:

- quality of pollution
- noise levels
- accident rate.

The expert system also monitors other factors like the psychic impact of time losses, violation of esthetic values, water pollution, violation of preserved areas, occupation of agriculture and forest land and solid waste.

The positive influences considered in a functionally optimal traffic system include:

- time saving
- transport payload
- security of person
- security of freight.

The above includes origin, destination and transit destinations.
The data base of the expert system was created by traffic specialists. The expert system is programmed in FURBO PROLOG and runs on PC/X or compatible.
A detailed description is attached.

2. MDS

MDS is a system for individual or group decision support with multicriteria evaluation of descrete alternatives.
Basic characteristics of MDS:

- several methods for group decision making;
- a user-friendly interface for setting up the rules of solving a problem;
- various methods for setting up and evaluation of criteria;
- possibility to compare results obtained in various comparisons;
- enables simultaneous solution of independend problems.

All above provide a better way for problem definition and consequently a more sound problem solution.

The system requires a manager to control its operation. The system works in the following procedure:

4	-	problem definition	(by the manager)
	-	setting of experts (weights - voting powers)	
	-	setting of alternatives description	
	-	setting of attributes	
2	-	model definition	
	-	selection of methods	
	-	evaluation of attributes	(by the experts)
	-	setting the rules	
	-	aggregation of individual settings)	
	-	disagreement of analysis)	(by the manager)
3	-	evaluation of alternatives	
	-	setting up quantitative values	(by the manager)
	-	individual evaluation of alternatives	
	-	aggregation of individual alternatives	
	-	evaluation of rules	
4	-	final results:	
	-	final ranking of alternatives	by criteria
	-	final ranking of alternatives	by rules
	-	final ranking alternatives	by criteria rules
	-	analysis of individual and group results.	

All above results are available in table and graph.

MDS offers a wide variety of practical use. For specific problems or applications, it is possible to create a tailored system to suit the needs of a particular problem and to specific methods of multicriteria evaluation.

3. FRG

The FRG participant presented the following systems:

1 - UMWIS: An environmental information system of the Regional Office of Data Processing and Statistics in North Rhine Westfalia.

2 - BALIS: Bavarian agricultural land information system.
This integrated system refers to agriculture, especially to its detailed reginal aspects and problems. It can be extended to deal with non-agricultural problems.

3 - EFOM-RENEW: In a recently started research project at the Jniversity of Hagen, the long-run techno-economic energy supply model EFOM-ENV (energy flow optimation model containing some components for dealing with environmental problems) is enlarged - step by step - by submodels for the most important renewable resources of energy. EFOM-RENEW is a dynamic linear programming model covering a planning period of 40 years and consisting of some 10.000 processes and some 10.000 constraints for the FRG. When submodels for renewable sources of energy are developed, special attention is given to modelling environmental problems. When completed, EFOM-RENEW can be used for studying the environmental burden which results from different long-range scenarios of energy supply.

4. HUNGARY

Consensus Development and Operations Research tools (CONDOR)
CONDOR is a group decision support system which is based on analysing and relating the criteria; alternatives and rankings in order to obtain a consensus of a group of experts on the solution of a problem.

The system is structured in a way to enable setting of:

- hierarchy of criterions helping the approach of all aspects of the problem;
- weights of criteria by each expert involved in decision making;
- the alternatives;
- evaluating alternatives;
- ranking of voters;
- choice of voting mechanisms.

The system is very flexible in the windows displayed and the size of each window. Results are shown in either/or both tables and graphs with the possibility of simultaneously overviewing all information.
CONDOR is programmed in C under microsoft windows. The system was presented through an application for the location of waste disposal sites.

5. IIASA (International Institute of Applied Systems Analysis)

IIASA presented an overview of two decision support systems as an example of the approach used at IIASA/ACA for the development of integrated DSS in the field of environmental and industrial planning.

1 - IRIMS (Ispra Risk Management System) - is a DSS for the risk management in the field of hazardous substances.

2 - An expert system for regional development implemented within the framework of a regional case study on Shanxi province in the PRC.

Both systems were presented focusing on their common characteristics reflecting the standards of DSS development at IIASA/ACA:

- Integration of the key DSS elements:
  - * Data: covered by the information systems in the DSS.
  - * Analysis: covered by a selected set of simulation and optimization models for scenario analysis related to the specific problems domain.
  - Decision support: covered by a multicriteria alternative selection tool.
- Integration of qualitative and quantitative approach allowing to draw on expertise as well as detailed data where available.
- Integration of all modules of the DSS by a common graphics interface which allow the user to interact with all components of the DSS in the same manner.

6. JAPAN

Report by T. TANIKAWA, T. HIRAYAMA and T. MATSUMAE;
Institute of Research and Development, Tokai University, Japan.

1. Inter-relationship between various environmental problems and industrial activities in industrialized and developing countries was overviewed. It is important to recognize that seemingly 'regional' problems can eventually result in much larger-scale environmental problems (e.g. acid rain). UNIDO's Clean Technology Programme should be strongly supported by the member countries.
2. Japanese activities to control and improve air quality were summarized. Rather extensive environmental assessment must be carried out when the construction of a new large factory is planned. Various computational tools are usually incorporated. Some of the Japanese examples should be useful for developing countries to carry out assessment work.
3. Global environmental problems are very complex. New ideas to attack various aspects of the problems are desirable. As an example, a new scheme to preserve the stratospheric ozone layer using ground-based powerful radio transmitters recently proposed by A.Y. Wong et al. in USA was mentioned.
4. It will be highly desirable to have an extensive world-wide network rooted by several super-computers. However, it will be very expensive.

As a short-term programme, we strongly support the standardization of data-collection techniques, computer data base, etc., and the establishment of a library of various environmental impact assessment models which can be distributed to developing countries through existing networks or even via off-line.

7. SWEDEN

A case of contamination of a water reservoir with H_2S due to local environment in a lake close Rabat (Morocco).A computer based model was built to solve the problem, however, upon applying the model.

Modelling the entrophication process in deep domestic water reservoir in Northern Africa. The problem was deoxygination and H_2S formation in deep layers of the reservoir. Two models were applied:

A - One-dimensional heat balance to calculate the stratification;

B - Ecosystem programme describing the development of algal nutrients, dissolved oxygen etc..

The models were used to:

- synthesize data and verify different assumptions and hypothesis regarding the dynamic properties of the system;
- explain (and may be quantify) certain aspects of the system;
- forecast the development of the system and the effects of varioyus measures.

By running the models several remedying measures for the reservoir were identified and quantified.

8. USSR

1. Environmental protection and analysis project.

The state of Ukrainian administration is undertaking a study on the environment status and the pollutants introduced by several sources. It was found that one out of three industrial projects presented to the state for approval does not have any consideration (or partial consideration) for the environmental pollution. It is decided that each enterprise should have a passport carrying all details relating to the effects it produced on the environment. This will apply to existing as well as forthcoming projects. Also it is decided that by the year 1990 a charge will be introduced on the pollutant substances released into the environment. These charges will depend on the complexity and type of the substance. Payments will be made of gradually increased nature depending on the amounts released over a 5-year period. The payments will be combined with payments of the cost damages made by each enterprise and will be used for environment protection.

Measurements of the pollutants will be made through:

- State and Ministries statistics
- new technologies
- major enterprises basic data.

The project will result in a system of measurements and monitoring the environment which is estimated to be completed in 2-3 years.

2. A package on computer-based ecological assessment and risk management technology.

3. Relation between industrial, agricultural and environmental data.
The data is collected through a network and fed to a statistics system to enable monitoring of the environmental impact.

4. Situation Centre:

At a visit to the Ukrainian SSR, Glushkov Institute of Cybernetics, the USSR delagate presented a situation room used for group decision support. An interactive system using a large display screen connected on line to the system together with wider monitors for complete views of a situation by a group of experts. The situation room was used to evaluate the different alternatives to overcome water reservoir contamination with nuclear radiation after the Chernobyl accident. They showed the effectiveness of the simulated model for reaching the best decision to solve the problem.

CONCLUSIONS AND RECOMMENDATIONS

In this section the term 'model' will be used primarily for conceptual constructs intended to describe natural or other processes. The models presented during the meeting can conveniently be divided into two groups. The first group covers comprehensive models on a continental scale, aimed at a large variety of problems (economical, social and environmental aspects of industrial and agricultural activities). The second group consists of local region models designed for selected industrial or agricultural environmental impact assessments (EIS). Furthermore, a number of decision support systems were also presented. In addition to these items one model which dealt with the airborne pollutants and associated forest damage was presented. All models dealt with aspects of environmental impact. The decision support systems could all be used to host different impact models.

None of the models or decision support systems can be used directly in UNIDO's activities as a 'ready-off-the-shelf' item. The only exception might be the model on local air pollution effects on forests, that were not included in any group. This model, which fulfills the easy-to-obtain input data requirement more than others, may be at the most easily adopted model for UNIDO's use in developing countries if the output quality is judged to be acceptable.

Following the discussion on UNIDO's requirements and wishes the group agrees on the following extended and specified criteria of desirable model characteristics:

1. Industrial applications.
   Self evident from UNIDO's mandate.

2. Easy-to-obtain data.

Environmental impact models can be either qualitative or quantitative. The former type can provide qualitative information (order to magnitude, direction etc.) from limited or incomplete data, while the latter can be used for detailed analysis and prognoses from exhaustive and high quality data. Thus, a library of software tools covering a range of complexities can make restricted environmental impact assessments possible even in situations where the availability of data is limited. Of course, better data entails the possibility to use more elaborate EIA models.

3. User-friendly.

Decision support systems provide a possibility to develop user-friendly EIA models of limited complexity. The systems could provide a completely guided mode of operation for novice users and an expert mode of operation where facilities of the system can be used as flexibly as possible by the expert. The techniques of graphical representation should be used wherever possible.

4. Easily adaptable to different computer systems including PCs (AT).

EIA models in the form of PC based decision support systems automatically fulfil this criterion. More complicated models should be written in a common high-level language following accepted standards. Special consideration should be given to interface problems. In particular software for graphical applications should be as independent of hardware and system software as possible, and different models should use similar file structures. Data bases should also be standardized wherever possible.

5. Limited expert need.

Evidently experts are needed to develop and adapt models to general or specific conditions. Furthermore, expertise is required for the interpretation of model results.

6. Easily adaptable to different conditions (e.g. geographical, climatological or economical).
   For example, special precautions should be taken when a model is applied to new climatic zones, in particular with regard to simulations of biosystems.

7. Step-by-step development of comprehensive EIA models.
   A modular approach should be taken in the development of comprehensive EIA models, allowing a stand-alone development of each module at a focal point, following the recommendations 1 - 6 above as development guidelines. A 'clearing house' focal point could be established to coordinate the development of the particular modules. Such a library of qualitative and quantitative models could be developed, which could be integrated into comprehensive EIA models.

The meeting recommends:

1. Participating countries and collaborating institutes to select and develop systems and models in accordance with the criteria defined by the meeting and to submit them to UNIDO for use in its programmes and projects;

2. that the potential of IIASA as one of the resource centres could be used for the expertise on computer-aided tools for environmental impact assessment;

3. that the offer of the Glushkov Institute of Cybernetics to use its potential and possibilities for development and selection of computer-aided tools for EIA in accordance with criteria proposed by the meeting, should be utilized by UNIDO;

4. to extend the application of EIA-models that include risk and uncertainty considerations;

5. UNIDO to initiate the establishment of a library of Environmental Impact Assessment models;

6. UNIDO to support training programmes (e.g. distance study, courses and seminars) aimed primarily at personnel from developing countries in input/output analysis and national/regional accounting extended to environmental problems in order to promote data quality and availability;

7. that to improve the cooperation of the network of focal points for UNIDPLAN, UNIDO should distribute an updated list of focal point identifications and contact persons to all participating countries. The structure of the data should be the following:

   name of the institution
   full address
   country
   telephone, telex, telefax, electronic mail id.
   contact person: name and position.

ACKNOWLEDGEMENTS

The meeting acknowledges:

The Ukrainian Academy of Sciences, Glushkov Institute of Cybernetics, for hosting the meeting; their scientific contributions, the visits to the institute and demonstration of the Chernobyl environmental monitoring system, the real time graphic monitoring satellite system. their providing the facilities enabling the members to demonstrate their contributions and for the sight-seeing tour.

The Chairman, Vice-Chairman and the Rapporteur for their extended time and efforts during the meeting.

ANNEX 1

UNIDO/UNIDPLAN FOCAL POINT in Czechoslovakia

INSTITUTE FOR APPLIED CYBERNETICS

Hanulova 5/a, 844 16 Bratislava, Czechoslovakia

R E P O R T

for the UNIDO high level meeting in Kiev, USSR
23.-27. october 1989

Overwiev of software and methodology beeing developed to analyze environmental impacts of industrial planning

Dr. Peter Parizek
Research secretary to Institute for Applied Cybernetics

Bratislava, CSSR, october 1989

1. FOCAL POINT for UNIDPLAN in Czechoslovakia

Czechoslovakia has participated actively in UNIDPLAN activities since 1988, when representatives of the State Planning Commission in Prague and Institute for Applied Cybernetics (IAC) in Bratislava took part in UNIDPLAN meetings in Budapest and Tbilisi. The Focal Point was established in IAC Bratislava under the general guidance of the State Planning Commission. The activities of UNIDPLAN are included within the CSSR-UNIDO JOINT Programme of Cooperation. The activities of focal point inside Czechoslovakia are widespread within several institutes and companies.

A national UNIDPLAN meeting was held on 5-7 th June 1989 in Bratislava. The aim of the meeting was to review and select computer aided planning tools which could be proposed to UNIDPLAN programme and to discuss and agree upon the workplan for the UNIDPLAN Programme development for 1990-1991. Prticipants from central planning authorities, research institutes and industry took part at this meeting. The meeting reviewed the presented tools and selected some of them to be recomended to the UNIDPLAN.

2. PC SOFTWARE TOOLS for Environmental Problems

Several Software tools suitable for industrial planning with environmental aspects have been presented on the national UNIDPLAN meeting. Knowledge based systems, suitable for regional planning with respect to environment and decision support systems with a wide range of applications were recomended for introduction in developing countries.

Two major knowledge based modeling enviroments should be mentioned here.

The one is a Object Oriented Programming Language SPACETALK designed for building up models for environmental aspects of regional planning. Spacetalk is a sophisticated tool incorporating basic features of knowledge representation languages, databases and expert systems. It is suitable for modeling in different areas.

One of the most sophisticated technology for solving environmental problems are experpert systems specialy developed for regional and urban planning. A special implementation of this system on the basis od SAK expert system shell has been developed in TERPLAN, Institute for Regional Planning in Prague. A special application of this system for evaluation impacts of transport on environment in urban areas has been developed. A sample application of this system will be presented during the meeting.

Within systems developed in IAC a special interest is given to the problems of multicriteria evaluation of alternatives.

Problems of this type arise in several kinds in any decision or planning processes. The design of the system fulfills the following requirements:

- the planning activity includes more specialist or decision makers, so it is necessary to support group decision making

- the information support of the system has to regard specialities of methodology of actual planning process and provide the facilities of a spreadsheet

- the system has to include tools for time series analysis

- the graphic representation of data has to be unique for all subsystems and provide the facilities of 2D and 3D business graphic

- according to the large variety of problems to be solved the system has to provide a wide range of methodological tools

- all susbsytems has to provide the same user interface
- the systems has to provide printouts of alphanumeric and graphic informatiom from all subsystems

- all subsystems use compatible data structures

Each subsystem can be used as a stand alone system with the possibility to compose separate modules into larger systems for special purposes.

The basis of the whole system is the subsystem called MDS, which is an abbreviation of Multi - Decision - Support. It is a general system for multicriteria evaluation of alternatives. The goal of MDS is to provide facilities for solving different problems of multicriteria decision making. It means, that it enables solutiom of problems of individual and/or group decision making, it provides a set of standard and original methods for evaluation of attributes and multicriteria ranking of alternatives according to these attributes. The user interface is fully menu driven. Except of well known methods for multicriteria evaluation of alternatives it enables to describe the model by use of rules (relational expresions to set up limits and relations between attributes).

There are several different possibilities of application of this system to the support decision in planning activities. It can be used first as a tool for evaluation of several alternatives of a plan, or as an environment for ranking and evaluation of planning objects (i.e. evaluation of projects which are proposed as parts of one plan). Another possibility is the confrontation of results of industrial production with analogous products on the market

and set up price levels according to technological level of production. It must be stressed that MDS is an opened system for solution of problems from several possible areas and thus it does not contain any criteria or attributes for special planning problems. The experts and decision makers are responsible for this act, which is a part of the problem set up in MDS. A more detailed description of MDS is attached to this report.

An application of this system to a problem of choosing optimal location for hazarduous waste is to be presented during the meeting.

Another system for planning and management support is the Time Series Analysis System - TSA, which is beeing developed as a database application over the same database management system dBASE III+. A specific data organization has been designed for this purpose, namely - database record = time serie, which saves a lot of memory problems of the PC, on the other hand requires special graphic tools for data representation. System provides several standard mathematical operations with time series using a special user friendly interpreter for formulating arithmetic and relational operations. It also provides the possibility of regression analysis with many options, trend analysis and forecasting and correlation analysis. This type of software is a very efficient tool in all kinds of long term or medium and short term planning. The system is designed for processing of data with different time periods e.g. days, weeks, months, years, etc.. A special graphic package has been developed for representation of time series. An experimental version of this system is now available.

Decision support analysis provided by all described systems requires an efficient graphic tool with some special facilities, which are not involved in graphic packages available on the market. A special graphic package is beeing developed to support all requirements of the described systems. The user does not need any special skills for graphic representation of data except denoting the data set and a graph type. Basic types of graphs (line, bar) in cooperation with all subsystems are now available.

An inseparable part of a software package toolbox for a manager or a decision maker are systems supporting administrative. These include several database applications for evidence of personalities, materials, finance etc. A special toolbox for this purpose has been developed as an accessory product of the software development. The technology used enables quick development of any special database application tailored for special needs of any customer.

The user interface for both these "magement information systems" and decision support systems described above is the same and it is based on pull-down menus and same keyboard commands for all systems.

Another kind of a PC software is the IGM system which is an analogon of a data retrieval system for documentographic or factographic information. A version for IBM PC XT/AT, DEC mini and IBM mainframe is under development in IAC. The main feature of the system is a quick data retreival for databases with a structure including some formated fields which are used as a subject for data retreival. An user firendly well documented version for PC is expected to be available at the end of 1989.

All described PC software requires a PC with 640 kB RAM,an EGA monitor, a hard disk and a graphic printer. A PC AT is more preferable accordig to the speed of all packages.

3. Summary

The state of the development of all described subsystems enables to develop in a short time period special applications for individual needs of customers. All systems have a user friendly interface, appropriate user's guides, online help facilities and high software reliability.

The activities of the Focal Point are futher oriented towards metalic and nonmetalic branches of the CSSR/UNIDO Joint Programme and close connected to the activities of participating institutions focused on the process of informatization within industrial companies and the whole society. New trends in implementation of new information technologies are to be introduced. Together with the activities of IAC within the framework of computer communication it is expected to widespread new advanced technologies in database mangement systems and in technologies for text processing.

Bratislava, october 1989

Peter Baruch

/

THE INSTITUTE OF APPLIED CYBERNETICS IN BRATISLAVA CZECHOSLOVAKIA

In the period from the second half of 1970's activities of the IAC resulted in possibility of providing the users from central bodies as well as individual institutions and organizations of different Czechoslovak national economy industries with required results. The achieved research results and their practical implementation present an evidence of the fact that research activities were carried out on a required level and adequately followed the up-to-date needs of their users. Several results reached a level comparable with the foreign one. In this respect mainly results from spheres of computer communication and advanced information processing and distribution technologies must be mentioned.

The Institute enhanced its research activities by creating an effective home as well as international scientific and technological cooperation.

The achieved level of the IAC development can be defined by the following characteristics:

a) in respect to formation of the communication systems:
   - the level of knowledge of international standardization and valid international standards
   - acquired methods of formation of purpose-aimed operation systems for elements of computer networks
   - practical experience and verified procedures acquired in the process of development and operation of network instruments in the sphere of actual user application,

b) in respect to formation of information systems and technologies:
   - the acquired database technologies for factographic and documentographic formation of databases with the use of different computer systems

- acquired technologies of creating applications of different kind and purpose especially with the use of personal computers
- acquired technologies for formation of systems for the purpose of decision making and expert systems,

c) in respect to engineering projection and realization activities:
- acquired methods and procedures for designing the systems of computer communication as well as for the individual stages of their project preparation
- software realization of models and methods for designing and projecting the computer communication systems
- practical experience and verified procedures acquired in the process of project activities,

d) in respect to computer information service:
- the acquired communication and information technologies for enabling the access to the world-wide information sources
- the established organization and technological basis.

The created provisions enabled the setting-up of long-term conceptions of the IAC mainly with regard to the need of meeting the requirements of informatization development in Czechoslovakia. In the next period more attention will be paid to the development of those topically related activities which will ensure especially the processes of formation of the software house and computer information service (database centre, applications of informatics).

In this respect the main and perspectively long-term activities of the Institute are presented as follows:
- research and development of systems for computer communication and information technologies for the technical infrastructure of informatization

- functions of a specialized information institution working on the basis of computer information processing (database centre) and services of the computer communication systems (of the computer network, local networks, networks interconnection, etc.)
- the use of own research and development results within the scope of integrated consultation, training, testing, certification, projection and realization activities for the other research, productive and non-productive spheres.

INFORMATION TECHNOLOGIES

In the field of database technologies the activity was concentrated on the data-base system of the CULLINET IDMS company. After a multilicence had been bought and introduced in Czechoslovakia the system was implemented into use for the DB applications. Specific research data base applications (tasks, organizations), licence data base, etc. were designed and applied. Besides this the administration of the IDMS data base provided the users and authors of applications with its service. For the interactive data base usage the telecommunication monitor IDMS-DC was used through terminal as well as computer IAC network.

Recent works have been oriented on an unified application database (ORACLE) environment in PC - mini - main computers and unified communication environment of open systems. Some additional supportive SW instruments for rationalization of relational database projecting were developed. Another field of interest comprises decision making and information systems. Based on the information database systems, decision support systems are being developed. In reality it relates to the support of a multicriteria evaluation of alternatives by a group of experts. Systems are built on the basis of

mathematical models and knowledge bases. Such systems are nowadays being developed in the environment of PC or PC/LAN. In the near future the activities will be promoted along this trend nevertheless in continuation of the unified application environment and communication environment of the LAN and WAN.

One of the spheres of research and its realization is computer network and network applications designing. On the basis of the research results in the field of computer networks as well as on the basis of the IAC computer network operation the support of computer networks (WAN,LAN) designing and their applications is being studied. New supportive program instruments for the analysis and designing of computer networks focusing at throughput, correctness and reliability were developed.

The developed instruments were used in studies of networks in specific environments, e.g. commerce, transportation, machinery, etc. In the operated IAC computer network measurements were made and some applications implemented (such as CICS+STAIRS IDMS+DC).

DATABASE CENTRE

The purpose of the IAC Database Centre is to provide integral information services promoting the management and scientific and technological development.

The information services of the Database Centre concentrate on:

- providing the access to data-bases available within the network enabling the access to own data-bases
- designing and operating own data-bases
- related activities.

The access to foreign data-base is realized by the Communication and Information Administration through two routes:

- Centrally bought foreign data-bases with multi-users access operated in ÚVTEI-Prague are provided through the IAC Computer Network.
- Other data-bases operating abroad are accessible through "Stredisko automatizovanej výmeny informácií" (Centre of Automated Information Exchange) located in the premises of the Data-base Centre.

Communication and information services of the DBC include case documentry surveys in the world data-base, bibliographic retrospective outlines for general topics and continuous documentary reviews as services of the DBC.

The activity of the DBC comprises also operation and access of the databases projected in IAC or in other Czechoslovak organizations. In the IAC there are mostly projected factographic databases which are intended to assist the management of the scientific and technological development as well as investments construction projects. Database Centre is active in the field of concentrating the Czechoslovak information funds which are not computerized and develops its efforts also in exchanging the information funds on the international level.

Efforts of the DBC are promoted by own designing capacities oriented on the development of intelligence data-bases as well as development and maintenance of the software for the factographic data-base operation. Within the framework of related services the DBC provides for reprographic services and primary information sources in form of the library service.

Further development of the DBC aims at analytical information services which will provide their users with a choice of relevant information, assessment of pertinent information and elaboration of situation and front reviews.

THE IAC COMPUTER NETWORK(IAC CN)

THE 1st GENERATION OF THE NETWORK PRODUCTS

The common denominator of the IAC activities of the past, present and future is the environment - a system enabling the data processing with a multiple remote access - a computer network.

The IAC in Bratislava was the first in Czechoslovakia and one of the first organizations in the CMEA countries to have built a global heterogenous computer network on the principles of interconnection of open systems with the use of results of its own research. The experimental triangular data network with packet switching and datagram services started its activity in laboratory conditions in 1980. In December 1983 at the 33rd International tests of the SMEP in Bratislava the Institute introduced for the first time in the history of the CMEA countries the network hardware and software for elaboration of global computer network through JSEP and SMEP computers. In the pilot network configuration (Fig.1.) the service for users was manifested in form of a remote access from terminals to applications on the main computer.

In the years 1984-1986 in Czechoslovakia a pilot computer network was gradually being built with communication elements located in different parts of Bratislava and Prague and terminals spread over the whole territory of the country. It served the needs of the own study works, verification of the developed network instruments in actual operation as well as acquisition of practical knowledge of the operator as well as that of the user. The experience gained through the pilot operation together with the services provided to the network users assisted in the fact that in May 1986 the IAC Computer Network was put into operation on the economic basis.

This enrolled Czechoslovakia as one of the advanced count-

I N S T I T U T E O F A P P L I E D C Y B E R N E T I C S

Hanulova 5a, 84 416 BRATISLAVA
C Z E C H O S L O V A K I A

MDS : Multi-Criterial Decision-Support System for Planning and Management

Implemented by Dipl.-Ing. Tomas Vasko
RNDr. Imrich Bertok

1. Introduction

MDS is an all-purpose system (environment) for multi-criterial evaluation of discrete alternatives. Its all-purpose nature is characterized by the following properties:

- it enables a simultaneous solution of several independent decision-making problems which are freely organized into groups
- the system is open towards the used methods, which means that an unlimited number may be included in the system
- the individual algorithms - methods may be implemented in any programming language and they are not a direct part of the shell of the system
- in the simplest case the system may serve as an overview database system of alternatives and their parameters

2. Description of the MDS system

The system is hierarchically divided into two levels:

a. - level of programs P(1) ... P(p)
b. - level of goals G(1) ... G(g)

Under the term "program" we understand complex areas of evaluation, e.g. program of electronisation, program of development of the food industry, program of construction on a certain building site etc.

Every program P(i) may incorporate any number of goals. Under the term "goal" we understand evaluated objects i.e. concrete objects of the decision-making process, e.g. relevant products, projects or technologies. The goals are characterized by attributes A(1) ... A(a), eventually rules R(1) ... R(r), whereas alternatives of the goal V(1) ... V(v) are the objects of evaluation. Further characteristics of the goal may eventually be created in the system with the help of special methods.

Attributes together with rules form the characteristic of the goal. The selection of appropriate attributes is made by experts E(1) ... E(e) or by the moderator of the decision process. From the point of view of the decision-making process we divide the attributes into qualitative and quantitative depending on their values being objectively measurable (which means they may be numerically expressed and input beforehand, e.g. technical parameters, numbers, weight etc.) or being the subject of appraisal by experts.

By the means of rules experts express general characteristics of the goal, which can not be expressed by the values of attributes or where this presents considerable difficulties. Rules serve to define borders, limitations, eventually relations between attributes. Rules are of the IF-THEN type, where in the conditional and active part attributes are present. Every rule has an allocated weight, which influences the final evaluation of alternatives. The rules are defined by the experts together or are input by the author of the program.

Every goal may be expressed by any number of alternatives. The aim of the MDS is to specify the optimal ranking of alternatives with the help of the knowledge expressed in attributes, in the weights of the particular rules and in the alternatives employing methods of multi-criterial evaluation.

Experts from the given field participate in the definition of the decision-making task and its solution. Their responsibility is to choose the attributes and general rules for the given goal, to select the weighs of the attributes and to determine the qualitative attributes of every alternative.

The moderator of the decision problem is responsible for the management of the process. He is the only person who can modify parameters of the system and provide common and final evaluation.

3. Conclusion

Such a broad-concept, open system with a modular structure offers a wide variety of practical use. For specific applications it is possible to create versions which are exactly "tailored to suit the needs" for one or several problems in a short span of time but nevertheless with all comfort required for software products of this kind, which also has a big importance from the commercial point of view.

ries of the world in which the global computer network has been established.

The above network development period is characterized by orientation on a standardized network architecture for interconnection of the open systems (OSA) as well as on relevant recommendations of the CCITT. The study works were carried out in such a way as to enable the computer network formation mainly on the basis of the SMEP and JSEP computers with the use of conditions provided for by the Czechoslovak Unified Telecommunications Network. The network instruments developed in the period until the end of 1987 form the so-called 1st generation (Fig.3.). It is represented first of all by single-purpose program systems for individual communication network elements. The characteristic features of the 1st generation network can be listed as follows: users data network with a datagram interface to terminal appliances and implementation of network program systems on the SMEP computers.

The IAC Computer Network configuration grew adequately to the operator´s possibilities of meeting the user´s needs (Fig.2.). It can be assumed that in the present network especially the user´s interest in using the existing information sources and computer capacities of the connected main computers is being satisfied. Then there are those who for their applications are only interested in using the service of the data network but nevertheless also those who are ready to offer the network their own main computers with sources and at the same time to establish with their own means the operation of other communication network elements.

In the period of the studied IAC Network operation the Institute signed agreements on Network participation and utilization with 67 organizations. Besides the network elements marked in Fig.2. the network is connected with more than 100

terminals. Following are the most interesting data characterizing the operation within the network:

- the throughput of the centre computer has not been fully utilized within the possible scope of the network operation (appr.30 packets/s)
- the probability of the successful realization of connection with the main computer on a regular operation basis in the on-line regime is not worse than 80% (the average one is better than 90%)
- the readiness of the individual communication network elements is better than 99,8%
- the number of the packets accepted by the data network from terminal equipments is somewhat within the range of 0,3 to 0,5 mil. packets/week
- the delay caused by the network is not bigger than 10 s
- the main network load (60%) is concentrated on the database centre ÚVTEI-ÚTZ Prague and the rest on the other main computers
- the mean time between failures is for short system falls about 150 hours and for outage of the whole system about 1 500 to 1 700
- the mean time of the failure repair is for short system falls less than 5 min. and for outage of the whole system about 2 hours.

Problem spheres to be studied during the on-coming network operation can be defined as follows:

- increase of the reliability and readiness
- more even distribution of the load in accordance with the development of applications
- coexistence of the operation, development products verification and work demonstrations
- usage fees
- extension and innovation .

INNOVATION OF THE IAC COMPUTER NETWORK

THE 2nd GENERATION OF THE NETWORK PRODUCTS

The IAC Computer Network is based on the network hardware of the 1st generation. The necessity to meet new requirements of users which concern changes in installation and utilization of the network together with the tendency of using the specialized systems for the communication purposes led to initiation of the development of network products of the 2nd generation (Fig.3.). Other development motives include: higher capacity and reliability of communication elements, decrease of their input, price and dimensions. The important factor was also presented by compatibility with the environment of the public data network as well as with products of computer and transmission technology manufacturers with interface of X.25.

The 2nd generation of network products is represented mainly by special microprocessor systems equiped with single purpose operation systems for individual communication elements of the computer network. The characteristic feature of the 2nd generation network is the data network interface according to the X.25 recommendation of the CCITT. That means that the network uses the service of virtual circuits and also other relevant recommendations of the CCITT. X.series are being used (e.g. X.200, X.75, X.3, X.28, X.29, etc.).

On the basis of the MXP-16 multiprocessor system (it comprises sepervisory processor and maximally 16 subordinate processors) data network elements and a gateway computer are being developed.

The node computer will provide for packet switching through permanent and switched virtual circuits. It will support the standard X.25 interface on the packet DTEs and concentrators and X.75 interface on the other node computers

and data networks. It will also support other selectable user options, especially the closed group option, the identification of the network users, the fast select and data for accounting. The centre functions distributed to individual processors are being realized by software systems for the supervisory processor and subordinate processors.

The network concentrator works as a concentrating equipment for creating several temporal data connections on one data circuit. On the circuit to the data network node it respects the X.25 interface. It also supports selected parameters according to the X.3 recommendation as well as X.28 and X.29 recommendations. Functions of the concentrator are realized by software parts for the supervisory processor and subordinate processors.

The measuring and control centre of the data network is implemented as a software for the PC/AT computer. It will be connected to the network as a host computer minimally through two data circuits with X.25 interface.

For the connection of the user's equipment to the connecting point of the data network on the node or the network concentrator it is required to keep the parameters of the relevant interface. Main computers will be connected mainly through the front-end microprocessors which will disburden them of functions related to communication control.

Connection of the 16 and 32 bit main SMEP computers with a common bus-bar and storage organizer to the network can be done through the front-end microprocessor by connection to the network or users concentrator or directly to the centre of the data network.

For the connection through the front-end microprocessor a monoprocessor AKM/SZ-X.25 system will be used. The necessary activities will be provided by a special software, which forms its own real time operation system and modules for the indivi-

dual communication functions. Connection to the concentrator with functions of the packet concentration centre (PAD) will be used in case, when a bilateral remote terminal access is required. The direct centre connection is done through a standard modem adapter. It represents a program implementation of the III.level of the X.25 recommendation into a special program module (SPM), which works under a given operation system.

An important system of the 2nd generation technical instruments is a modular multimicroprocessor kit-3MS. Module combinations of the kit enable formation of other communication elements for the 2nd generation computer network.

On the basis of this kit it is possible, for connection of the main JSEP computers to the network, to create a front--end processor with X.25 interface to the data network node also with support of the X.29 recommendation. Special processor software will contain its own real time operation system with primitives for communication of processor run on different processors interconnected by the I-41 kit, an emulator of the local JSEP equipment and modules for providing for the individual communication functions.

Another modules combination of the kit enables formation of a users data concentrator which will carry out functions of the packet concentration node (PAD). Functionally it is characterized by the X.25 interface to the data network node and the support of selected parameters of the X.3 recommendation and recommendations of X.28 and X.29. On the basis of the 3MS kit it is possible to form an emulator of the local terminal system and statistical or time multiplexor. Prospectively possible is also the kit usage for connection of computer sources into the local network, or to the inter-network computer for the connection of the local and global computer network.

The essential stage of the network systems formation of the 2nd generation will be finished in 1989. From this year

on within the IAC Computer Network an exchange of the SMEP node computers for the MXP-16 systems with the datagram interface software will be carried out. From 1990 an innovation of the network to the one with virtual circuits service will be initiated. By gradual substitution of the node software a users data network with X.25 interface will be created and to this the user's equipment with the same interface will be connected. For this purpose other network instruments of the 2nd generation systems will be utilized.

For the same period within the framework of the Czechoslovak Transportation and Communications it is planned to construct a packet experimental public data network (PEVDS) which will make use of the network instruments developed and supplied by the IAC. The year 1990 is the expiry date of the permission issued by the Communications Department on the agreed mode of the data circuits usage within the IAC Computer Network. Therefore it became a question of the day to make an agreement of the interested organization (IAC, VÚS and MTTÚ Prague) on the way and procedure of shifting over to utilization of the new data transmission service as well as on providing for the data network operation and the necessary network instruments development. The aim of their common effort is to provide the Czechoslovak users from 1991 with an environment adequate to their needs.

In the period from 1990 together with the 2nd generation network instruments usage also the interconnection with international systems and networks built within the framework of the CMEA countries will be considered. This is confirmed besides other things by the interest of the Communications Department of the Estonian Soviet Socialist Republic to implement the users data concentrator in their conditions and as well as by their interest in possibilities of interconnection with networks in Scandinavian countries.

The complex of modern network instruments for the 2nd generation computer network represents an actual contribution of the Institute of Applied Cybernetics in Bratislava to formation of the technological infrastructure necessary for the informatization process of the Czechoslovak society.

FIG. 1 PILOT COMPUTER NETWORK CONFIGURATION
DECEMBER 1983

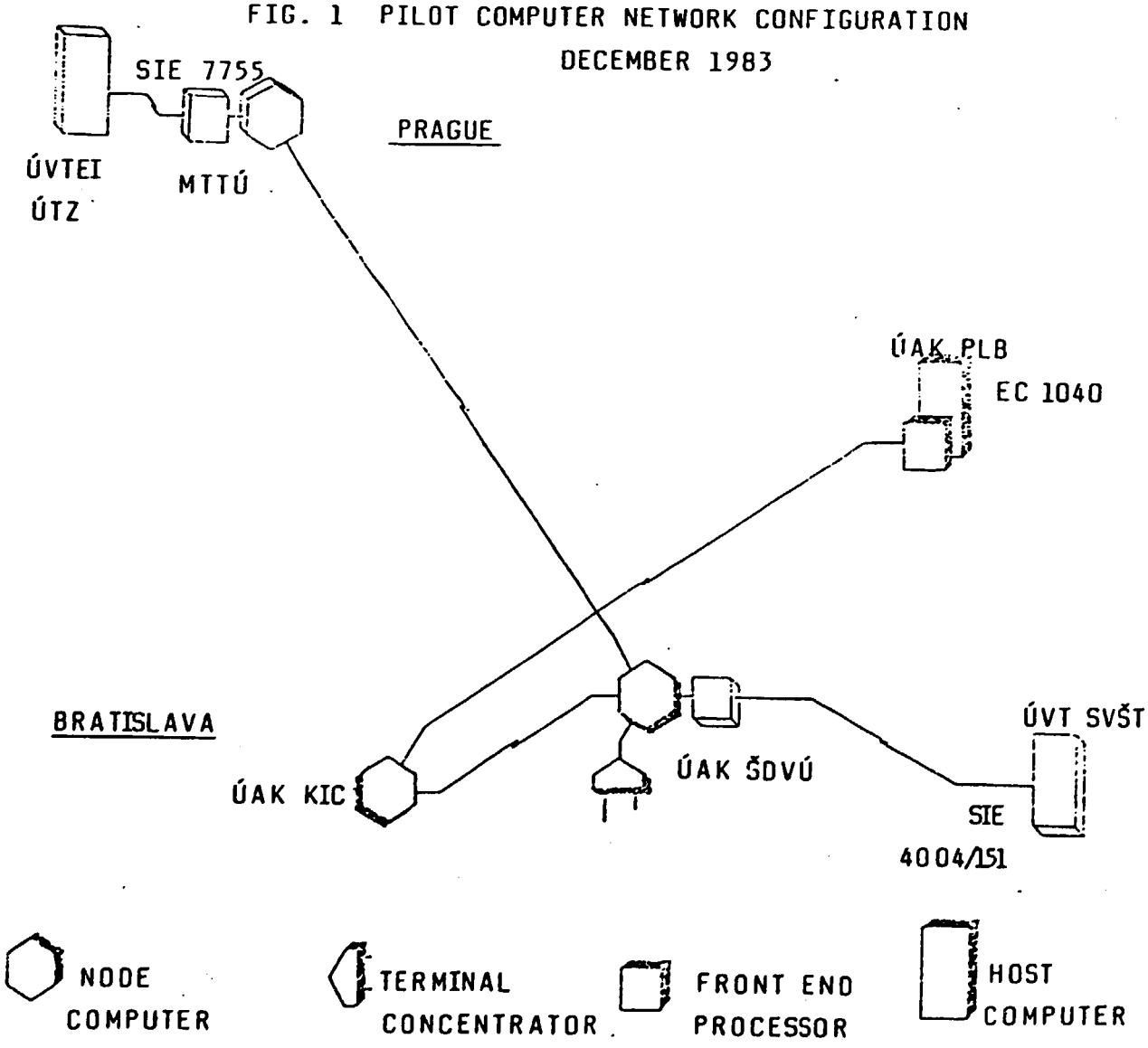


Fig.1. Pilot Computer Network Configuration
December 1983

Network element sites:

Bratislava: ÚAK PLB (Computer Laboratory) - Hanulova St.
ÚAK ŠDVÚ (State Wood Research Institute) -
- Lamačská cesta
ÚAK KIC (Communication Information Centre) -
- ul. Čs. armády
ÚVT VŠ (University Institute of Computer Tecl
nology) - Mlynská dolina

Prague : MTTÚ (International and Intercity Telephone
and Cable Exchange) - Olšanská St.
ÚVTEI ÚTZ(Centre for Scientific, Technologi-
cal and Economic Information, Cen-
tral Technical Base) - Havelkova S

FIG. 3 STAGES OF THE NETWORK INSTRUMENTS
DEVELOPMENT IN CZECHOSLOVAKIA

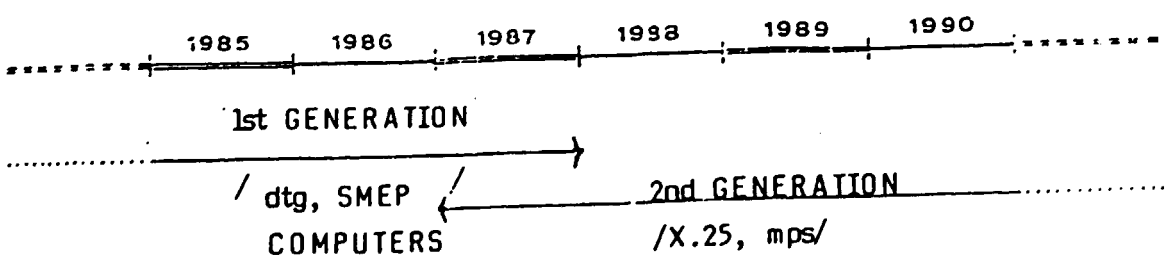


Fig. 3. Stages of the Network Instruments Development in Czechoslovakia

Data Network Interface: dtg - datagram
X.25 - according to the CCITT X.25 recommendation

Communication elements: SMEP - SMEP Computers
mps - microprocessor systems

Fig. 2. IAC Computer Network
January 1989
Network element sites:

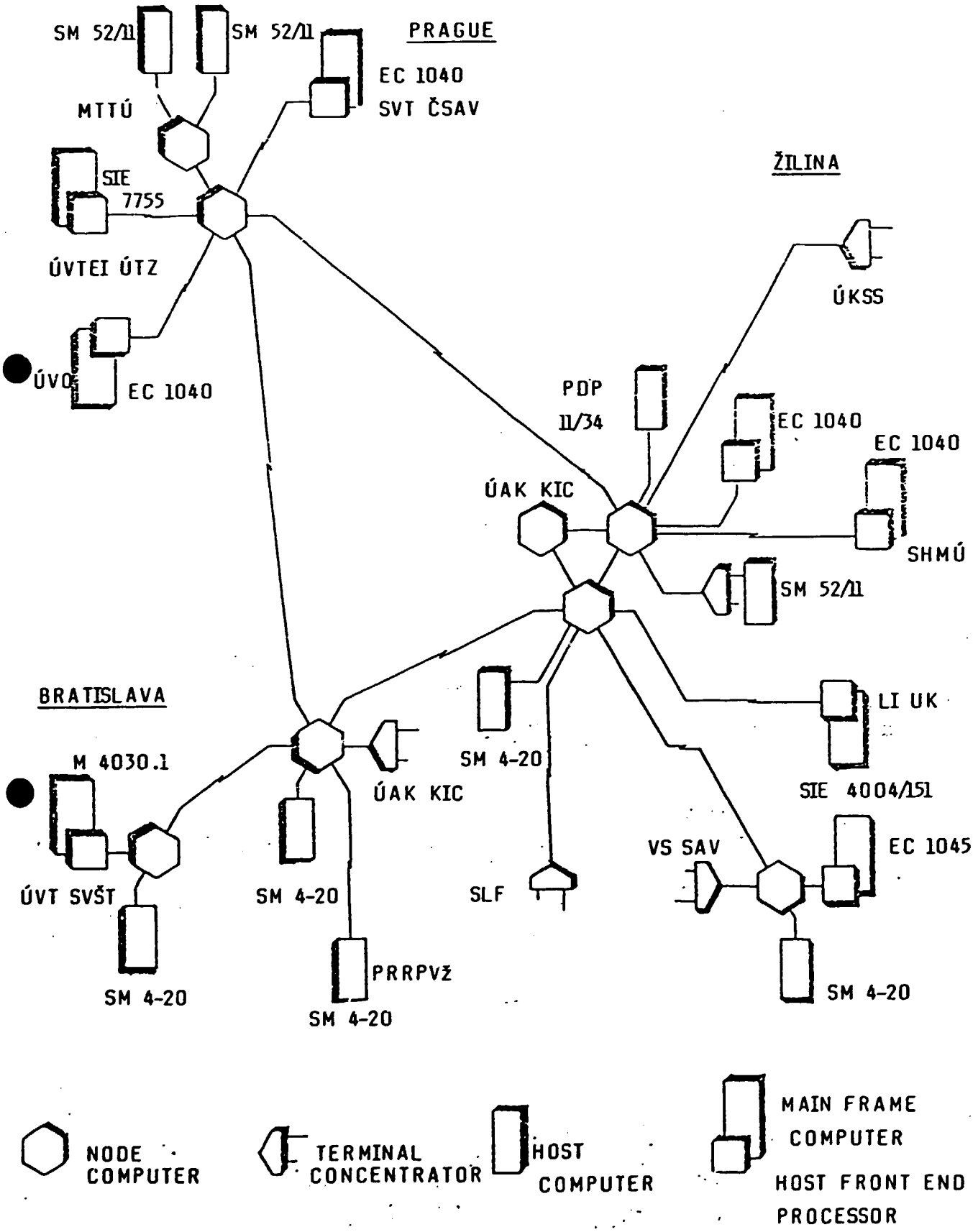
Bratislava: ÚVT SVŠT (The Institute for Computer Technology at the Slovak Technical University) - Gottwaldovo nám.
PRRPVž (Enterprise of Management Rationalization in Agriculture and National Nutrition) - ul. Obrancov mieru
SLF (Slovnaft Refinery and Petrochemical Company) - Vlčie hrdlo

VS SAV (Computer Centre of the Slovak Academy of Sciences)-Dúbravská cesta
LI UK (Laboratory of Informatics at the Faculty of Mathematics and Physics of the Comenius University)-Mlynská dolina
SHMÚ (Slovak Hydrometeorological Institute)- - Jeséniova ul.

Žilina: ÚKSS (Area Communications Administration)- - Poštová ul.

Prague: SVT ČSAV (Computer Technology Centre of the Czechoslovak Academy of Sciences)- - ul. Pod vodárenskou věží
ÚVO (Office for Inventions and Patents) -

FIG. 2 IAC COMPUTER NETWORK - JANUARY 1989



Terplan

ZALOŽEN 1964

ANNEX II

UNIDO

Kiev 23. - 27.10.1989

AN EXPERT SYSTEM EVALUATING THE IMPACT OF AN TRAFFIC SYSTEM IN THE CITY ON THE ENVIRONMENT

Eva SOVJÁKOVÁ
TERPLAN - Czechoslovak Institute for Regional Planning
Platnéřská 19, 110 00 Prague, Czechoslovakia

Abstract :

The SAK-ZPDoprav consulting expert system is described. The system evaluated the impact of a traffic system on environment in the city. The implementation of the system is based on an "empty" consulting system SAK programmed in Turbo PROLOG on PC/XT computer. The general inference procedure and a calculus for uncertain reasoning used in the SAK-ZPDoprav system are mentioned. The structure of both main knowledge bases of the SAK-ZPDoprav expert system are given in detailes. On the diagram in the appendix the examples of appriciations of probleme of a traffic system in several towns in the Czechoslovakia by both the human expert and the expert system SAK-ZPDoprav are confronted.

Terplan - the Czechoslovak Institute for Regional Planning concentrates on prognosticating and planning the development of residential agglomerations, large territories or cities. Frequent tasks include also the localization of large capital-construction and building projects, e.g. the localization of nuclear-power facilities, consideration of territorial aspects of routing superhighways etc.

Computer support utilizing a vast data bank of the Integrated Information System on the Territory of Czechoslovakia - IST - and featuring a number of application methods constitutes an indispensable part of the designing work. Techniques of knowledge consultation systems - the IST Expert Systems are one of modern methods included among decision support systems - DSS.

At the present time, IST expert systems focus on solving problems in two fields of managing the development of investments. The first thematic group concentrates on the solution of problems of territorial and localization analysis in which the criteria of selection get more perfect or complicated according to the growing knowledge of the real-estate market and of the process of evaluating real estates and building sites. The other complex of problems embraces the determination of the impact of capital-construction or building projects on the human environment. An important stimulus for materializing expert systems emanated from the need of processing, evaluating and unifying knowledge gained, on the one hand, inductively from the information provided by the IST and, on the other hand, from the knowledge representing the team work of specialists-experts in various disciplines of regional planning.

IST expert systems differ from common type of expert systems in particular by their territorial aspects. Although in the present phase of solution information on the territory concerned is incorporated implicitly in the knowledge base, in the future such information should be available from the processing of graphic knowledge.

We present the example of an expert system for evaluating the influence of traffic on the environment in a residential area as an example of applying the techniques of expert systems. The above expert system was launched in 1987 consisting at the present time of two data bases, special-purpose data base and mathematical models for calculating traffic noise and pollution.

The expert system evaluates the impact of traffic on the environment primarily from the following three aspects:

- quality of pollution / in the Czechoslovak Socialist Republic industries and the power industry are estimated to account for 68 per cent, heating for 15 per cent and transportation for 17 per cent of total amount of substances emitted in the atmosphere /,
- noise / only in Czech towns more than 2 million people are estimated to be endangered by noise exceeding 65 dB /,
- accident rate.

In addition to the three most serious influence the expert system follows also other ones as e. g. the psychic impact of time losses, violation of esthetic values, water pollution, violation of preserved areas, occupation of agricultural and forest land, and solid waste. The positive influances considered in the functionally optimal traffic system include time saving, transport payload itself or secure and civilized transport of persons and freight in the origin-destination direction, including transit.

The objective of consultations is to present the view of a traffic specialist working on designing the city traffic network concerning the traffic system.

KNOWLEDGE ACQUISITION

The data base of the SAK - ZPD expert system was created by a traffic specialist. During testing the data base was divided in the end into two interrelated bases. The first one evaluates comprehensively the traffic system in the city, other one evaluating in detail traffic situation from the viewpoint of environment on a selected traffic route. An expert system adapted in such a manner can register changes on individual routes. The master control system feeds such change converted in relation to other routes into the system evaluating the traffic system and its impact on the environment as a whole.

At the present time, the city knowledge base includes the total of

44 questions
4 interlaying statements
1 goal statement.

The knowledge base for an individual route contains

42 questions
6 interlaying statements
1 goal statement.

The result of consultation is presented in text "According to your answer and my knowledge base, I deduced that impact of the assessed traffic on environment is:..."

In the appendix the structures of both main knowledge bases are given in details.

SOME INFORMATION ABOUT THE SAK CONSULTING SYSTEM

The empty consulting system SAK was designed and programmed by J.Iványek, J.Ferjenčík and J.Švenda /Prague School of Economics, Department of Scientific and Technical Information/ in Turbo PROLOG on PC/XT computer as a version of a MYCIN-like consulting system EQUANT /constructed by P.Hájek and M.Hájková, Czechoslovak Academy of Sciences, Mathematical Institute, see 2/.

KNOWLEDGE BASE IMPLEMENTATION

A knowledge base of the system generelly consists of a list of statements $P_1,..,P_m$ and a list of rules $R_1,...,R_n$ in the following form:

if (antecedent A) then (consequent P)with a weight(w)

symbolically: A => P(w),

where an antecedent A is an elementary conjunction of some statements or their negations, a consequent P is some statement that does not lie within the antecedent, and w is the uncertainty measure of the rule. It is assumed that the rule net does not contain a loop. The statements that are within the consequent of no rule are question; the statement that are within the antecedent of no rule are goal statements; other statements are interlaying ones. Each rule can be provided by an context - a statement that determine in which situation the rule is to be applied.

A CALCULUS FOR UNCERTAIN REASONING

There are four functions to determine a calculus for uncertain reasoning used in the SAK consultation system.

Those functions are NEG, CONJ, CTR, GLOB defined on the fixed weight interval(-1, 1).

1/ The NEG function for evaluation of the weight of the statement negation in case the weight x of the statement itself is known.

NEG(x) = - x .

2/ The CONJ function for evaluation of the weight of a conjunction of two statements in case their weights x and y are known.

CONJ (x,y) = max(0,min(x,y)) .

This CONJ function is usual semantics of a conjunction.

3/ The CTR function for determining a contribution of the rule A=>P(w) to the weight of the statement P in case the weight a > 0 of the antecedent A is known /for a ≤ 0 CTR(a,w) = 0 is defined/.

CTR (a,w) = sign(w) . max (0, a + |w| -1) .

CTR is an assessement of the modus ponens rule in fuzzy logic.

4/ The GLOB function for combining contributions of several rules directing at the same statement. The GLOB function is deriv derived from the semantics of "bold" disjunction in fuzzy logic:

$$GLOB(x_1,..,x_k,y_1,...,y_t) =$$

$$= \min(1,x_1+...+x_k) + \max(-1,y_1+...+y_t) ,$$

where $x_1,...,x_k$ are all positive contributions and $y_1,..,y_t$ are all negative contributions to the same statement.

CONSULTATIONS WITH THE SAK - ZPD SYSTEM

The system is giving the user consecutive questions in the form of texts stored in the knowledge base under respective statements-questions. The sequence of the questions is given by a position of these statements within the knowledge base. The user answers the questions simply by a code selected from the scale with eleven points / the same way as for expressing uncertainty of rules/:

certainly	yes	5
likely	yes	4
.	yes	3
perhaps	yes	2
.	yes	1

I do not know, the question is meaningless for my problem		0
.	no	-1
perhaps	no	-2
.	no	-3
likely	no	-4
certainly	no	-5

The general inference procedure ensures in the SAK-ZPD consulting system to carry out the following calculations :

In case that weights of statements-questions are given /the system will obtain them from the user during the consultation/, the weights of antecedents of those rules in the ZPD knowledge base which contain questions only are calculated by the NEG, CONJ functions. The weights of antecedents and the uncertainty degrees of rules are used for determining contributions of rules by means of the CTR function, and the weights of all interlaying statements through the GLOB function. Now, it is analogously possible to calculate the weights of the antecedents of other rules /since the weights of the statements in their antecedents are already known/, and to determine their contributions. Finally, the weight of the goal statement is calculated through the GLOB function from the contributions of corresponding rules.

At user's requirement, the system is able:
- to explain why it is submitting a question,
- to explain the way it derived the weight of a statement,
- to explain the way it derived the contribution of a rule,
- to print the inference process in details,
- to allow a change of an answer to a question,
- to stop the consultation before the normal end.

The consultation normally ends after the system has submitted all necesarry questions to the user and inferred the weight of the goal statement. In the communication with the user, the system is expressing all the weights by number in the interval of (5,5) - although it is internally working with the weight from the interval of (-1, 1).

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"83" Will city transport be assessed in the territory dealt with?

"66" Is the connection between town-serving transport and city transport ensured?

"67" Are the demands of transport such as to require a change of city transport to a higher-capacity type?

"68" Does city transport ensure satisfactory connection between the individual districts?

"84" Will air transport be assessed in the territory dealt with?

"10" Does the location of the airport affect negatively the level of noise in the major part of the territory dealt with?

"69" Does the noise generated by air transport exceed the admissible level for residential areas?

"85" Are there any protected regions in the territory dealt with, viz. National Parks, National Wildlife Refuges, National Reserves etc.?

"86" Are these protected regions crossed by any road transport?

"32" Does road transport encroach upon the zones of natural and curative sources of 1st and 2nd degree, or the inner health resort territories?

"33" Does road transport encroach upon 1st and 2nd degree zones of drinking water supply?

"34" Does the reconstruction of the road network encroach upon the territories of a National Park, National Wildlife Refuge, National Reserve etc.?

"38" Have adequate measures been adopted in the zones of drinking water supply preventing accidental pollution?

"39" Have adequate measures been adopted in the zones of drinking water supply preventing seasonal pollution?

"40" Have adequate measures been adopted in the zones of drinking water supply preventing systematic pollution?

"87" Do railway lines cross these protected territories?

"61" Does railway transport encroach upon the zones of natural and curative sources of 1st and 2nd degree, or the inner health resort territories?

"62" Does railway transport encroach upon 1st and 2nd degree zones of drinking water supply?

"63" Does railway transport encroach upon the territory of a National Park, National Wildlife Refuge, National Reserve etc.?

"70" Have adequate measures been adopted in the protective zones preventing accidental pollution caused by railway transport?

"71" Have adequate measures been adopted in the protective zones preventing systematic pollution caused by railway transport?

"90" Is there land or are there forests in the territory under examination that are subject to special protective treatment?

"77" Is the territory with protected land or woods crossed by road transport?

"35" Does the reconstruction of road network in the territory with specially protected agricultural land affect negatively the conditions in that territory?

"36" Does the reconstruction of road network affect negatively protective woods and woods for specific purposes?

"78" Are the territories with protected land and woods crossed by railway transport?

"64" Does the reconstruction of railway network encroach upon the territory with specially protected agricultural land?

"65" Does the reconstruction of railway network encroach upon the territory of protective woods and woods for specific purposes?

"75" The noise caused by air transport and city transport in the territory examined has a negative effect on the environment.

"97" The system of transport assessed from the point of view of its functionality ensures effectuation of the transport requirements.

"88" Road transport can be an impairment to the territories protected.

"89" Railway transport can be an impairment to the territories protected.

"79" Road transport can impair specially protected land and woods.

"80" Railway transport can impair specially protected land and woods.

"99" The types of transport assessed impair protected territories.

"98" Transport on the routes assessed is an impairment to the environment.

"100" According to your answer and my knowledge base, I deduced that impact of the assessed traffic on environment is: ...

APPENDIX 2

THE SEQUENCE OF INQUIRES OF THE SAK-ZPDtrasy
(influences from the traffic system on the environment along the route)

"31" Will the effects of transport along the selected road be assessed?

"14" Is the communication satisfactorily maintained as far as the roadway is concerned?

"15" Does the communication have sharp bends and high gradients?

"16" Does the level of noise on the communication examined exceed the admissible equivalent level in physical training and health strengthening grounds and nature reserves?

"17" Does the level of noise on the communication examined exceed the admissible equivalent level in areas of educational and cultural facilities?

"18" Does the level of noise on the communication examined exceed the admissible equivalent level in urban residential areas?

"19" Does the level of noise on the communication examined exceed the admissible equivalent level in suburban developments?

"20" Does the level of noise on the communication examined exceed the admissible equivalent level in mixed zones?

"21" Have the minimum widths of the hygienic and isolating zones of distances from the communication been adhered to?

"22" Have the hygienic and isolating zones been adhered to as far as the parking areas and lay-bys are concerned?

"23" Does the intensity of the traffic exceed the capacity of the communication?

"24" Is "green wave" traffic effectuated on the communication when traffic is regulated by traffic lights?

"25" Is the communication assessed unduly taxed with transit traffic?

"26" Are the extraurban sections of the communication satisfactorily protected as far as collisions of automobiles with animals are concerned?

"27" Does the communication have any defective level crossings?

"28" Have crossroads been designed in accordance with the intensity of the traffic and the types of the communications involved as flyovers and underpasses?

"29" Has the communication a dividing effect?

"30" Is the communication well landscaped?

"31" Must the roadway be reconstructed in order that vibrations of the buildings along it may by reduced?

"37" Does the communication have any crossings or subways at suitable points?

"41" Can high probability of exceedance of transient concentration of CO (approximating to maximum) be expected on the communication?

"42" Is the surface of the roadway in longer sections of the communication assessed paved?

"43" Has the inconvenient section of the communication crossing the urban area been suggested for reconstruction of displacement (viz. bypass)?

"44" Are the pedestrians totally separated from the traffic?

"45" Is the communication satisfactorily lighted?

"46" Should measures be taken to raise the width between the building lines or the areas of crossroads in order that the negative effect of traffic on the environment may be prevented?

"47" Should the speed of vehicles be reduced on the communication due to the negative effect of traffic on the environment?

"48" Are the railway stations on a satisfactory cultural level as far as their equipment and conveniences for the passengers are concerned?

"50" Have the so-called passive modifications of buildings been effected in order that the negative effect of road traffic may be reduced?

"72" Does the communication have any bottlenecks and inadequate overpasses?

"82" Will the effects of traffic along the railway line selected be assessed?

"49" Is the railway line assessed electrified?

"51" Do the demands of the traffic exceed the capacity of the individual sections of the railway line?

"52" Do the demands of the traffic exceed the capacity of the railway junctions?

"53" Does the level of noise caused by railway transport exceed the admissible level (during the dey and at night) in health strengthening and physical training grounds and nature reserves?

"54" Does the level of noise caused by railway transport exceed the admissible level in the areas of educational and cultural facilities?

"55" Does the level of noise caused by railway transport exceed the admissible level in urban residential areas?

"56" Does the level of noise caused by railway transport exceed the admissible level in suburban residential areas?

"57" Does the level of noise caused by railway transport exceed the admissible level in mixed zones?

"59" Does the railway line heve a separating effect?

"60" Has the railroad track satisfactorily been maintained?

"74" Have the so-called passive modifications of buildings been effected in order that the negative effect of railway transport may be reduced?

"91" The noise caused by traffic has a negative effect upon the environment along the route assessed.

"92" Exhalations from traffic degrade the environment along the route assessed.

"94" Noise of emissions of traffic degrade the environment along the route assessed.

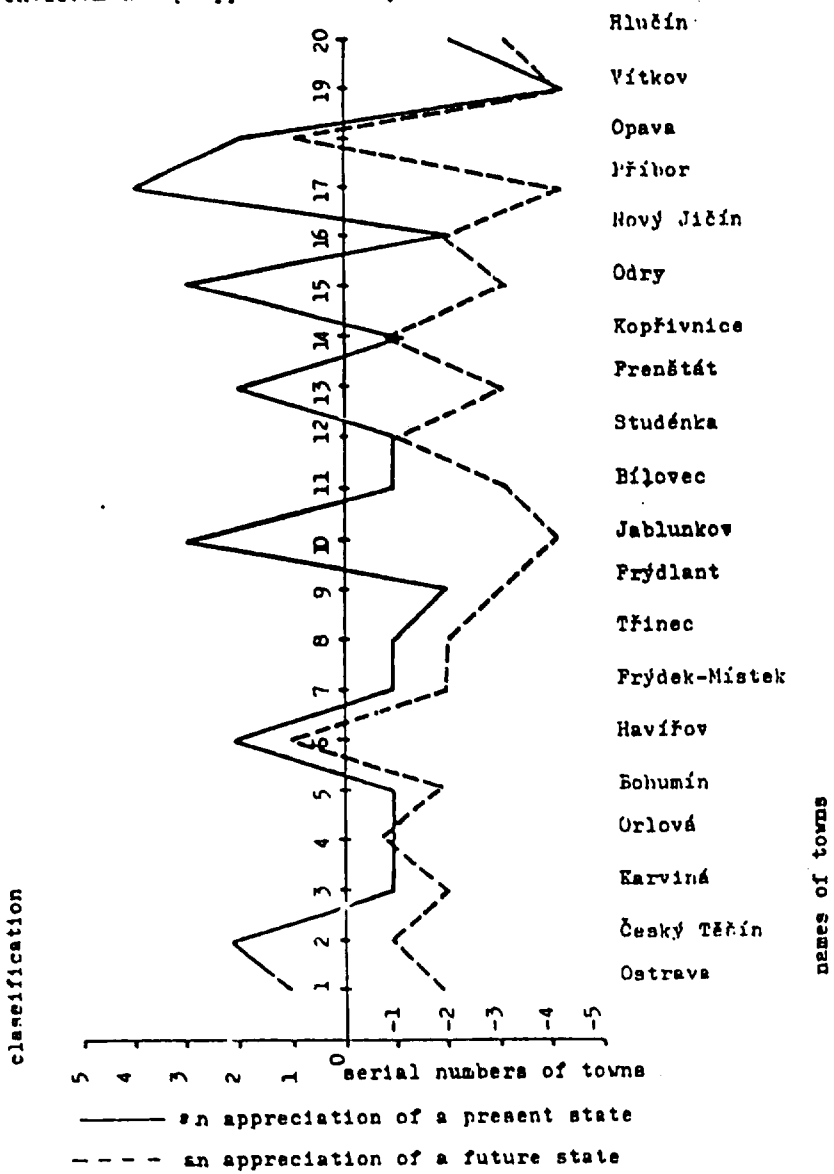
"93" From the point of view of capacity and economy the location of the transporting route assessed satisfies the demands of transport.

"95" The safety of traffic has declined.

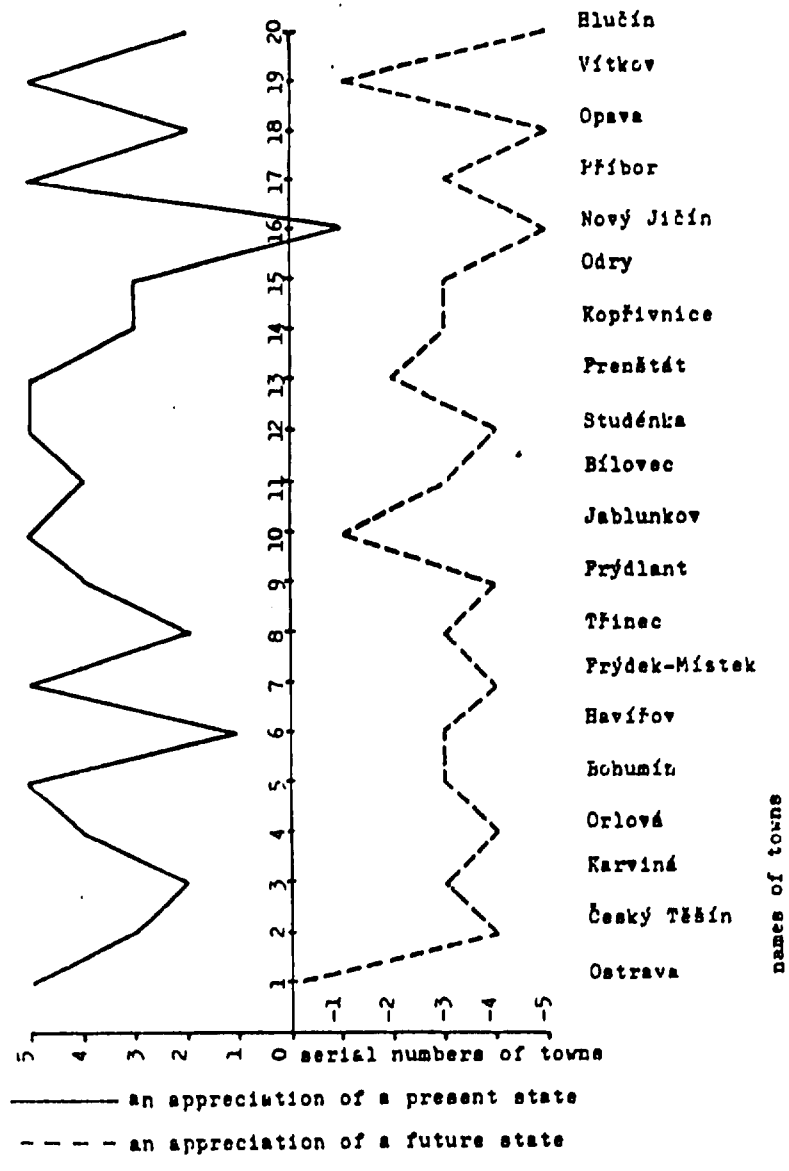
"96" The other effects of traffic assessed, viz. the separating effect, the aesthetic effect, the culture of transport, the vibrations and the time losses on the route assessed, are negative as far as the environment is concerned.

"98" The traffic along the route assessed is an impairment to the environment.

The development of the impact of the traffic system on the environment by appreciation by a human expert



The development of the impact of the traffic system on the environment by appreciation by an expert system



Computer-aided tools for environmental impact assessment in a sustainable world

by
Josef Gruber *

October 20, 1989

1 Introduction

Our world can be sustainable only if ecological risks connected with the production and consumption of goods and services are kept low. In order to keep these risks low, large amounts of information are needed. Also needed (better: needed above all) are powerful governments which are determined to serve the long-run well-being of the whole population of the individual countries and which are willing to cooperate world-wide.

The information required about each ecologically relevant substance concerns

a) the quantity of the substance produced;

b) the places where it is produced, processed, traded, transported and consumed or disposed of;

c) the effects (= impacts) it has or may have under various circumstances.

* Address of the author:
Chair of Statistics and Econometrics, Department of Economics, University of Hagen (FernUniversität), Feithstr. 140, D-5800 Hagen 1, Telefon 02331/804-2615, Telex 823137 feuni d, Telefax: 804313
This note has been prepared at the invitation of UNIDO, Vienna (Austria), for the expert meeting in Kiev (USSR), October 23-27, 1989.

To collect, administer, process and use this information about each ecologically relevant substance is a task which can hardly ever be completed: The number of pieces of information is very large and many of these pieces of information are difficult to determine (even if e.g. the best electronics equipment and the most advanced statistical methods are used).

For each ecologically relevant substance, reliable information is required about many types of impacts (= effects), e.g.

- on human beings (unborn and during various phases of life. on the genetic code)
- on animals and plants
- on soil, water, air
- in the short-run, medium-run, long-run.

The required pieces of information about such impacts can be arranged

- in a matrix, perhaps even in a three-dimensional matrix, or
- in a long list or register (in which the columns or rows of the matrix are "stacked"; in German, such a list is sometimes called "Kataster").

The form of arrangement is not important.

The number of ecologically relevant substances is very large. It is steadily increasing, mainly because of new chemical products. For example, in the Federal Republic of Germany (FRG) there are now between 5000 und 10000 chemical substances with at least 10000 kg marketed per year (Deutscher Bundestag, 1986; Vorreyer, 1987, S. 104). The number of substances of which smaller quantities are produced and marketed is most likely still much larger [1]. Even if many of these substances are not as "effectice" as e.g. plutonium or dioxin, the task of environmental impact assessment for a sustainable world is tremendous.

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1 For example, it is estimated that the Rhine river in Northrhine-Westfalia contains 50000 to 100000 (organic) substances, of which only some 140 are taken into account in this state (= "Land") of the FRG (Anonymous, Bonner Energie-Report, Oct. 2, 1989, p. 8).

This is true for countries in all stages of development. In a developing country, the number of substances is most likely much smaller than in a developed country like the FRG with a strong chemical industry. But the main components and properties of computer-aided tools for environmental impact assessment in a sustainable world will be the same in any case.

2 On components and properties of computer-aided tools for environmental impact assessment/proposal for action

Computer-aided tools for environmental impact assessment should contain the following components and possess at least the following properties:

1. A register (in German: Kataster) of emissions for each ecologically relevant substance and each region of a country.
2. A register of immissions for each ecologically relevant substance and each region of a country .
3. A register of transport, diffusion. impacts (= effects) and damages of ecologically relevant substances.
4. A bank of quantitative methods and models.
5. Compatibility of software and hardware.
6. Keeping social costs low.

The registers will contain some information which is **rather specific** for each country (e.g. quantities of substances). They will also contain a large fraction of information which is **the same** for at least groups of countries. perhaps for all countries (e.g. effects).

The larger the need for an exchange of information among countries, the stronger is the need for using e.g. the same or at least **compatible software** and **standardized hardware.**

The **statistical offices** of the states and countries and their international counterparts will play a major role in establishing and operating systems of

environmental impact assessment. Many other state agencies (e.g. ministries) and private organizations (e.g. producers' associations, consumers' associations) will contribute to and use systems of environmental impact assessment.

Establishing and maintaining a computer-aided system of environmental impact assessment in each country is **expensive**. Such a system will bring sufficient benefits to society only if it facilitates **improved decision making** at various aggregation levels (e.g. decision making of individual firms, of branch-specific associations of producers and of central and regional governments): At least the major effects of decisions should be investigated before decisions are made; the decisions should satisfy optimality criteria.

To reach this goal with a minimum of institutional difficulties, a **bank of quantitative methods and models** must be an integrated part of the system for environmental impact assessment. At the minimum, one should be able to feed a separate methods bank with data from the system for environmental impact assessment. The methods bank will have to comprise a whole range of methods and models from statistics, operations research, cybernetics, systems analysis etc. A brief report on very positive results from an integrated system in Bavaria will be given in the next section.

When setting up a computer-aided system of environmental impact assessment, it is extremely important to choose an **institutional framework** which keeps the **social costs** of producing and handling ecologically relevant substances low. Ideally, all costs of producing and handling ecologically relevant substances would be **internalized**, and the social costs would consequently be zero. This ideal situation can hardly be reached in practice. But second-best solutions are often feasible. For example, why should a private firm which produces an ecologically dangerous substance not pay **all costs**, that means not only production costs, but also the costs of controlling, avoidance and damage? If some of these costs are taken care of by public bodies, false price signals are given to the economic agents, the allocation of resources will not be optimal and social costs will arise.

To provide information on all economical and ecological interdependencies, it is important to establish national accounts which include ecological matters in detail (**"ecological bookkeeping"**). Closely related to this is the use of ecologically oriented **input-output-techniques**.

Therefore, an important step in building up computer-aided systems of environmental impact assessment in developing countries is probably to train people (specialists and "multipliers") in these fields. UNIDO could perhaps

organize or help other organizations to organize training courses and seminars. One internationally leading authority on ecological bookkeeping and related input-output-techniques is Dr. C. Stahmer from the Statistisches Bundesamt (= Central Statistical Office of the FRG) in Wiesbaden.

If sufficient funds can be obtained, the **University of Hagen** could, in close cooperation with external specialists like C. Stahmer, perhaps develop **special courses for distance studies**/continuing education in ecological bookkeeping and related input-output-techniques at the university level. These courses could be offered to people all over the world. Also, **special seminars** could be arranged which supplement these distance study courses.

3 Three examples from the FRG

In the oral presentation, a report (including some handouts) is given on the following systems and research activities:

1. Environmental information system UMWIS of the Regional Office of Data Processing and Statistics in North Rhine-Westfalia (see LDS, 1989). The same system is available in all states of the FRG. It alone is insufficient for investigating the environmental impacts of production and consumption activities. Some further information is given on the basis of the publications "Länderarbeitsgemeinschaft Wasser (1989)" and "Umweltbundesamt (1989)".

2. Bavarian agricultural land information system BALIS (see Rintelen, 1986). This integrated system refers to agriculture, especially to its detailed regional aspects and problems. It can be extended to deal also with nonagricultural problems. Therefore, it deserves close examination.

3. EFOM-RENEW: In a recently started research project at the University of Hagen, the long-run techno-economic energy-supply model EFOM-ENV (energy flow optimization model containing some components for dealing with environmental problems) is enlarged – step by step – by submodels for the most important renewable sources of energy (see Gruber and Vorreyer, 1988). EFOM-RENEW is a dynamic linear programming model covering a planning period of 40 years and consisting of some 10000 processes and some 10000 constraints for the FRG. When submodels for renewable sources of energy are developed, special attention is

given to modeling environmental problems. When completed, EFOM-RENEW can be used i.a. for studying the environmental burden which results from different long-run scenarios of energy supply.

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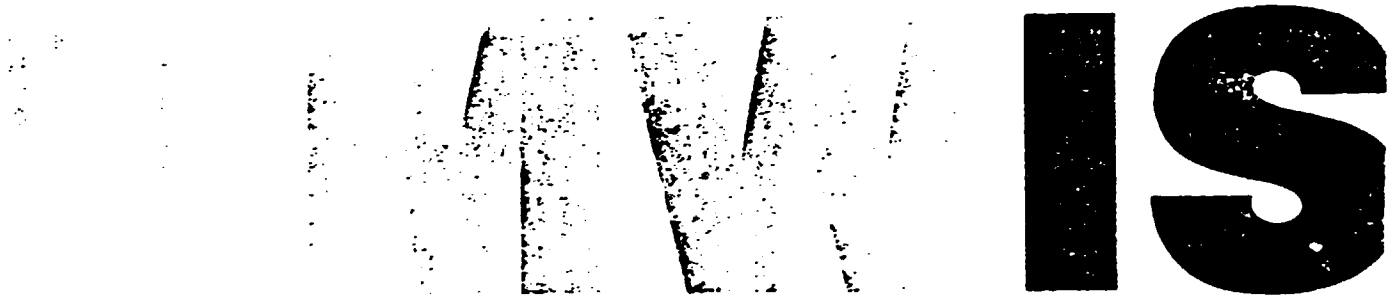
Environmental information system LDS

Environmental framework data
Economic and social structure
Road traffic
Water supply
Effluent disposal
Volume of refuse
Refuse removal
Recycling
Water-contaminating substances – accidents
Environmental protection investments
External data banks



Umwelt-informationssystem LDS

Umweltrahmendaten
Wirtschafts- und Sozialstruktur
Straßenverkehr
Wasserversorgung
Abwasserbeseitigung
Abfallaufkommen
Abfallbeseitigung
Recycling
Unfälle mit wassergefährdenden Stoffen
Umweltschutzinvestitionen
Externe Datenbanken

Sonderdruck des LDS NRW
zur ENVITEC '89

Special brochure of the Regional Office for Data Processing and Statistics of North Rhine-Westphalia (LDS NRW) for the ENVITEC '89

UMWIS

Herausgeber
Landesamt
für Datenverarbeitung und Statistik
Nordrhein-Westfalen

You have expressed interest

in the environmental information system (UMWIS)

LDS. Thank you very much!

May we first of all introduce ourselves?
The Regional Office for Data Processing and Statistics of North Rhine-Westphalia (LDS NRW) ascertains comprehensive statistical data about the social, economic and financial circumstances of our community as well as about our environment, the damage to the ecology and measures for its improvement.

All statistical inquiries constitute essential parts of an integrated general system in which large-scale counts and spot checks as well as regular total and partial inquiries are combined to form various analyses and forecasts.

In the „LDS NRW", the Regional Data Processing Centre (LDVZ) is responsible for the technical support of these tasks (handling about 32 000 report units in the environmental field alone). Furthermore, the „LDVZ" performs various non-statistical tasks in accordance with the law on automated data processing in the Federal State of North Rhine-Westphalia.

UMWIS means the systematic summary of a varying instrumentation and its linkage with a comprehensive offering of data on the part of the LDS NRW in the field of environmental protection.

Furthermore, direct access to national and international facts and literature data banks is possible via an interconnected system.

This brochure aims to give you an idea of the contents and function of this information system in an abridged version.

Regional Office for
Data Processing and Statistics
of North Rhine-Westphalia

Benker

Sie haben Interesse

am Umweltinformationssystem (UMWIS) LDS.

Vielen Dank!

Zunächst dürfen wir uns kurz vorstellen:
Das Landesamt für Datenverarbeitung und Statistik Nordrhein-Westfalen (LDS NRW) erhebt umfassendes statistisches Datenmaterial über die sozialen, wirtschaftlichen und finanziellen Zusammenhänge unseres Gemeinwesens; auch über die uns umgebende Umwelt und deren Belastungen sowie über Maßnahmen zu ihrer Verbesserung.

Alle statistischen Erhebungen sind Bestandteile eines integrierten Gesamtsystems, in dem Großzählungen und Stichproben einerseits sowie laufende Total- und Teilerhebungen andererseits zu vielfältigen Analysen und Prognosen verknüpft sind.

Für die technische Unterstützung dieser Aufgaben (allein im Umweltbereich Bearbeitung von rd. 32 000 Berichtseinheiten) ist innerhalb des LDS NRW die Landesdatenverarbeitungszentrale (LDVZ) zuständig. Darüber hinaus erfüllt die LDVZ zahlreiche nichtstatistische Aufgaben nach dem Gesetz über die automatisierte Datenverarbeitung in Nordrhein-Westfalen.

UMWIS ist die systematische Zusammenfassung verschiedener Instrumentarien und deren Verknüpfung zu einem umfassenden Datenangebot des LDS NRW im Umweltbereich.

Darüber hinaus wird über Verbund der direkte Zugriff auf nationale und internationale Fakten- und Literaturdatenbanken geboten.

Diese Broschüre soll in Kurzform Inhalt und Funktionsweise dieses Informationssystems dokumentieren.

Landesamt
für Datenverarbeitung und Statistik
Nordrhein-Westfalen

Benker

Contents

Inhalt

I. Programme of environmental statistics

1. Brief description

Environmental protection in its individual fields has been carried out continuously and systematically for the past 10 to 15 years only. As a result, most of the data bases are new or are currently being established.

Since 1975, environmental statistics have been ascertained nation-wide and are thus the youngest branch of the official German statistics. Due to their present scope and structure they are in many fields the only basis for planning and decisions or they complete the knowledge of those special sections the tasks of which are measurements and controls in the field of environmental protection.

In a word, the environmental statistics provide an essential part of the quantity and quality structure in the fields of water and effluents. The water inquiries are made separately for the public sector and for the mining and industrial fields as well as for public supply from thermal electric stations.

In the field of refuse, too, practically the whole range of refuse collection and disposal in the Federal State is demonstrated in the producing industries and in the public as well as industrial waste disposal split up into „origin", „treatment" and „disposal". The out-plant recycling is ascertained separately.

I. Umweltstatistisches Programm

1. Kurzbeschreibung

Erst seit 10 bis 15 Jahren wird Umweltschutz in seinen einzelnen Teilbereichen durchgängig und systematisch betrieben. Entsprechend sind die meisten Datengrundlagen neu bzw. befinden sich noch im Aufbau.

Die Umweltstatistiken werden seit 1975 bundesweit erhoben und sind damit der jüngste Zweig der amtlichen deutschen Statistik. Sie sind in ihrem gegenwärtigen Umfang und ihrer Struktur so angelegt, daß sie in weiten Bereichen die alleinige Planungs- und Entscheidungsgrundlage darstellen oder aber die Erkenntnisse jener Fachbereiche ergänzen, die messend und prüfend im Umweltschutz tätig sind.

Kurz umrissen liefern die Umweltstatistiken das Mengen- und wesentliche Teile des Qualitätsgerüstes im Wasser- und Abwasserbereich. Die Wassererhebungen werden getrennt nach dem öffentlichen und bergbaulich-industriellen Sektor sowie bei den Wärmekraftwerken für die öffentliche Versorgung durchgeführt.

Auch im Abfallbereich wird mit dem Produzierenden Gewerbe und der öffentlichen sowie gewerblichen Abfallentsorgung praktisch das gesamte Abfallgeschehen im Lande nach den Tatbeständen „Entstehung", „Behandlung" und „Verbleib" nachgewiesen. Gesondert erhoben wird das außerbetriebliche Recycling.

Description of the statistics Bezeichnung der Statistik	*Years under review (the statistical ascertainment is made 1 year later)* Berichtsjahre (Die statistische Erhebung findet jeweils 1 Jahr später statt)	*Results are available for the years under review* Ergebnisse liegen vor für die Berichtsjahre
Statistics relating to public refuse removal Statistik der öffentlichen Abfallbeseitigung	1975, 1977, 1980, 1982, 1984, 1987	1975, 1977, 1980, 1982, 1984, 1987*)
Statistics relating to refuse removal in the producing industries and hospitals Statistik der Abfallbeseitigung im Produzierenden Gewerbe und in Krankenhäusern	1975, 1977, 1980, 1982, 1984, 1987	1975, 1977, 1980, 1982, 1984, 1987*)
Statistics relating to public water supply and effluent disposal Statistik der öffentlichen Wasserversorgung und Abwasserbeseitigung	1975, 1979, 1983, 1987	1975, 1979, 1983, 1987*)
Statistics relating to water supply and effluent disposal in mining and processing industries Statistik der Wasserversorgung und Abwasserbeseitigung im Bergbau und Verarbeitenden Gewerbe	1975, 1977, 1979, 1981, 1983, 1987	1975, 1977, 1979, 1981, 1983, 1987*)
Statistics relating to water supply and effluent disposal in thermal electric stations for public supply Statistik der Wasserversorgung und Abwasserbeseitigung bei Wärmekraftwerken für die öffentliche Versorgung	1975, 1977, 1979, 1981, 1983, 1987	1975, 1977, 1979, 1981, 1983, 1987
Statistics relating to accidents in storage and transport of water-contaminating substances Statistik der Unfälle bei der Lagerung und beim Transport wassergefährdender Stoffe	1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988	1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987
Statistics relating to investments for environmental protection in the producing industries Statistik der Investitionen für Umweltschutz im Produzierenden Gewerbe	1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987	1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986

*) *provisional results*
*) *vorläufige Ergebnisse*

The investments for the environmental protection in the producing industries and the total expenditures of the State (investments and current expenditures) for this task are further important data sources. The registration of accidents in storage and transport of water-contaminating substances complete the present programme of environmental statistics.

Weitere wichtige Datenquellen sind die Investitonen für den Umweltschutz im Produzierenden Gewerbe und die Gesamtausgaben des Staates (Investitionen und laufende Aufwendungen) für diese Aufgabe. Die Erfassung des Unfallgeschehens bei der Lagerung und dem Transport wassergefährdender Stoffe rundet das gegenwärtige umweltstatistische Programm ab.

Furthermore, the various special statistics contain a wide range of environmental characteristics and combinations which can, of course, be called via UMWIS. For example, the traffic statistics offer a comprehensive data volume about the accidents occuring on our roads, moreover as far as the conveyance system of passengers and goods as well as the transportation of critical material together with the type and extension of the road network is concerned. A short survey of the whole catalogue of data stock is given in the following chapter „Regional Data Bank".

Darüber hinaus enthalten die zahlreichen Fachstatistiken eine Fülle umweltrelevanter Merkmale und Merkmalskombinationen, die selbstverständlich auch über UMWIS abgerufen werden können.
So liefern beispielsweise die Verkehrsstatistiken umfangreiches Datenmaterial über das Unfallgeschehen auf unseren Straßen, die Personen- und Güterbeförderung einschließlich der Gefahrguttransporte sowie über die Art und Länge des Straßennetzes. Eine Kurzübersicht des gesamten Datenbestandskataloges enthält das folgende Kapitel „Landesdatenbank".

In this context we would like to point out that the official statistical office is the institution which provides these data
- *extensively*
- *regularly and*
- *in accordance with nation-wide standardized methods.*

In diesem Zusammenhang muß deutlich hervorgehoben werden, daß die amtliche Statistik die einzige Institution ist, die diese Daten
- flächendeckend
- nach bundesweit einheitlichen Methoden und
- regelmäßig

zur Verfügung stellt.

The following tables will give you an idea of the data available from the environmental statistics as well as of the ecologically relevant symptoms taken from the traffic statistics. All the data are also available in a systematical and regional structure and can be interrelated in accordance with your special evaluation targets as long as the legal regulations about the secrecy of individual statements are not affected.

Mit den nachfolgenden Tabellen wird ein Überblick über das Datenangebot aus den Umweltstatistiken sowie über umweltrelevante Merkmale aus den Verkehrsstatistiken gegeben. Alle Daten liegen auch in tiefer systematischer und regionaler Gliederung vor und können – soweit nicht die gesetzlichen Vorschriften über die Geheimhaltung von Einzelangaben tangiert werden – nach ihren speziellen Auswertungszielen verknüpft werden.

The environmental statistical programme will be shortly extended and improved.
UMWI will then also be able to provide data about air-contaminating emissions, employees in the environmental protection equipment industries as well as about the quantities and material flows in the field of special refuse.

In Kürze wird das umweltstatistische Programm erweitert und verbessert.
UMWIS liefert dann auch Daten über luftbelastende Emissionen, Beschäftigte in den Umweltschutzgüterindustrien sowie über Mengen und Stoffflüsse im Sonderabfallbereich.

Key to the symbols

(acc. to DIN 55 301 –
German Industrial Standard)

- *0 less than half of 1 in the last occupied digit, however, more than nothing*
- *– nothing available (exactly zero)*
- *. . . value will be available later on*
- */ no indication – numerical value is not definite enough*
- *. numerical value is unknown or to be kept secret*
- *x table panel is blocked because statement is not meaningful*

- *p provisional figure*
- *r corrected figure*
- *s estimated figure*

Zeichenerklärungen

(nach DIN 55 301)

- 0 weniger als die Hälfte von 1 in der letzten besetzten Stelle, jedoch mehr als nichts
- – nichts vorhanden (genau null)
- . . . Angabe fällt später an
- / keine Angabe, da Zahlenwert nicht sicher genug
- . Zahlenwert unbekannt oder geheimzuhalten
- x Tabellenfach gesperrt, weil Aussage nicht sinnvoll

- p vorläufige Zahl
- r berichtigte Zahl
- s geschätzte Zahl

2. Public Refuse Removal
2. Öffentliche Abfallbeseitigung

2.1 Development of the public refuse collection
2.1 Entwicklung der öffentlichen Müllabfuhr

Year / Jahr	*Population* / Wohnbevölkerung			*household and bulky refuse per inhabitant and year* / Haus- und Sperrmüll je Einwohner und Jahr		*Specific gravity of household and bulky refuse* / Spezifisches Gewicht des Haus- und Sperrmülls
	total / insgesamt	*connected to refuse collection* / darunter an die Müllabfuhr angeschlossen				
		altogether / zusammen	*waste removal carried out by private enterprises* / darunter durch Privatunternehmen entsorgt			
	1 000 / 1 000			*kg* / kg	*m³* / m³	*kg/m³* / kg/m³
1975	17 219	17 100	6 661	317	1,2	258
1977	17 030	16 999	6 926	336	1,6	210
1980	17 058	17 052	6 799	362	1,9	190
1982	16 961	16 959	6 839	372	2,1	179
1984	16 704	16 699	6 815	380	2,3	163
1987	16 712	16 712	6 845	379	2,4	160

2.2 Expenditures of the communities and unions of local government units for refuse collection and refuse removal
– DM per inhabitant –
2.2 Ausgaben der Gemeinden und Gemeindeverbände für Müllabfuhr und Abfallbeseitigung
– DM je Einwohner –

Administrative District / Verwaltungsbezirk	*1978* / 1978	*1979* / 1979	*1980* / 1980	*1981* / 1981	*1982* / 1982	*1983* / 1983	*1984* / 1984	*1985* / 1985	*1986* / 1986	*1987* / 1987
North Rhine-Westphalia / Nordrhein-Westfalen	46,17	50,53	56,22	60,23	63,27	68,50	72,71	76,93	81,14	89,22

2.3 Public waste disposal plants
2.3 Öffentliche Abfallbeseitigungsanlagen

Year / Jahr	Plants / Anlagen						
	total / insgesamt	of which / devon					
		processing an removal plants / Behandlungs-/Beseitigungsanlagen					Transfer stations and collecting centres for industrial waste / Umladestationen und Sammelstellen für Gewerbeabfälle
		altogether / zusammen	of which / devon				
			dumps / Deponien	refuse incinerating plants / Müllverbrennungsanlagen	composting plants / Kompostierungsanlagen	other plants (e. g. reclamation of raw material) / sonstige Anlagen (z. B. Rohstoffrückgewinnung)	
	Quantity / Anzahl						
1975	396	389	375	10	2	2	7
1977	233	220	199	10	3	8	13
1980	186	166	147	10	3	6	20
1982	189	166	143	11	3	9	23
1984	205	185	164	11	4	6	20
1987	220	188	160	13	7	8	32

2.4 Capacity of the dumping grounds and quantity of refuse delivered
2.4 Deponienkapazität und angelieferte Abfallmenge

Year / Jahr	remaining volume of the dumping areas (capacity of the dumping areas) / Noch verfüllbares Restvolumen der Deponien (Deponiekapazität)	Quantity of refuse removed / Beseitigte Abfallmenge		
		total / insgesamt	of which / darunter	
			on dumps / auf Deponien	in refuse incinerating plants / in Müllverbrennungsanlagen
	mill. m^3 / Mill. m^3	mill. metric tonnes / Mill. t		
1975	141	17,1	15,6	1,4
1977	123	17,9	16,0	1,8
1980	138	19,2	17,1	1,9
1982	177	19,4	16,8	2,2
1984	168	21,2	18,5	2,3
1987	144	23,6	19,8	2,9

3. Composting of household refuse
3. Kompostierung von Hausmüll

3.1 Production of compost in public composting plants in 1987
3.1 Komposterzeugung in öffentlichen Kompostierungsanlagen 1987

Annual output of the plant from ... to below ... metric tonnes per year	*composting plants*	*quantities of refuse delivered*	*quantity of compost produced*
	Quantity	*metric tonnes*	
Jahresleistung der Anlage von ... bis unter ... Tonnen pro Jahr	Kompostierungs-anlagen	Angelieferte Abfallmengen	Menge des erzeugten Kompostes
	Anzahl	t	
below 5 00C unter 5 000	2	3 083	772
5 000 to 10 000 5 000 – 10 000	–	–	–
10 000 to 20 000 10 000 – 20 000	3	35 573	13 060
20 000 and more 20 000 und mehr	2	21 152	8 347

3.2 Utilization of compost in 1987
– metric tonnes –
3.2 Verwertung des Kompostes 1987
– Tonnen –

Annual output of the plant from ... to below ... metric tonnes per year	*Utilization of compost produced*				
	agriculture, forestry, horticulture		*landscape gardening and cultivation*	*stored or burnt*	*other utilization*
	sold	*free of charge*			
Jahresleistung der Anlage von ... bis unter ... Tonnen pro Jahr	Vom erzeugten Kompost wurden				
	an Landwirtschaft, Forst-wirtschaft, Gartenbau		zur Land-schaftsgestal-tung und Land-schaftspflege abgegeben	abgelagert oder verbrannt	anderweitig verwendet
	verkauft	kostenlos abgegeben			
below 5 000 unter 5 000	–	–	772	–	–
5 000 to 10 000 5 000 – 10 000	–	–	–	–	–
10 000 to 20 000 10 000 – 20 000	795	–	4 185	3 698	4 382
20 000 and more 20 000 und mehr	5 495	–	2 852	–	–

4. Refuse removal in the producing industries and hospitals
4. Abfallbeseitigung im Produzierenden Gewerbe und in Krankenhäusern

4.1 Total refuse quantity split up into branches of industry in 1987
– metric tonnes –
4.1 Abfallaufkommen insgesamt nach Wirtschaftsbereichen 1987
– Tonnen –

Main groups of refuse	*quantity of refuse*				
	total	*split up into the following branches of industry*			
		primary and producer goods industry	*capital goods producing industry*	*building trade*	*other branches of industry*
Abfallhauptgruppen	Abfallaufkommen				
	insgesamt	davon entfielen auf die Wirtschaftsbereiche			
		Grundstoff- und Produktionsgüter-gewerbe	Investitionsgüter produzierendes Gewerbe	Baugewerbe	übrige erfaßte Wirtschafts-bereiche
Building rubble, excavated earth, road break-up debris Bauschutt, Bodenaushub, Straßenaufbruch	26 178 368	1 848 503	372 885	23 113 463	843 517
Furnace slag, rumble from metallurgical plants and foundries Ofenausbruch, Hütten- und Gießereischutt	897 593	875 943	4 882	504	16 264
Moulding sand, core sand, dust, other solid mineral refuse Formsand, Kernsand, Staube, andere feste mineralische Abfalle	4 847 474	2 414 855	204 211	16 370	2 212 038
Ash, slag, soot from combustion Asche, Schlacke, Ruß aus der Verbrennung	14 108 634	943 214	24 218	23 854	13 117 348
Metallurgical slags and dross Metallurgische Schlacken und Kratzen	5 271 229	5 253 932	14 978	–	2 319
Metal waste Metallabfalle	3 209 030	805 029	1 453 951	33 369	916 681
Oxides, hydroxides, radioactive waste, salts, other solid production-specific refuse Oxide, Hydroxide, Salze, radioaktive Abfalle, sonstige feste produktionsspezifische Abfalle	238 185	228 013	5 824	–	4 348
Acids, lyes, sludges, laboratory refuse, chemical residues, detergents, other liquid production-specific refuse Sauren, Laugen, Schlamme, Laborabfalle, Chemikalienreste, Detergentien, sonstige flussige produktionsspezifische Abfalle	1 354 507	1 076 141	177 724	81	100 561
Solvents, paints, lacquers, glues Losungsmittel, Farben, Lacke, Klebstoffe	208 777	136 283	33 962	622	37 910
Mineral oil refuse, oil sludges, phenols Mineralolabfalle, Olschlamme, Phenole	901 345	612 298	174 288	50 732	64 027
Plastic, rubber and textile refuse Kunstoff-, Gummi-, Textilabfalle	331 405	124 824	46 068	8 468	152 045
Sludge from water conditioning Schlamme aus Wasseraufbereitung	226 543	57 364	9 386	671	159 122
Other kinds of sludge including sewage treatment Sonstige Schlamme einschl. Abwasserreinigung	2 936 458	1 880 586	37 064	8 580	1 010 228
Industrial waste similar to household refuse (kitchen and canteen scraps, refuse from employees' rooms, sweepings, garden refuse) Hausmullahnliche Gewerbeabfalle (Küchen- und Kantinenabfalle, Abfalle aus Belegschafts-unterkünften, Kehricht, Gartenabfalle)	2 490 023	509 254	847 837	141 016	991 916
Paper and cardboard waste Papier- und Pappeabfalle	375 151	75 014	2 911	189	297 037
Other organic waste Sonstige organische Abfalle	2 727 173	767 457	41 224	102 444	1 816 048
Hospital-specific refuse Krankenhausspezifische Abfalle	24 381	661	–	–	23 720
Other refuse Sonstige Abfalle	4 924	940	655	170	3 159
Total Insgesamt	66 331 200	17 610 311	3 452 868	23 500 533	21 768 288

5. Public water supply and effluent disposal
5. Öffentliche Wasserversorgung und Abwasserbeseitigung

5.1 Water production
5.1 Wassergewinnung

Year	*Water production*											
	total	*of which*										
		groundwater and well water		*bank filtrate*		*enriched groundwater*		*river water*		*water from lakes or storage basins*	
	mill. m³		%	*mill. m³*	%	*mill. m³*	%	*mill. m³*	%	*mill. m³*	%
Jahr	Wassergewinnung										
	insgesamt	davon									
		Grund- und Quellwasser		Uferfiltrat		angespeichertes Grundwasser		Flußwasser		See- bzw. Talsperrenwasser	
	Mill. m³		%	Mill. m³	%	Mill. m³	%	Mill. m³	%	Mill. m³	%
1969	1 476,9	587,9	39,8	329,1	22,3	373,3	25,3	.	.	186,6	12,6
1975	1 484,3	640,0	43,1	282,4	19,0	365,5	24,5	20,3	1,4	176,1	11,9
1979	1 533,7	541,8	35,3	264,5	17,2	471,1	30,7	55,7	3,6	200,6	13,1
1983	1 475,9	574,7	38,9	224,1	15,2	434,5	29,4	28,1	1,9	214,5	14,5
1987	1 435,2	567,0	39,5	243,6	17,0	395,5	27,6	8,2	0,6	220,9	15,4

5.2 Supply rate and groups of purchasers
5.2 Versorgungsquote und Beziehergruppen

Year	*inhabitants*			*water distribution*				
	total	*connected to the public water supply*	*supply rate*	*total*	*of which*			
					households	*water consumption per inhabitant and day*	*industry*	*other purchasers*
	mill. m³		%	*mill. m³*		*litres*	*mill. m³*	
Jahr	Einwohner			Wasserabgabe				
	insgesamt	an die öffentliche Wasserversorgung angeschlossen	Versorgungsquote	insgesamt	davon an			
					Haushalte	Wasserverbrauch je Einwohner und Tag	gewerbliche Unternehmen	sonstige Abnehmer
	Mill. m³		%	Mill. m³		Liter	Mill. m³	
1969	17,040	16,134	94,7	1 328,0	839,3	142,5	488,7	.
1975	17,177	16,445	95,7	1 341,4	807,1	134,5	534,3	.
1979	17,017	16,474	96,8	1 449,6	863,5	143,6	495,8	90,3
1983	16,837	16,347	97,1	1 373,3	907,4	152,1	383,7	82,2
1987	16,712	16,305	97,6	1 342,0	910,0	152,9	361,5	70,4

5.3 Public sewage system
5.3 Öffentliche Kanalisation

Year	*inhabitants (total)*	*percentage of inhabitants connected to the public sewage system compared with the total of inhabitants*	*total length of the sewage system*	*percentage of the separate system[1] compared with the total length of the sewage system*
	1 000	*%*	*km*	*%*
Jahr	Einwohner insgesamt	Anteil der an die Kanalisation angeschlossenen Einwohner an den Einwohnern insgesamt	Länge des Kanalnetzes insgesamt	Anteil der Trennkanalisation[1] an der Länge des Kanalnetzes insgesamt
	1 000	%	km	%
1969	17 040	81,9	40 355	36,5
1975	17 177	87,6	51 693	40,5
1979	17 017	89,1	59 304	41,1
1983	16 837	91,1	65 548	43,2
1987	16 712	92,3	69 711	43,8

1) separate wastewater and rainwater sewers
1) getrennte Schmutz- und Regenwasserkanäle

5.4 Public sewage clarification plants
5.4 Öffentliche Kläranlagen

Year	*inhabitants (total)*	*inhabitants connected to sewage clarification plants*		*Quantity of the cleaned sewage*		
				total	*cleaned in*	
					mechanical plants	*plants with biological or other further treatment*
	1 000		*%*	*1 000 m³*	*%*	
Jahr	Einwohner insgesamt	An Kläranlagen angeschlossene Einwohner		Menge des gereinigten Abwassers insgesamt	davon gereinigt in	
					mechanischen Anlagen	Anlagen mit biologischer oder sonstiger weitergehender Behandlung
	1 000		%	1 000 m³	%	
1969	17 040	12 653	74,3	1 902 321	50,4	49,6
1975	17 177	14 488	84,3	2 626 262	56,2	43,8
1979	17 017	14 822	87,1	2 879 709	25,9	74,1
1983	16 837	15 124	89,8	2 515 463	7,7	92,3
1987	16 712	15 328	91,7	2 865 238	3,3	96,7

6. Water supply and effluent disposal in mining and processing industries
6. Wasserversorgung und Abwasserbeseitigung im Bergbau und Verarbeitenden Gewerbe

6.1 Quantity of water split up into types of water
– 1 000 m³ –
6.1 Wasseraufkommen nach Wasserarten
– 1 000 m³ –

Year	*Quantity of water*	*of which*							
		own production					*outside procurement*		
		total	*of which*				*total*	*of which*	
			groundwater	*bank filtrate*	*well water*	*surface water*		*from the public network*	*from other sources*
Jahr	Wasser-aufkommen	Davon							
		Eigengewinnung					Fremdbezug		
		zu-sammen	davon				zu-sammen	davon	
			Grund-wasser	Ufer-filtrat	Quell-wasser	Ober-flächen-wasser		aus dem öffentlichen Netz	von anderen Betrieben
1969	6 090 323	5 297 758	2 192 043	399 025	.	2 706 690	792 565	.	.
1975	5 599 255	4 844 447	1 702 182	478 434	17 477	2 646 352	754 907	443 599	311 208
1979	5 812 443	5 127 744	1 629 640	427 765	21 548	3 084 792	684 699	379 658	305 041
1983	5 127 178	4 607 442	1 693 382	423 392	11 825	2 478 843	519 736	312 492	207 244
1987	4 587 292	4 074 102	1 263 595	385 457	11 441	2 413 609	513 190	301 809	211 381

7. Accidents in storage and transport of water-contaminating substances
7. Lagerungs- und Transportunfälle mit wassergefährdenden Stoffen

7.1 Accidents in storage and quantities of substances in 1986 und 1987
7.1 Lagerungsunfälle und Stoffmengen 1986 und 1987

Characteristics / Merkmal	*Unit* / Einheit	*accidents with water-contaminating substances total* / Unfälle mit wassergefährdenden Stoffen insgesamt		*in 1987 with* / Davon 1987 (mit)					
				inorganic substances / anorganischen Stoffen	*heating fuel oil and diesel oil* / Heizöl und Dieselkraftstoffen	*other fuels* / sonstigen Kraftstoffen	*crude oil, waste oil, other mineral oil products* / Rohöl, Altöl, sonstigen Mineralölprodukten	*other organic compounds* / sonstigen organischen Verbindungen	*no indication of the substance* / ohne Angabe der Stoffart
		1986	1987						
Accidents total	*number*								
Unfälle insgesamt	Anzahl	585	546	23	347	19	124	18	15
including									
darunter									
quantity of substance not indicated	*number*								
keinerlei Angabe zur Stoffmenge	Anzahl	96	110	5	56	7	29	8	5
Accidents with indication of the quantity of substance stored	*number*								
Unfälle mit Angaben zur gelagerten Stoffmenge	Anzahl	339	301	14	207	7	61	4	8
Stored quantity of substance									
Gelagerte Stoffmenge	m^3	17 011	6 050	182	5 544	94	100	121	9
Accidents with indication of lost quantity of substance	*number*								
Unfälle mit Angaben zur ausgelaufenen Stoffmenge	Anzahl	455	413	18	274	11	91	10	9
Lost quantity of substance									
Ausgelaufene Stoffmenge	m^3	1 519	554	12	272	136	118	15	1
Accidents with indication of recovered quantity of substance	*number*								
Unfälle mit Angaben zur wiedergewonnenen Stoffmenge	Anzahl	300	269	11	192	7	49	5	5
Recovered quantity of substance									
Wiedergewonnene Stoffmenge	m^3	911	259	4	197	3	50	4	1
Accidents with indication of non-recovered quantity of substance	*number*								
Unfälle mit Angaben zur nicht wiedergewonnenen Stoffmenge	Anzahl	196	182	8	120	5	38	6	5
Non-recovered quantity of substance									
Nicht wiedergewonnene Stoffmenge	m^3	208	74	3	44	3	13	11	0

7.2 Accidents in transport and quantities of substances in 1986 and 1987
7.2 Transportunfälle und Stoffmengen 1986 und 1987

Characteristics / Merkmal	*Unit* / Einheit	*accidents with water-contaminating substances total* / Unfälle mit wasser gefährdenden Stoffen insgesamt		*in 1987 with* / Davon 1987 (mit)					
		1986 / 1986	*1987* / 1987	*inorganic substances* / anorganischen Stoffen	*heating fuel oil and diesel oil* / Heizöl und Dieselkraftstoffen	*other fuels* / sonstigen Kraftstoffen	*crude oil waste oil other mineral oil products* / Rohöl, Altöl, sonstigen Mineralölproduktion	*other organic compounds* / sonstigen organischen Verbindungen	*no indication of the substance* / ohne Angabe der Stoffart
Accidents total / *Unfälle insgesamt*	*number* / *Anzahl*	*247*	*219*	*12*	*131*	*15*	*15*	*44*	*2*
including / darunter									
quantity of substance not indicated / keinerlei Angabe zur Stoffmenge	*number* / Anzahl	43	42	5	27	1	3	6	–
Accidents with indication of the quantity of substance transported / Unfälle mit Angabe zur beförderten Stoffmenge	*number* / Anzahl	130	100	7	49	5	9	29	1
Transported quantity of substance / Beförderte Stoffmenge	m^3	22 358	12 323	20	9 516	1 157	1 270	359	1
Accidents with indication of lost quantity of substance / Unfälle mit Angaben zur ausgelaufenen Stoffmenge	*number* / Anzahl	190	171	7	99	14	12	37	2
Lost quantity of substance / Ausgelaufene Stoffmenge	m^3	200	240	10	134	20	41	34	1
Accidents with indication of recovered quantity of substance / Unfälle mit Angaben zur wiedergewonnenen Stoffmenge	*number* / Anzahl	97	93	5	51	8	7	22	–
Recovered quantity of substance / Wiedergewonnene Stoffmenge	m^3	118	89	8	41	5	6	28	–
Accidents with indication of non-recovered quantity of substance / Unfälle mit Angaben zur nicht wiedergewonnenen Stoffmenge	*number* / Anzahl	94	86	3	44	7	6	26	–
Non-recovered quantity of substance / Nicht wiedergewonnene Stoffmenge	m^3	68	109	1	85	11	1	12	–

8. Investments for environmental protection in the producing industry
8. Umweltschutzinvestitionen im Produzierenden Gewerbe

8.1 Investments for environmental protection in 1985 and 1986
– 1,000 DM –
8.1 Umweltschutzinvestitionen 1985 und 1986
– 1 000 DM –

Main group of industry a = 1985, b = 1986 / Wirtschaftshauptgruppe a = 1985, b = 1986		*Investments for environmental protection* / Investitionen für Umweltschutz				
		total / insgesamt	*split up unto* / davon für			
			refuse removal / Abfallbeseitigung	*protection of waters* / Gewässerschutz	*noise prevention* / Lärmbekämpfung	*keeping the air clean* / Luftreinhaltung
total / insgesamt	a	2 307 977	118 413	328 349	121 [illegible]	1 740 176
	b	3 288 786	151 914	305 060	92 647	2 719 465
of which / darunter						
primary and producer goods industry / Grundstoff- und Produktionsgüterindustrie	a	730 535	40 133	162 954	59 027	468 422
	b	667 184	43 510	194 107	45 241	384 324
capital goods producing industry / Investitionsgüter produzierendes Gewerbe	a	231 394	3 435	19 842	23 673	184 445
	b	197 064	4 968	33 650	17 022	141 424
commodity goods producing industry / Verbrauchsgüter produzierenden Gewerbe	a	48 216	3 854	14 558	6 845	22 959
	b	56 943	6 512	11 596	8 022	30 811
food and semi-luxuries industry / Nahrungs- und Genußmittelgewerbe	a	34 350	1 538	19 979	2 900	9 933
	b	37 883	542	27 355	1 665	8 320

9. Traffic
9. Verkehr

9.1 Road traffic accidents and their effects 1970 – 1987
9.1 Straßenverkehrsunfälle und ihre Folgen 1970 – 1987

Year / Jahr	Accidents / Unfälle						Victims / Verunglückte			
	inside / innerhalb	outside / außerhalb	totalling / insgesamt	of these with / davon mit			totalling / insgesamt	of these / davon		
	places[1] / von Ortschaften[1]			bodily injury / Personenschaden	property damage only / nur Sachschaden: serious property damage / schwerem Sachschaden	property damage only / nur Sachschaden: minimal damage / Bagatellschaden		killed persons / Getötete	seriously injured persons / Schwerverletzte	slightly injured persons / Leichtverletzte
1970	107 737	41 510	336 128	106 377	42 870	186 881	149 631	4 632	44 011	100 988
1971	103 364	40 705	316 694	101 213	42 856	172 625	141 848	4 386	41 604	95 858
1972	109 451	39 495	324 872	101 312	47 634	175 926	141 518	4 236	42 210	95 072
1973	101 215	36 681	306 741	93 216	44 680	168 845	128 288	3 690	38 624	85 974
1974	97 153	33 557	287 085	87 254	43 456	156 375	117 561	3 162	35 949	78 450
1975	94 458	35 505	290 914	86 602	43 361	160 951	117 448	3 257	37 367	76 824
1976	108 991	39 863	333 569	93 659	55 195	184 715	125 476	3 294	39 781	82 411
1977	119 599	44 494	361 466	99 049	65 044	197 373	133 090	3 225	41 746	88 119
1978	125 416	45 335	386 478	97 212	75 539	215 727	129 588	3 203	40 606	85 779
1979	129 133	44 981	400 984	93 468	80 646	226 870	122 956	2 681	38 359	81 916
1980	138 565	48 096	412 958	96 311	88 340	226 307	128 813	2 885	39 398	86 530
1981	139 831	47 000	413 998	93 810	93 021	227 167	122 846	2 497	37 429	82 920
1982	142 330	48 321	409 471	94 096	96 555	218 820	122 653	2 521	37 817	82 315
1983	108 669	41 975	446 326	97 886	52 758	295 682	127 678	2 608	39 204	85 866
1984	105 990	41 260	481 333	93 749	53 501	334 083	120 551	2 182	35 470	82 899
1985	94 374	38 381	492 124	81 405	51 350	359 369	103 718	1 692	29 342	72 684
1986	98 066	40 851	521 255	86 393	52 524	382 338	110 416	1 807	30 521	78 088
1987	91 727	40 798	541 715	81 764	50 761	409 190	105 363	1 544	28 346	75 473

1) As from 1964 without minimal accidents
1) ab 1964 ohne Bagatellunfälle

9.2 Road traffic accidents and victims 1981 – 1987 as per types of roads
9.2 Straßenverkehrsunfälle und Verunglückte 1981 – 1987 nach Straßenarten

Kind of evidence	*1981*	*1982*	*1983*	*1984*	*1985*	*1986*	*1987*
Art des Nachweises	1981	1982	1983	1984	1985	1986	1987
			on roads of all types				
			auf Straßen aller Art				
Accidents with bodily injury							
Unfälle mit Personenschaden	93 810	94 096	97 886	93 749	81 405	86 393	81 764
of these							
davon							
inside places							
innerhalb von Ortschaften	69 850	69 998	72 687	70 019	60 222	63 499	59 099
outside places							
außerhalb von Ortschaften	23 960	24 098	25 199	23 730	21 183	22 894	22 065
Accidents with serious property damage							
Unfälle mit schwerem Sachschaden	93 021	96 555	52 758	53 501	51 350	[illegible] 524	50 761
of these							
davon							
inside places							
innerhalb von Ortschaften	69 981	72 332	35 982	35 971	34 152	34 567	32 628
outside places							
außerhalb von Ortschaften	23 040	24 223	16 776	17 530	17 198	17 957	18 133
Victims							
Verunglückte Personen	122 846	122 653	127 678	120 551	103 718	110 416	105 363
of which							
davon							
killed persons							
Getötete	2 497	2 521	2 608	2 182	1 692	1 807	1 544
seriously injured persons							
Schwerverletzte	37 429	37 817	39 204	35 470	29 342	30 521	28 346
slightly injured persons							
Leichtverletzte	82 920	82 315	85 866	82 899	72 684	78 088	75 473
			on superhigways				
			auf Autobahnen				
Accidents with bodily injury							
Unfälle mit Personenschaden	4 066	3 967	4 105	4 019	3 583	4 351	4 446
Victims							
Verunglückte Personen	6 219	6 092	6 525	6 007	5 503	6 439	6 862
of these							
davon							
killed persons							
Getötete	200	176	212	152	137	170	128
seriously injured persons							
Schwerverletzte	1 599	1 644	1 795	1 539	1 397	1 587	1 662
slightly injured persons							
Leichtverletzte	4 420	4 272	4 518	4 316	3 969	4 682	5 072
Accidents with serious property damage							
Unfälle mit schwerem Sachschaden	9 064	9 305	6 983	7 371	6 958	7 490	7 975

Cont. 9.2 Road traffic accidents and victims 1981 – 1987 as per types of roads
Noch: **9.2 Straßenverkehrsunfälle und Verunglückte 1981 – 1987 nach Straßenarten**

Kind of evidence	*1981*	*1982*	*1983*	*1984*	*1985*	*1986*	*1987*
Art des Nachweises	1981	1982	1983	1984	1985	1986	1987
			on federal roads **auf Bundesstraßen**				
Accidents with bodily injury							
Unfälle mit Personenschaden	19 266	19 281	19 876	19 096	16 789	17 864	17 337
Victims							
Verunglückte Personen	26 716	26 329	27 037	25 732	22 402	23 978	23 320
of these							
davon							
killed persons							
Getötete	628	700	689	592	460	486	417
seriously injured persons							
Schwerverletzte	8 167	8 046	8 250	7 505	6 247	6 487	6 167
slightly injured persons							
Leichtverletzte	17 921	17 583	18 098	17 635	15 695	17 005	16 736
Accidents with serious property damage							
Unfälle mit schwerem Sachschaden	17 324	18 034	10 603	10 444	10 000	10 440	9 627
			on main roads **auf Landstraßen**				
Accidents with bodily injury							
Unfälle mit Personenschaden	24 296	24 642	25 625	24 533	21 191	22 943	21 813
Victims							
Verunglückte Personen	33 048	33 210	34 615	32 642	27 941	30 461	29 041
of these							
davon							
killed persons							
Getötete	845	810	876	739	558	596	546
seriously injured persons							
Schwerverletzte	10 726	10 763	11 324	10 065	8 346	8 996	8 228
slightly injured persons							
Leichtverletzte	21 477	21 637	22 415	21 838	19 037	20 869	20 267
Accidents with serious property damage							
Unfälle mit schwerem Sachschaden	19 019	20 341	11 756	12 152	11 623	12 353	11 601
			on local roads **auf Kreisstraßen**				
Accidents with bodily injury							
Unfälle mit Personenschaden	9 049	9 406	10 158	9 566	8 342	8 892	8 385
Victims							
Verunglückte Personen	12 135	12 570	13 504	12 542	10 735	11 468	10 927
of these							
davon							
killed persons							
Getötete	342	330	344	287	213	217	187
seriously injured persons							
Schwerverletzte	4 069	4 363	4 634	4 060	3 489	3 459	3 354
slightly injured persons							
Leichtverletzte	7 724	7 877	8 526	8 195	7 033	7 792	7 388
Accidents with serious property damage							
Unfälle mit schwerem Sachschaden	6 910	7 401	4 414	4 394	4 420	4 472	4 289
			on other roads **auf anderen Straßen**				
Accidents with bodily injury							
Unfälle mit Personenschaden	37 133	36 800	38 122	36 536	31 500	32 343	29 783
Victims							
Verunglückte Personen	44 728	44 452	45 997	43 626	37 137	38 070	35 211
of these							
davon							
killed persons							
Getötete	482	505	487	412	324	338	266
seriously injured persons							
Schwerverletzte	12 868	13 001	13 201	12 301	9 863	9 992	8 935
slightly injured persons							
Leichtverletzte	31 378	30 946	32 309	30 915	26 950	27 740	26 010
Accidents with serious property damage							
Unfälle mit schwerem Sachschaden	40 704	43 474	19 052	19 140	18 339	17 769	17 269

9.3 Amount of motor vehicles and motor
9.3 Bestand an Kraftfahrzeugen und Kraftfahr

Serial No. / Lfd. Nr.	*Year* / Jahr	*Total of motor vehicles* / Kraftfahrzeuge insgesamt	*Motor vehicles obliged to have* / Zulassungspflichtige Kraftfahrzeuge: *totalling* / zusammen	*motor-cycles incl. motor-scooters* / Kraftrader einschl. Kleinkrafträdern	*passenger vehicles* / Personenkraftwagen	*estate cars* / Kombinationskraftwagen
1	1978	7 027 056	6 450 152	98 820	5 413 399	386 809
2	1979	7 418 717	6 840 029	117 791	5 736 662	415 617
3	1980	7 649 404	7 054 445	141 554	5 888 150	438 341
4	1981	7 762 628	7 247 735	171 532	6 013 912	462 178
5	1982	7 866 890	7 357 563	196 431	6 073 398	486 827
6	1983	7 962 577	7 473 811	215 159	6 144 017	511 792
7	1984	8 092 460	7 631 960	226 509	6 253 579	544 840
8	1985	8 212 344	7 778 469	234 242	6 354 742	577 327
9	1986	8 422 426	8 049 180	242 599	6 559 288	625 956
10	1987	8 642 391	8 321 395	250 294	6 760 826	680 493

*) without vehicles of the German Federal Railway and of the German Federal Postal Authorities – 1) for which no registration paper is issued – 2) among others ca
*) ohne Fahrzeuge der Deutschen Bundesbahn und der Deutschen Bundespost – 1) Fahrzeuge, für die kein Fahrzeugbrief ausgestellt wird – 2) u. a. Wohnkraftwagen,

9.4 Amount of motor vehicles) on 1,*
9.4 Bestand an Kraftfahrzeugen*) mit amtlichem

Serial No. / Lfd. Nr.	*Administrative District* / Verwaltungsbezirk	*Motor vehicles with* / Kraft: *totalling* / insgesamt	*motorcycles incl. motorscooters and lightype motorcycles* / Kraftrader einschl. Kraftrollern und Leichtkrafträdern	*passenger vehicles* / Personenkraftwagen
	Kreisfreie Städte			
1	Düsseldorf	284 879	10 902	229 590
2	Duisburg	225 118	8 413	187 959
3	Essen	282 073	10 646	232 054
4	Krefeld	110 431	3 679	91 180
5	Mönchengladbach	117 664	3 667	97 764
6	Mülheim a. d. Ruhr	92 419	3 446	75 966
7	Oberhausen	96 389	3 304	81 691
8	Remscheid	59 114	2 156	47 611
9	Solingen	79 047	3 077	63 506
10	Wuppertal	171 812	7 387	138 107
	Kreise			
11	Kleve	136 883	4 082	108 093
12	Mettmann	250 824	10 644	203 057
13	Neuss	217 560	8 140	178 019
14	Viersen	139 365	4 693	112 185
15	Wesel	228 129	8 582	185 355
16	**Reg.-Bez. Düsseldorf**	**2 491 707**	**92 818**	**2 032 137**
	davon			
17	kreisfreie Städte	1 518 946	56 677	1 245 428
18	Kreise	972 761	36 141	786 709
	Kreisfreie Städte			
19	Aachen	105 339	4 389	85 583
20	Bonn	137 024	5 010	112 576
21	Köln	430 080	15 276	348 204
22	Leverkusen	82 090	3 445	67 123
	Kreise			
23	Aachen	138 815	5 123	115 167
24	Düren	125 240	5 085	100 491
25	Erftkreis	212 057	8 487	173 248
26	Euskirchen	91 901	3 696	70 097
27	Heinsberg	109 888	3 942	89 604
28	Oberbergischer Kreis	140 375	6 384	110 647
29	Rhein-Berg. Kreis	143 658	6 024	116 086
30	Rhein-Sieg-Kreis	257 374	11 191	205 452
31	**Reg.-Bez. Köln**	**1 873 841**	**78 052**	**1 594 278**
	davon			
32	kreisfreie Städte	764 533	28 120	613 486
33	Kreise	1 210 308	49 932	980 792

*) without vehicles of the German Federal Railway and of the German Federal Postal Authorities – 1) among others caravans, ambulances, fire-brigade vehicles, self-
*) ohne Fahrzeuge der Deutschen Bundesbahn und der Deutschen Bundespost – 1) u. a. Wohnkraftwagen, Krankenkraftwagen, Feuerwehrfahrzeuge,

vehicle trailers) from July 1, 1978 – 1987*
zeuganhängern*) am 1. Juli 1978 – 1987

official number plate				*Admission-free motor-vehicles subject to registration with official registration number*[2]	*Admission-free motor-vehicles with insurance registration number*	*Motor vehicle trailers*	*Serial No.*
of which							
trucks	*power driven buses incl. trolley buses*	*towing vehicles*	*remaining motor vehicles*[2]				
mit amtlichem Kennzeichen				Zulassungsfreie, anmeldepflichtige Kraftfahrzeuge mit amtlichem Kennzeichen[1]	Zulassungsfreie Kraftfahrzeuge mit Versicherungskennzeichen	Kraftfahrzeuganhänger	Lfd. Nr.
davon							
Lastkraftwagen	Kraftomnibusse einschl. Obussen	Zugmaschinen	übrige Kraftfahrzeuge[2]				
297 853	15 941	203 445	33 885	46 125	531 779	289 291	1
311 050	16 537	205 166	37 206	39 802	539 086	310 278	2
321 342	17 079	206 188	41 791	36 804	558 155	332 504	3
330 327	17 217	206 134	46 435	43 058	471 835	350 229	4
326 161	17 249	205 949	51 548	65 866	443 461	367 342	5
322 630	17 078	206 572	56 563	84 771	403 995	383 475	6
321 942	16 898	206 083	62 109	95 894	364 615	400 [illegible]	7
321 917	16 709	207 112	66 420	94 497	339 378	416 838	8
325 056	16 520	208 819	70 942	81 534	291 712	434 085	9
327 226	16 760	210 300	75 496	67 045	253 953	451 126	10

ravans, ambulances, fire-brigade vehicles – – – Source: Kraftfahrt-Bundesamt (Federal Bureau of Transports)
Krankenkraftwagen, Feuerwehrfahrzeuge – – – Quelle: Kraftfahrt-Bundesamt

July 1987 subdivided into administrative districts
Kennzeichen am 1. Juli 1987 nach Verwaltungsbezirken

official number plate					*motor vehicle trailers*	*motor vehicles per 1,000 inhabitants*	*Serial No.*
of which							
estate cars	*powerdriven buses incl. trolleybuses*	*trucks*	*towing vehicles*	*remaining motor vehicles*[1]			
fahrzeuge					Kraftfahrzeuganhänger	Kraftfahrzeuge je 1 000 Einwohner	Lfd. Nr.
davon							
Kombinationskraftwagen	Kraftomnibusse einschl. Obussen	Lastkraftwagen	Zugmaschinen	übrige Kraftfahrzeuge[1]			
27 319	583	12 557	1 382	2 546	9 090	508	1
15 977	341	8 724	1 732	1 972	9 800	439	2
23 517	450	11 309	1 300	2 797	10 825	460	3
8 688	205	4 703	906	1 070	5 174	510	4
8 498	255	5 374	1 127	979	5 802	461	5
7 540	116	3 993	655	704	3 745	445	6
6 510	227	3 457	472	728	3 810	435	7
5 359	135	2 872	494	487	2 674	489	8
7 903	205	3 315	365	676	3 738	499	9
16 270	381	7 333	830	1 504	6 597	460	10
9 840	203	5 243	8 198	1 224	10 905	521	11
21 614	206	10 596	2 361	2 346	10 773	523	12
17 268	371	8 144	4 025	1 593	9 967	534	13
10 507	243	6 157	4 222	1 356	8 988	531	14
16 928	515	7 699	6 972	2 178	13 866	548	15
203 638	**4 436**	**101 475**	**26 041**	**22 162**	**115 758**	**496**	**16**
127 581	2 898	63 636	9 263	13 463	61 258	474	17
76 057	1 538	37 839	25 778	8 699	54 500	532	18
8 499	348	4 383	828	1 309	4 190	440	19
11 920	292	4 860	655	1 711	4 879	470	20
38 801	1 004	20 492	2 132	4 171	16 453	470	21
7 241	262	2 656	560	774	3 700	532	22
9 330	276	5 038	2 682	1 189	9 120	483	23
8 278	270	4 936	4 893	1 287	7 731	528	24
16 262	334	7 965	3 715	2 026	10 530	522	25
6 853	250	3 479	6 565	961	6 743	568	26
6 452	282	3 991	4 752	865	7 894	506	27
11 491	289	6 042	5 317	1 205	8 614	568	28
13 202	198	4 725	2 037	1 386	6 895	576	29
22 062	375	8 485	7 421	2 398	13 2[illegible]	532	30
160 381	**4 180**	**78 671**	**41 597**	**18 282**	**98 [illegible]**	**507**	**31**
66 461	1 906	32 290	4 205	7 965	29 222	471	32
93 920	2 274	43 681	37 392	11 317	69 718	532	33

propelled working machines – – – Source: Kraftfahrt-Bundesamt (Federal Bureau of Transports)
selbstfahrende Arbeitsmaschinen – – – Quelle: Kraftfahrt Bundesamt

Cont. 9.4 Amount of motor vehicles) on 1,*
Noch: 9.4 Bestand an Kraftfahrzeugen*) mit amtlichem

Sonder-Nr.	Administrative District	Motor vehicles with		
		totalling	motorcycles incl. motorscooters and lightype motorcycles	passenger vehicles
Lfd. Nr.	Verwaltungsbezirk	Kraft		
		insgesamt	Krafträder einschl. Kraftrollern und Leichtkrafträdern	Personenkraftwagen
	Kreisfreie Städte			
34	Bottrop	54 306	2 574	45 195
35	Gelsenkirchen	119 415	4 072	100 717
36	Münster	123 770	4 369	98 146
	Kreise			
37	Borken	152 568	4 042	117 752
38	Coesfeld	82 002	2 871	70 525
39	Recklinghausen	287 752	11 377	247 580
40	Steinfurt	206 372	7 323	160 711
41	Warendorf	129 760	4 476	100 082
42	**Reg.-Bez. Münster**	1 176 767	41 184	946 708
	davon			
43	kreisfreie Städte	297 493	11 015	244 058
44	Kreise	879 274	30 089	696 650
	Kreisfreie Stadt			
45	Bielefeld	150 026	5 209	120 603
	Kreise			
46	Gütersloh	168 204	5 783	129 225
47	Herford	133 657	4 671	106 902
48	Höxter	74 793	2 649	55 902
49	Lippe	173 979	6 401	138 048
50	Minden-Lübbecke	165 835	5 387	128 077
51	Paderborn	122 861	4 455	94 460
52	**Reg.-Bez. Detmold**	989 356	34 565	772 217
	davon			
53	kreisfreie Stadt	150 026	5 209	120 603
54	Kreise	839 329	29 346	652 614
	Kreisfreie Städte			
55	Bochum	171 779	6 586	143 268
56	Dortmund	259 958	9 507	214 905
57	Hagen	99 554	3 875	81 115
58	Hamm	80 557	2 785	66 833
59	Herne	71 778	2 496	60 765
	Kreise			
60	Ennepe-Ruhr-Kreis	179 266	8 328	144 923
61	Hochsauerlandkreis	134 519	4 496	103 963
62	Märkischer Kreis	216 302	8 582	173 058
63	Olpe	64 829	2 350	51 040
64	Siegen-Wittgenstein	152 875	6 994	119 135
65	Soest	139 229	5 145	108 761
66	Unna	186 122	7 407	152 720
67	**Reg.-Bez. Arnsberg**	1 754 768	66 551	1 420 496
	davon			
68	kreisfreie Städte	683 626	25 249	566 886
69	Kreise	1 073 142	43 302	853 600
70	**Nordrhein-Westfalen**	8 398 438	315 980	6 780 826
	davon			
71	kreisfreie Städte	3 404 624	126 270	2 790 461
72	Kreise	4 993 814	188 810	3 970 365

July 1987 subdivided into administrative districts
Kennzeichen am 1. Juli 1987 nach Verwaltungsbezirken

official number plate					*motor vehicle trailers*	*motor vehicles per 1,000 inhabitants*	*Serial No*
of which							
estate cars	*powerdriven buses incl. trolleybuses*	*trucks*	*towing vehicles*	*remaining motor vehicles*[1]			
fahrzeuge							
davon					Kraftfahrzeuganhänger	Kraftfahrzeuge je 1 000 Einwohner	Lfd. Nr.
Kombinations-kraftwagen	Kraftomnibusse einschl. Obussen	Lastkraftwagen	Zugmaschinen	übrige Kraftfahrzeuge[1]			
3 659	54	1 883	549	394	2 295	484	34
8 114	157	4 869	634	852	4 736	422	35
12 330	346	5 305	1 902	1 372	7 027	465	36
11 376	371	6 860	10 918	1 249	13 525	493	37
7 757	195	3 305	7 324	825	7 924	517	38
21 762	647	9 371	4 312	2 703	15 087	478	39
16 134	450	7 276	12 853	1 625	15 009	542	40
10 535	209	4 669	8 648	1 161	10 016	525	41
91 867	**2 429**	**43 538**	**47 140**	**10 181**	**75 619**	**490**	**42**
24 103	557	12 057	3 085	2 618	14 058	450	43
67 564	1 872	31 481	44 055	7 563	61 561	505	44
14 248	235	6 687	1 544	1 500	7 744	500	45
14 353	382	8 370	8 485	1 606	12 677	585	46
10 857	350	5 416	4 253	1 208	8 755	596	47
5 179	221	2 954	7 267	621	5 329	533	48
14 771	332	6 395	6 332	1 700	12 299	538	49
11 764	234	6 593	12 299	1 481	11 970	595	50
10 070	236	4 566	8 084	990	9 501	528	51
81 242	**1 990**	**40 981**	**48 264**	**9 106**	**68 274**	**554**	**52**
14 248	235	6 687	1 544	1 500	7 744	500	53
66 994	1 755	34 294	46 720	7 606	60 530	564	54
13 068	367	5 951	759	1 780	6 364	451	55
20 295	506	10 543	1 774	2 428	11 475	458	56
8 126	239	4 388	798	1 013	4 587	484	57
5 949	131	2 827	1 470	562	4 551	485	58
4 929	213	2 417	271	687	2 580	420	59
15 284	295	6 416	2 344	1 676	8 291	534	60
11 700	270	5 441	7 357	1 292	9 724	518	61
19 978	533	7 886	4 114	2 151	10 621	525	62
5 513	184	2 582	2 669	491	4 252	525	63
13 213	288	5 763	6 081	1 391	9 816	548	64
11 043	312	5 020	7 509	1 439	10 599	520	65
14 467	387	5 927	3 102	2 112	9 675	474	66
143 586	**3 725**	**65 161**	**38 258**	**17 022**	**92 535**	**493**	**67**
52 367	1 456	26 126	5 072	6 470	29 557	458	68
91 198	2 269	39 035	33 186	10 552	62 978	518	69
680 483	**16 760**	**327 226**	**210 300**	**77 763**	**451 126**	**503**	**70**
284 760	7 052	140 896	23 169	32 016	141 839	469	71
395 733	9 708	186 330	187 131	45 737	309 287	529	72

10. List of LDS-publications in the field of environmental protection
10. Veröffentlichungen des LDS zum Thema Umweltschutz

Title / Titel	*Order-number* / Bestell-Nr.	*Price in DM* / Preis/DM
Statistical reports **Statistische Berichte**		
Abfallbeseitigungsanlagen im öffentlichen und gewerblichen Bereich (1975)	Q 29 3 7500	1,00
Öffentliche Abfallbeseitigung (1980, 1984)	Q 21 3 8000	5,00
	Q 21 3 8400	4,50
Öffentliche und gewerbliche Abfallbeseitigung – Regionalergebnisse (1975)	Q 20 3 7500	1,00
Abfall- und Abwasserbeseitigung in der Viehhaltung (1979, 1981)	Q 23 3 7900	2,00
	Q 23 3 8100	2,00
Abfallbeseitigung im Produzierenden Gewerbe und in Krankenhäusern 1984	Q 22 3 8400	5,00
Öffentliche Wasserversorgung (1983)	Q 10 3 8300	8,50
Öffentliche Abwasserbeseitigung (1983)	Q 11 3 8300	4,50
Wasserversorgung und Abwasserbeseitigung im Bergbau und Verarbeitenden Gewerbe (1981, 1983)	Q 12 3 8100	4,00
	Q 12 3 8300	4,50
Wasserversorgung und Abwasserbeseitigung bei Wärmekraftwerken für die öffentliche Versorgung (1975, 1977, 1983, 1987)	Q 14 3 7500	1,00
	Q 14 3 7700	1,00
	Q 14 3 8300	2,00
	Q 14 3 8700	2,00
Unfälle bei Lagerung und Transport wassergefährdender Stoffe (1977, 1978, 1979, 1980, 1984, 1985, 1986, 1987)	Q 13 3 7700	1,40
	Q 13 3 7800	1,40
	Q 13 3 7900	2,00
	Q 13 3 8000	2,00
	Q 13 3 8400	2,00
	Q 13 3 8500	2,00
	Q 13 3 8600	2,00
	Q 13 3 8700	2,00
Investitionen für Umweltschutz im Produzierenden Gewerbe (1980, 1981, 1983, 1984, 1985, 1986)	Q 31 3 8000	4,00
	Q 31 3 8100	3,50
	Q 31 3 8300	4,50
	Q 31 3 8400	4,50
	Q 31 3 8500	4,00
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II. The Regional Data Bank of North Rhine-Westphalia (LDB)

1. Access to the environmental data of the official statistics

In the Regional Office for Data Processing and Statistics of North Rhine-Westphalia, the Regional Data Bank (LDB) has increasingly been used as an informative instrument of the official statistics for more than 15 years. The original order given by the Federal State Government to the Office was to establish an information system based on electronic data processing which was to furnish data for the support of processes of planning and decisions primarily to the Parliament and Administration of the Federal State of North Rhine-Westphalia. However, already from the beginning of this work, the requirements on the local level, of the economy and of science were taken into consideration with regard to the selection of the data to be stored as well as to the possibilities of evaluation.

In accordance with the „Law Governing the Organization of Automated Data Processing in North Rhine-Westphalia", the Regional Data Bank is, on principle, at everybody's disposal. The only restrictions are made with regard to the general regulations of statistical secrecy, which are also valid for the conventional forms of the transfer of statistical material.

The data basis

At present, the Regional Data Bank contains a stock of approximately 325,000 criteria with 3.5 million time series elements and 2.3 billion data sets, i. e. exclusively regionally aggregated data. Despite its huge scope, this data pool represents only a selection out of the total statistical material available in the Regional Office for Data Processing and Statistics. This selection is based on a large-scale analysis of the demand of the most important users. Furthermore, the following framework conditions are valid derived from some main fields of application of the data bank:

- *the data to be stored should be available on a regionally low aggregation level (i. e. possibly on a community or at least on a district level), so as to serve for the regional statistical analysis, and – as smallest components – for converting to non-administrative area units.*

- *in order to be able to conduct time series analyses, the aim should furthermore be to create fairly long series.*

II. Die Landesdatenbank Nordrhein-Westfalen (LDB)

1. Ein Zugangsweg zu den Umweltdaten der amtlichen Statistik

Seit mehr als anderthalb Jahrzehnten wird im Landesamt für Datenverarbeitung und Statistik Nordrhein-Westfalen die Landesdatenbank (LDB) in ständig zunehmendem Maße als Auskunftsinstrument der amtlichen Statistik eingesetzt. Wenn auch der ursprüngliche Auftrag der Landesregierung an die Behörde den Aufbau eines EDV-gestützten Informationssystems betraf, das primär dem Parlament und der Verwaltung des Landes Nordrhein-Westfalen Daten zur Unterstützung von Planungs-und Entscheidungsprozessen liefern sollte, so wurden doch bereits von Beginn der Arbeiten an auch die Belange der kommunalen Ebene, der Wirtschaft und der Wissenschaft berücksichtigt, und zwar sowohl in bezug auf die Auswahl der einzuspeichernden Daten als auch auf die Auswertungsmöglichkeiten hin.

Nach dem „Gesetz über die Organisation der automatisierten Datenverarbeitung in Nordrhein-Westfalen" steht die Landesdatenbank grundsätzlich jedermann für Auskünfte und Auswertungen zur Verfügung; als einschränkende Regelungen sind im wesentlichen nur die allgemeinen statistischen Geheimhaltungsbestimmungen zu nennen, wie sie auch für die konventionellen Formen der Weitergabe statistischen Materials Gültigkeit haben.

Die Datenbasis

Die LDB weist derzeit einen Bestand von rd. 325 000 Merkmalen mit 3,5 Mill. Zeitreihengliedern und 2,3 Mrd. Daten auf, und zwar ausschließlich räumlich aggregierten Daten. Trotz seines gewaltigen Umfangs stellt dieser Datenpool lediglich eine Auswahl aus dem gesamten im LDS vorhandenen statistischen Material dar, die sich auf eine breit angelegte Bedarfsforschung bei den wesentlichsten Benutzern stützt. Außerdem gelten folgende Rahmenbedingungen, die sich von einigen Haupteinsatzfeldern der Datenbank herleiten:

- Die einzuspeichernden Daten sollen auf regional niedriger Aggregationsstufe (d. h. möglichst auf Gemeinde-, zumindest aber auf Kreisebene) verfügbar sein, um sowohl der regionalstatistischen Analyse als auch – als kleinste Bausteine – der Umrechnung auf nichtadministrative Gebietseinheiten zu dienen.

- Um Zeitreihenanalysen durchführen zu können, wird zudem die Bildung längerer Reihen angestrebt.

– *in order to meet the information requirements of a possibly large range of users, data deriving from all important spheres of life – as far as such are available – should be stored. These data do not necessarily have to originate from the official statistics, but can also be taken from external sources.*

The survey following this article reproduces today's contents of the Regional Data Bank, i. e. with a detailed presentation of the field of environmental and traffic data and – due to lack of space – in an abridged version for the remaining sections. The data stock catalogue contains a total listing of all data stored. This catalogue can be ordered from the Regional Office for Data Processing and Statistics free of charge.

It goes without saying that the data selection ist not to be regarded as a single procedure, because further corrective and complementary selections will have to be made which derive from the modifications of the statistical programme and above all from the reciprocal relation between the users and the operators of the Regional Data Bank.

The analysis of the user inquiries is an important guideline for the complementation of the data stock. However, the reversed connection has to be considered, too, because the experience made proves that very often important latent information requirements can only be expressed definitely only once there is a corresponding offer of information from the Regional Data Bank.

– Um den Informationsbedürfnissen eines möglichst großen Kreises von Benutzern entgegenzukommen, sollen – soweit verfügbar – Angaben aus allen wichtigen Lebensbereichen gespeichert werden; die Daten müssen nicht notwendig aus der amtlichen Statistik stammen, sondern werden auch aus externen Quellen gewonnen.

Die im Anschluß an diesen Beitrag folgende Übersicht gibt den heutigen Inhalt der LDB wieder, und zwar in ausführlicher Darstellung für den Bereich der Umweltdaten und – aus Platzgründen – in Kurzform für die übrigen Abschnitte. Eine Gesamtdarstellung aller gespeicherten Daten enthält der Datenbestandskatalog, der kostenlos vom LDS zu beziehen ist.

Es ist im übrigen selbstverständlich, daß die Datenauswahl nicht als ein einmaliger Vorgang anzusehen ist, sondern daß auch weiterhin korrigierende und ergänzende Auswahlentscheidungen getroffen werden müssen, die sich aus Modifizierungen des statistischen Programms, vor allem aber aus der Wechselbeziehung zwischen Benutzern und Betreibern der Landesdatenbank ergeben.

Dabei ist die Analyse der Benutzeranfragen zwar eine wichtige Leitlinie bei der Ergänzung des Datenbestandes, doch muß zusätzlich auch jeweils der umgekehrte Zusammenhang gesehen werden, da die gewonnenen Erfahrungen belegen, daß durchaus wichtige latente Informationsbedürfnisse oftmals erst dann konkret artikuliert werden, wenn seitens der Landesdatenbank ein entsprechendes Informationsangebot ergeht.

The access routes

First of all, an inquiry for statistical data sent to the Regional Office for Data Processing and Statistics is checked for its realizability, taking into account the total internal information potential, i. e. the programme of publications, unpublished available „tables of reserves", a special consultation of the statistical department or just a retrieval from the Regional Data Bank with or without mechanical further processing of the data. Finally, the decision will be made in favour of the procedure which will deliver the best relevant result at the lowest cost.

Die Zugangswege

Eine Anfrage nach statistischen Daten, die das Landesamt erreicht, wird zunächst auf ihre Realisierbarkeit hin überprüft. Dabei wird immer das gesamte Informationspotential des Hauses in Betracht gezogen, sei es in Gestalt des Veröffentlichungsprogramms, unveröffentlicht vorliegender „Vorratstabellen", einer speziellen Beratung durch die statistische Fachabteilung oder eben eines Abrufes aus der Landesdatenbank mit oder ohne maschinelle Weiterverarbeitung der Daten. Die Entscheidung wird letztlich zugunsten desjenigen Verfahrens fallen, mit dem das gewünschte Ergebnis sachlich bestmöglich und kostengünstig zu erreichen ist.

If an order is given to the data bank, it will be executed by the data bank coordinating centre, where the user can find his contact person with whom he can talk about details, who gives his advice to him and who also delivers the agreed final product to him. This usually termed indirect access does not require any user knowledge about the utilization of the electronic data processing in general and of the Regional Data Bank in particular. The entire technical conversion of the order placed free of any formal requirement is the task of the coordinating centre. During the years of the initial stage, this indirect access was the only way possible and still today the main part of all users of the Regional Data Bank use this possibility.

Kommt es auf diesem Wege zu einem Auftrag an die Datenbank, so wird er durch die Datenbank-Leitstelle ausgeführt; der Benutzer hat in ihr seinen Ansprechpartner, mit dem er Details erörtert, der ihn berät, und von dem er schließlich das vereinbarte Endprodukt erhält. Dieser landläufig als indirekt oder mittelbar bezeichnete Zugang fordert vom Benutzer keinerlei Kenntnisse über den Umgang mit der EDV im allgemeinen und der Landesdatenbank im besonderen. Die gesamte technische Umsetzung der frei von jeder Formvorschrift formulierten Bestellung ist allein Sache der Leitstelle. Auf diesem indirekten Wege, der in den Jahren der Aufbauphase der einzig mögliche war, erreicht auch heute noch der zahlenmäßig weit überwiegende Teil aller Benutzer die Landesdatenbank.

A smaller number of users, however, utilize the data bank in direct access. The technical prerequisite is a terminal installed at the user's location which is connected to the Regional Office for Data Processing and Statistics via a line of the Federal German Post Office. By means of this terminal one can use the large-scale computer of the subscriber operating system. This possibility is availed of for instance by the Federal State Parliament, various ministries, the district planning departments and some scientific institutes and will be further extended. It is, however, doubtful whether this way is suited for a larger range of users, although it has indusputable advantages, e. g. the ad hoc-availability at the moment of demand, the independence from staff bottlenecks in the coordinating centre or the possibility of changing set values directly in interactive mode with the computer, to correct them and to optimize solutions. The reason for this doubt is that in case of such a developed offer of services as the one available from the Regional Data Bank, a direct access inevitably entails considerable technical and personnel requirements, which are certainly financially independent if (and only if) the system is utilized intensively.

Dem steht eine geringe Zahl von Anwendern gegenüber, die sich der Datenbank im direkten Zugangsverfahren bedienen. Technische Voraussetzung ist eine benutzerseitig installierte Datenstation, die über eine Leitung der Bundesspost mit dem LDS in Verbindung steht und den dortigen Großrechner im Teilnehmerbetrieb nutzt. Diese heute u. a. vom Landtag, verschiedenen Ministerien, den Bezirksplanungsstellen und einigen wissenschaftlichen Instituten genutzte Möglichkeit wird weiter ausgebaut werden. Ob dieser Weg trotz aller unbestreitbaren Vorzüge wie beispielsweise der Ad-hoc-Verfügbarkeit im Bedarfsmoment, der Unabhängigkeit von personellen Engpässen in der Leitstelle oder der Möglichkeit, im Dialog mit dem Computer unmittelbar Vorgaben zu verändern, nachzuregeln, Lösungen zu optimieren, indes für einen größeren Nutzerkreis gangbar ist, erscheint fraglich; denn bei einem dergestalt ausgebauten Leistungsangebot, wie es die LDB aufweist, ist ein Direktzugang zwangsläufig mit nicht unerheblichem Aufwand in technischer wie auch personeller Hinsicht verbunden, der sich zweifellos bei entsprechend intensiver Nutzung des Systems, aber auch nur dann, finanziell trägt.

The catalogue of services

For the calculatory and analytical evaluation of data, the Regional Data Bank has programmes at its disposal which originate partly from own developments and partly from the software market. The data bank's own programmes offer – in modular structure and interlinkable as desired – practically all desirable functions for the handling of matrices, e. g. sorting, mirroring, linkage, but also all calculating operations in which the matrix elements are responsive and processable individually, as a vector or as an interval. Finally, the data bank offers the proven programmes „SPSS" and „SAS" as evaluation programmes for analytical-statistical tasks. By means of these programmes, even sophisticated statistical methods can be made available for the user. The so-called „Census-XII-procedure" for the analysis of time series completes the catalogue of processing programmes.

Der Leistungskatalog

Zur rechnerisch-analytischen Bearbeitung von Daten stehen der Landesdatenbank zum Teil eigenentwickelte, zum Teil auf dem Software-Markt erworbene Programme zur Verfügung. Die datenbankeigenen Programme bieten – modular aufgebaut und beliebig miteinander verknüpfbar – praktisch alle wünschenswerten Funktionen zur Bearbeitung von Matrizen: Sortierung, Spiegelung, Verknüpfung, aber auch alle Rechneroperationen, wobei die Matrixelemente einzeln, als Vektor oder als Intervall ansprechbar und bearbeitbar sind. Als Auswertungsprogramme für analytisch-statistische Aufgaben schließlich bietet die Datenbank die bewährten Programmpakete SPSS und SAS an, mit deren Hilfe auch anspruchsvolle statistische Methoden dem Benutzer zugänglich gemacht werden. Vervollständigt wird der Katalog der Bearbeitungsprogramme durch das sogenannte Census-X-11-Verfahren zur Analyse von Zeitreihen.

If by using the above-described procedures the desired information has been produced, this is usually followed by the issue of the results, which can be effected in a freely selectable form, likewise in accordance with the wishes of the user. Needless to say, the most frequently requested variant ist the table, for the lay-out of which the programmes of the Regional Data Bank offer the maximum freedom to the user.

Sind unter Verwendung der vorstehend beschriebenen Verfahren die gewünschten Informationen erarbeitet worden, so schließt sich üblicherweise die Ausgabe der Ergebnisse an, die ebenfalls den Benutzerwünschen entsprechend in frei wählbarer Form erfolgen kann. Dabei ist die häufigst verlangte Variante natürlich nach wie vor die Tabelle, bei deren Gestaltung die Programme der Landesdatenbank dem Anwender größtmögliche Freiheit einräumen.

Besides the tables there are various graphic possibilities of representation available. First of all, there are the „business graphics", that can be produced via the screen and the small printer, which can be displayed as curves, circle diagrams or bar charts. If there are more-sophisticated demands made with regard to the possibilities of display and the graphic quality, there is still the posibility of taking the data from the data bank and producing the graphics off-line on an efficient plotter.

Neben der tabellarischen Ergebniswiedergabe stehen verschiedene graphische Darstellungsmöglichkeiten zur Verfügung. Hier sind zunächst einmal die über Bildschirm und Kleindrucker zu erzeugenden „Business Graphics" zu nennen, die als Verlaufskurven, Kreis- oder Säulendiagramme ausgeführt werden können. Sofern höhere Ansprüche an die Gestaltungsmöglichkeiten und die zeichnerische Qualität gestellt werden müssen, bleibt immer der Weg der Datenbereitstellung aus der Datenbank und der offline vorzunehmenden graphischen Weiterverarbeitung auf einem leistungsfähigen Plotter.

It goes without saying that data stock from the Regional Data Bank cannot only be made available in the form of tables or graphics but also on magnetic tapes or diskette for further processing on computers owned by the user. Details about the system compatibility should be discussed before with the data bank coordinating centre.

Selbstverständlich können Datenbestände aus der LDB nicht nur in Gestalt von Tabellen oder Graphiken bereitgestellt werden, sondern auf Wunsch auch auf Magnetbändern oder Disketten zur weiteren Verarbeitung auf benutzerseitigen Computern. Einzelheiten zur Systemverträglichkeit sollten dabei vorab unmittelbar mit der Datenbank-Leitstelle besprochen werden.

Finally, reference should be made to the cost regulation regarding the use of the Regional Data Bank. In accordance with the decree of the Minister of the Interior of the Federal State of North Rhine-Westphalia, the use is free of charge for all authorities and institutions of the Federal State. Orders from other users have to be charged on the basis of the quantity of data called. At present, the price per data item is DM 0.003, the minimum per order, however, being DM 30.–. The data medium selected has no influence on the price. Methods of processing which are outside the range of the Regional Data Bank (e. g. plotter) are calculated and charged individually.

Abschließend soll kurz auf die Kostenregelung für die Inanspruchnahme der Landesdatenbank eingegangen werden. Laut Erlaß des Innenministers des Landes Nordrhein-Westfalen ist die Nutzung lediglich für alle Behörden und Einrichtungen des Landes kostenfrei. Aufträge aller anderen Benutzer sind auf der Basis der abgerufenen Datenmenge abzurechnen. Dabei beträgt der Kostensatz z. Z. 0,003 DM je Datenwert, mindestens aber 30 DM je Auftrag. Ohne Einfluß auf die Kostenhöhe ist der gewählte Datenträger. Außerhalb der Landesdatenbank liegende Verfahrensanwendungen (z. B. Plotter-Einsatz) werden jeweils individuell kalkuliert und abgerechnet.

2. Catalogue of data stock – abridged version –

PROTECTION OF THE ENVIRONMENT

PUBLIC REFUSE REMOVAL

Waste disposal plants split up into types of plants

Processing and removal plants
(including transfer stations and collecting centres for industrial waste)
Processing and removal plants
dumps
refuse incinerating plants
composting plants
other removal plants
Transfer stations and collecting centres for industrial waste
transfer stations
collecting centres for industrial waste

Capacity of processing and removal plants

Capacity of
dumping areas (remaining volume)
refuse incinerating plants
composting plants

Quantities of refuse delivered to refuse removal plants split up into types of waste and way of delivery

Processing and removal plants
(including transfer stations and collecting centres for industrial waste)
Processing and removal plants
dumps
refuse incinerating plants
composting plants
other removal plants
Transfer stations and collecting centres for industrial waste
transfer stations
collecting centres for industrial waste
types of waste
total (excluding old tyres and car wrecks)
household and similar industrial refuse, bulky refuse
slag from refuse incinerating plants, road refuse
sewage sludge, faeces, sewer mud
excavated earth, building rubble
oil drenched soil, substances from separators
solid production-specific waste
pulpy production-specific waste
liquid production-specific waste
other refuse
old tyres
car wrecks

2. Datenbestandskatalog – Kurzfassung

UMWELTSCHUTZ

ÖFFENTLICHE ABFALLBESEITIGUNG

Abfallbeseitungsanlagen nach Anlagenarten

Behandlungs- und Beseitigungsanlagen (einschl. Umladestationen und Sammelstellen für Gewerbeabfälle)
Behandlungs- und Beseitigungsanlagen
Deponien
Müllverbrennungsanlagen
Kompostierungsanlagen
sonstige Beseitigungsanlagen
Umladestationen und Sammelstellen für Gewerbeabfälle
Umladestationen
Sammelstellen für Gewerbeabfälle

Kapazität von Behandlungs- und Beseitigungsanlagen

Kapazität von
Deponien (Restvolumen)
Müllverbrennungsanlagen
Kompostierungsanlagen

An Abfallbeseitigungsanlagen gelieferte Abfallmengen nach Abfallarten und Art der Anlieferung

Behandlungs- und Beseitigungsanlagen (einschl. Umladestationen und Sammelstellen für Gewerbeabfälle
Behandlungs- und Beseitigungsanlagen
Deponien
Müllverbrennungsanlagen
Kompostierungsanlagen
sonstige Beseitigungsanlagen
Umladestationen und Sammelstellen für Gewerbeabfälle
Umladestationen
Sammelstellen für Gewerbeabfälle
Abfallarten
insgesamt (ohne Altreifen und Autowracks)
Hausmüll, hausmüllähnliche Gewerbeabfälle, Sperrmüll, MVA-Schlacke, Straßenkehricht
Klärschlamm, Fäkalien, Kanalschlamm
Bodenaushub, Bauschutt
ölgetränktes Erdreich, Abscheidegut
feste produktionsspezifische Abfälle
breiige produktionsspezifische Abfälle
flüssige produktionsspezifische Abfälle
sonstige Abfälle
Altreifen
Autowracks

delivery
total
by public refuse collection and other public institutions
by other suppliers

Anlieferung
insgesamt
durch öffentliche Müllabfuhr und sonstige öffentliche Einrichtungen
durch sonstige Anlieferer

Collected quantity of household and bulky refuse
total

Eingesammelte Menge an Haus- und Sperrmüll
insgesamt

REFUSE REMOVAL IN THE PRODUCING INDUSTRIES AND HOSPITALS

Companies with own removal plants as well as their capacity split up into types of plants and industrial sectors

Companies
Capacity
dumps
refuse incinerating plants (capacity starting from 1982)
total
energy and water supply
mining
primary and producer goods industries
capital goods producing industry
commodity goods producing industry
food and semi-luxuries industry
building industry
hospitals

ABFALLBESEITIGUNG IM PRODUZIERENDEN GEWERBE UND BEI KRANKENHÄUSERN

Betriebe mit betriebseigenen Beseitigungsanlagen sowie deren Kapazität nach Anlagearten und wirtschaftlicher Gliederung

Betriebe
Kapazität
Deponien
Müllverbrennungsanlagen (Kapazität ab 1982)
insgesamt
Energie- und Wasserversorgung
Bergbau
Grundstoff- und Produktionsgütergewerbe
Investitionsgüter produzierendes Gewerbe
Verbrauchsgüter produzierendes Gewerbe
Nahrungs- und Genußmittelgewerbe
Baugewerbe
Krankenhäuser

Quantities of refuse split up into types of company-owned plants, main groups of refuse and industrial sectors

Quantity of refuse
total
dumps
refuse incinerating plants
processing plants (residues)
total
building rubble, excavated earth
furnace slag, rumble from metallurgical plants and foundries
moulding sand, core sand, dust, other solid mineral refuse
ash, slag, soot from combustion
metallurgical slags and dross
scrap metal
oxides, hydroxides, salts, radioactive waste, other solid production-specific refuse
acids, lyes, sludges, laboratory refuse, chemical residues, detergents, other liquid production-specific refuse
solvents, paints, lacquers, glues
mineral oil refuse, oil sludges, phenols
plastic, rubber and textil refuse (excluding old tyres)
sludges from water conditioning
other sludges (including sewage treatment)
industrial waste similar to household refuse
paper and cardboard waste
other organic waste
hospital-specific refuse

Abfallaufkommen nach Art der betriebseigenen Anlagen, Abfallhauptgruppen und wirtschaftlicher Gliederung

Abfallaufkommen
insgesamt
Deponien
Müllverbrennungsanlagen
Behandlungsanlagen (Rückstände)
insgesamt
Bauschutt, Bodenaushub
Ofenausbruch, Hütten- und Gießereischutt
Formsand, Kernsand, Stäube, andere feste mineralische Abfälle
Asche, Schlacke, Ruß aus der Verbrennung
metallurgische Schlacken und Krätzen
Metallabfälle
Oxide, Hydroxide, Salze, radioaktive Abfälle, sonstige feste produktionsspezifische Abfälle
Säuren, Laugen, Schlämme, Laborabfälle, Chemikalienreste, Detergentien, sonstige flüssige produktionsspezifische Abfälle
Lösungsmittel, Farben, Lacke, Klebstoffe
Mineralölabfälle, Ölschlämme, Phenole
Kunststoff-, Gummi- und Textilabfälle (ohne Altreifen)
Schlämme aus der Wasseraufbereitung
sonstige Schlämme (einschl. Abwasserreinigung)
hausmüllähnliche Gewerbeabfälle
Papier- und Pappeabfälle
sonstige organische Abfälle
krankenhausspezifische Abfälle

other non-mentioned refuse	anderweitig nicht genannte Abfälle
total	insgesamt
energy and water supply	Energie- und Wasserversorgung
mining	Bergbau
primary and producer goods industries	Grundstoff- und Produktionsgütergewerbe
capital goods producing industry	Investitionsgüter produzierendes Gewerbe
commodity goods producing industry	Verbrauchsgüter produzierendes Gewerbe
food and semi-luxuries industry	Nahrungs- und Genußmittelgewerbe
building industry	Baugewerbe
hospitals	Krankenhäuser

PUBLIC WATER SUPPLY

ÖFFENTLICHE WASSERVERSORGUNG

Inhabitants connected to the water supply and water distribution to end-user split up into water types

An die Wasserversorgung angeschlossene Einwohner und Wasserabgabe an Letztverbraucher nach Wasserarten

Connected inhabitants	Angeschlossene Einwohner
Water distribution to end-user	Wasserabgabe an Letztverbraucher
total	insgesamt
real groundwater	echtes Grundwasser
enriched groundwater	angereichertes Grundwasser
water form lakes or storages basins	See- bzw. Talsperrenwasser
groundwater and surface water mixed	Grund- und Oberflächenwasser gemischt
well water and surface water mixed	Quell- und Oberflächenwasser gemischt
groundwater, well water and surface water mixed	Grund-, Quell- und Oberflächenwasser gemischt
other types of water	sonstige Wasserarten

Produced untreated water split up into water types

Gewonnenes Rohwasser nach Wasserarten

Untreated water	Rohwasser
total	insgesamt
real groundwater	echtes Grundwasser
groundwater with bank filtrate	Grundwasser mit Uferfiltrat
enriched groundwater	angereichertes Grundwasser
well water	Quellwasser
surface water (not for the enrichment of groundwater)	Oberflächenwasser (nicht zur Anreicherung von Grundwasser)

PUBLIC EFFLUENT DISPOSAL

ÖFFENTLICHE ABWASSERBESEITIGUNG

Length of the sewer network, connected inhabitants and quantity of sewage in the sewer system

Länge des Kanalnetzes, angeschlossene Einwohner und Abwasseraufkommen in den Kanalisationen

Length of the sewer setwork	Länge des Kanalnetzes
total	insgesamt
combined system	Mischkanalisation
separate system	Trennkanalisation
Inhabitants connected	Angeschlossene Einwohner
to the sewage system	an die Kanalisation
to clarification plants	an Kläranlagen
Quantity of sewage in the sewage system	Abwasseraufkommen in den Kanalisationen

Sewage split up into origin and method of treatment

Treated sewage
total
household sewage
industrial sewage
groundwater, brook water, other wastewater
mechanical treatment
biological treatment without further chemical-physical treatment
biological treatment with further chemical-physical treatment
other treatment

Abwasser nach Herkunfts- und Behandlungsart

Behandeltes Abwasser
insgesamt
häusliches Abwasser
gewerbliches Abwasser
Grund-, Bachwasser, sonstiges Abwasser
mechanische Behandlung
biologische ohne weitergehende chemisch-physikalische Behandlung
biologische mit weitergehender chemisch-physikalischer Behandlung
sonstige Behandlung

Clarification plants and the raw sludge produced as well as harmfulness of effluents originating from clarification plants

Clarification plants
Raw sludge

Harmfulness of the sewage
quantity
quantity of the sewage
settleable substances
biochemical oxygen demand after 5 days
chemical oxygen demand
total sewage to be treated

Kläranlagen und darin angefallener Rohschlamm sowie Schädlichkeit des Abwassers aus Kläranlagen

Kläranlagen
Rohschlamm

Schädlichkeit des Abwassers
Menge
Bezugsmenge des Abwassers
absetzbare Stoffe
biochemischer Sauerstoffbedarf nach 5 Tagen
chemischer Sauerstoffbedarf
zu behandelndes Abwasser insgesamt

WATER SUPPLY AND EFFLUENT DISPOSAL IN MINING AND PROCESSING INDUSTRIES

Volume of water split up into origin and industrial sectors

Volume of water
total
own production
total
groundwater/well water
surface water
outside water procurement
total
public network
other institutions
total
mining
primary and producer goods industry
capital goods producing industry
commodity goods producing industry
food and semi-luxuries industry

WASSERVERSORGUNG UND ABWASSERBESEITIGUNG IM BERGBAU UND VERARBEITENDEN GEWERBE

Wasseraufkommen nach Herkunft und wirtschaftlicher Gliederung

Wasseraufkommen
insgesamt
Eigenförderung
insgesamt
Grund-/Quellwasser
Oberflächenwasser
Fremdbezug
insgesamt
öffentliches Netz
andere Betriebe
insgesamt
Bergbau
Grundstoff- und Produktionsgütergewerbe
Investitionsgüter produzierendes Gewerbe
Verbrauchsgüter produzierendes Gewerbe
Nahrungs- und Genußmittelgewerbe

Utilization of water split up into industrial sectors

Utilization of water
- *single use*
  - *cooling water*
- *multi-use*
- *first filling or additional water for water circuits*
- *water given to others or unused discharged water*
  - *total*
  - *mining*
  - *primary and producer goods industry*
  - *capital goods producing industry*
  - *commodity goods producing industry*
  - *food and semi-luxuries industry*

Wasserverwendung nach wirtschaftlicher Gliederung

Wasserverwendung
- Einfachnutzung
  - Kühlwasser
- Mehrfachnutzung
- Erstfüllung bzw. Zusatzwasser für Wasserkreisläufe
- an andere abgegebenes bzw. ungenutzt abgeleitetes Wasser
  - insgesamt
  - Bergbau
  - Grundstoff- und Produktionsgütergewerbe
  - Investitionsgüter produzierendes Gewerbe
  - Verbrauchsgüter produzierendes Gewerbe
  - Nahrungs- und Genußmittelgewerbe

Use of water split up into industrial sectors

Water use
- *total*
- *cooling water*
  - *total*
  - *mining*
  - *primary and producer goods industry*
  - *capital goods producing industry*
  - *commodity goods producing industry*
  - *food and semi-luxuries industry*

Wassernutzung nach wirtschaftlicher Gliederung

Genutztes Wasser
- insgesamt
- Kühlwasser
  - insgesamt
  - Bergbau
  - Grundstoff- und Produktionsgütergewerbe
  - Investitionsgüter produzierendes Gewerbe
  - Verbrauchsgüter produzierendes Gewerbe
  - Nahrungs- und Genußmittelgewerbe

Discharge of untreated effluent split up into final disposal and industrial sectors

Discharged waste water
- *total*
- *directly into water courses*
  - *total*
  - *cooling water*
    - *without recooling*
  - *remaining effluent*
- *into the subsoil*
- *into the sewage system*
- *into a company-owned sewage treatment plant*
- *to other plants*
  - *total*
  - *mining*
  - *primary and producer goods industry*
  - *capital goods producing industry*
  - *commodity goods producing industry*
  - *food and semi-luxuries industry*

Ableitung von unbehandeltem Abwasser nach dem Verbleib und wirtschaftlicher Gliederung

Abgeleitetes Abwasser
- insgesamt
- direkt in ein Gewässer
  - insgesamt
  - Kühlwasser
    - ohne Rückkühlung
  - übriges Abwasser
- in den Untergrund
- in die Kanalisation
- in eine betriebseigene Abwasserbehandlungsanlage
- an andere Betriebe
  - insgesamt
  - Bergbau
  - Grundstoff- und Produktionsgütergewerbe
  - Investitionsgüter produzierendes Gewerbe
  - Verbrauchsgüter produzierendes Gewerbe
  - Nahrungs- und Genußmittelgewerbe

Effluent treated in company-owned sewage treatment plants split up into method of treatment and industrial sectors

Effluent treated
mechanically
biologically without chemical or chemical-physical further treatment
biologically with chemical or chemical-physical further treatment
Sewage treatment plants
total
mining
primary and producer goods industry
capital goods producing industry
commodity goods producing industry
food and semi-luxuries industry

In betriebseigenen Abwasserbehandlungsanlagen behandeltes Abwasser nach Art der Behandlung und wirtschaftlicher Gliederung

Behandeltes Abwasser
mechanisch
biologisch ohne chemische oder chemisch-physikalische Weiterbehandlung
biologisch mit chemischer oder chemisch-physikalischer Weiterbehandlung
Abwasserbehandlungsanlagen
insgesamt
insgesamt
Bergbau
Grundstoff- und Produktionsgütergewerbe
Investitionsgüter produzierendes Gewerbe
Verbrauchsgüter produzierendes Gewerbe
Nahrungs- und Genußmittelgewerbe

INVESTMENTS FOR ENVIRONMENTAL PROTECTION IN THE PRODUCING INDUSTRY

Investments for environmental protection in the producing industry

Investments
total
split up into
refuse removal
protection of waters
noise prevention
keeping the air clean
Turn-over of the enterprises with investments for environmental protection
Employees of the enterprises with investments for environmental protection
Total investments
total
energy and water supply
mining
primary and producer goods industries
capital goods producing industry
commodity goods producing industry
food and semi-luxuries industry

INVESTITIONEN FÜR UMWELTSCHUTZ IM PRODUZIERENDEN GEWERBE

Investitionen für Umweltschutz im Produzierenden Gewerbe

Umweltschutzinvestitionen
insgesamt
für Abfallbeseitigung
für Gewässerschutz
für Lärmbekämpfung
für Luftreinigung
Umsatz der Betriebe mit Umweltschutzinvestitionen
Beschäftigte der Betriebe mit Umweltschutzinvestitionen
Gesamtinvestitionen
insgesamt
Energie- und Wasserversorgung
Bergbau
Grundstoff- und Produktionsgütergewerbe
Investitionsgüter produzierendes Gewerbe
Verbrauchsgüter produzierendes Gewerbe
Nahrungs- und Genußmittelgewerbe

TRAFFIC

VERKEHR

ROAD TRAFFIC

STRASSENVERKEHR

County roads according to driveway widths and pavement types

Road lengths:
inside place
outside place
totalling
with simply fastened driveways without ballasting,
with water-bound covering
with wear-resisting layers
with carpet coverings
with medium-heavy and heavy bituminous pavement
with large-set pavement, small-set pavement and ancient cobbled pavement
with cement-concrete base
with further surfacing structures
Road lengths:
inside place
outside place
(driveway widths from ... up to below ... m):
4, 4 – 5, 5 – 6, 6 – 7,7 and more meters

Gemeindestraßen nach Fahrbahnbreiten und Deckenarten

Straßenlängen:
innerorts
außerorts
insgesamt
mit einfach befestigten unbeschotterten Fahrbahnen,
wassergebundenen Decken
mit Oberflächenschutzschichten
mit Teppichbelägen
mit mittelschweren und schweren bituminösen Belägen
mit Großpflaster, Kleinpflaster und altem Kopfsteinpflaster
mit Zementbetondecken
mit sonstiger Deckenbauweise

Straßenlängen:
innerorts
außerorts
(Fahrbahnbreiten; von ... bis unter ... m):
4, 4-5, 5-6, 6-7, 7 und mehr Meter

Roads of the overregional traffic according to the responsible building contractors

Roads
Federal roads
main roads
local roads
totalling
passages through the place
totalling
as to contractor responsibility of the Federal Republic respectively of the „Landschaftsverbände" or the Districts
as to contractor responsibility of the Communities
free routes
in all (until 1972)
subdivided into contractor responsibility of the Federal Republic respectively of the „Landschaftsverbände"
or the Districts (until 1972)
Federal superhighways

Straßen des überörtlichen Verkehrs nach Baulastträgern

Straßen
Bundesstraßen
Landstraßen
Kreisstraßen
insgesamt
Ortsdurchfahrten
insgesamt
in Baulast des Bundes bzw. der Landschaftsverbände bzw. der Kreise
in Baulast der Gemeinden
freie Strecken
insgesamt (bis 1972)
in Baulast des Bundes bzw. der Landschaftsverbände bzw. der Kreise
in Baulast Dritter (bis 1972)
Bundesautobahnen

Existing amount, new vehicle registrations, transfers of property and cancellation of motor vehicles of varied type according to owner and purchaser groups, respectively

Existing amount:
New vehicle registrations:
Transfers of property:
Cancellations:
- *motor-cycles*
  - *in all*
- *motor scooters*
- *passenger cars*
- *estate cars*
- *trucks*
- *truck loading capacity*
- *power-driven buses and trolley buses*
- *towing vehicles of normal type* } *(only existing amount)*
- *semi-trailer motor vehicles* }
- *Special-type motor vehicles*
  - *(owner groups (based upon existing amount and cancellations)):*
  - *(purchaser groups (with new vehicle registrations and transfers of property)):*
  - *in all*
  - *enterprises and independent people*
    - *totalling*
    - *farming and forestry, animal keeping and fishery*
    - *electric power industry and water supply, mining*
    - *manufacturing industry*
    - *building trade*
    - *wholesale trade*
    - *trade mediation*
    - *retail trade*
    - *traffic and transmission of news*
    - *credit institutes and insurance trade*
    - *rendering of services*
  - *organizations without acquisition character*
  - *governmental units and social insurance*
  - *employees, non-wage and salary earners as well as unknown situation*
    - *in all*
    - *officers*
    - *employees*
    - *operators*
    - *non-wage and salary earners as well as unknown situation*

Bestand, Neuzulassungen, Besitzumschreibungen und Löschungen von Kraftfahrzeugen verschiedener Art nach Haltergruppen bzw. Käufergruppen

Bestand:
Neuzulassungen:
Besitzumschreibungen:
Löschungen:
- Krafträder
  - insgesamt
- Kraftroller
- Pkw
- Kkw
- Lkw
- Lkw-Ladekapazität
- Omnibusse und Obusse
- gewöhnliche Zugmaschinen (nur Bestand)
- Sattelzugmaschinen
- Sonderkraftfahrzeuge
  - (Haltergruppen (bei Bestand und Löschungen)):
  - (Käufergruppen (bei Neuzulassungen und Besitzumschreibungen)):
  - insgesamt
  - Unternehmen und Selbständige
    - insgesamt
    - Land- und Forstwirtschaft, Tierhaltung und Fischerei
    - Energiewirtschaft und Wasserversorgung, Bergbau
    - Verarbeitendes Gewerbe
    - Baugewerbe
    - Großhandel
    - Handelsvermittlung
    - Einzelhandel
    - Verkehr und Nachrichtenübermittlung
    - Kreditinstitute und Versicherungsgewerbe
    - Dienstleistungen
  - Organisationen ohne Erwerbscharakter
  - Gebietskörperschaften und Sozialversicherung
  - Arbeitnehmer, Nichterwerbspersonen und unbekannt
    - insgesamt
    - Beamte
    - Angestellte
    - Arbeiter
    - Nichterwerbspersonen und unbekannt

Amount of motor vehicles of varying type according to the years of official registration

Existing amount:
- *motor-cycles*
- *passenger cars*
- *estate cars*
- *trucks*
- *power-driven buses and trolley buses*
- *towing vehicles*
- *special-type motor vehicles*
- *motor vehicle trailers*
  - *(years of admission):*
  - *in all*
  - *unknown*
  - *1948 and earlier (until 1973)*
  - *1949 until 1952*

Bestand an Kraftfahrzeugen verschiedener Art nach Zulassungsjahren

Bestand:
- Krafträder
- Pkw
- Kkw
- Lkw
- Omnibusse und Obusse
- Zugmaschinen
- Sonderkraftfahrzeuge
- Kfz-Anhänger
  - (Zulassungsjahre):
  - insgesamt
  - unbekannt
  - 1948 und früher (bis 1973)
  - 1949 bis 1952

1952 and earlier (1974 – 1977)
1953 until 1956 (until 1977)
1956 and earlier (as from 1978)
1957 until 1960 (as from 1971)
1957
1958 (until 1970)
1959
1960
1961 (until 1974)
1962
1963
1964
1961 (until 1964; as from 1975)
1965 (as from 1975)
1966
1967
yearly extension to the rate of a new year of admission

1952 und früher (1974-1977)
1953 bis 1956 (bis 1977)
1956 und früher (ab 1978)
1957 bis 1960 (ab 1971)
1957
1958 (bis 1970)
1959
1960
1961 (bis 1974)
1962
1963
1964
1961 (bis 1964; ab 1975)
1965 (ab 1975)
1966
1967
jährliche Erweiterung um ein neues Zulassungsjahr

Existing amount, new vehicle registrations, transfers of property and cancellations of passenger cars and estate cars according to their driving mechanisms and as per the owner groups respectively purchaser groups

Existing amount:
New registrations:
ransfers of property:
Cancellations:
passenger cars
estate cars
drive systems
with Otto engine
with Diesel engine
with rotary piston engine
with electric drive
with other drive systems
(owner groups respectively purchaser groups see indication above)

Bestand, Neuzulassungen, Besitzumschreibungen und Löschungen von Pkw und Kombis nach Antriebsarten und Haltergruppen bzw. Käufergruppen

Bestand:
Neuzulassungen:
Besitzumschreibungen:
Löschungen:
Pkw
Kkw
Antriebsarten
mit Ottomotor
mit Dieselmotor
mit Rotationskolbenmotor
mit elektrischem Antrieb
mit anderen Antriebsarten
(Haltergruppen bzw. Käufergruppen, siehe oben)

Existing amount, new vehicle registrations, transfers of property and cancellations of passenger cars and estate cars and towing vehicles as per HP classes (as from 1978 motor vehicle classes) and as per owner groups

Existing amount:
New vehicle registrations:
Transfers of property:
Cancellations:
passenger cars
estate cars
(HP classes; from ... up to ... HP): only for passenger cars, estate cars
10, 11 – 15, 16 – 19, 20, 21 – 23, 24 – 28, 29 – 30, 31 – 34, 35 – 37, 38 – 40, 41 – 45, 46 – 55, 56 – 60, 61 – 75, 76 – 90,
91 – 115, 116 – 120, 121 – 150, 151 and more HP
(owner groups see above; only as to existing amount)

Bestand, Neuzulassungen, Besitzumschreibungen und Löschungen von PKW und Kombis nach Hubraumklassen und Haltergrupen bzw. Käufergruppen

Bestand:
Neuzulassungen:
Besitzumschreibungen:
Löschungen:
PKW
Kkw
(PS-Klassen) von ... bis ... PS):
nur für PKW, Kkw
10, 11-15, 16-19, 20, 21-23, 24-28, 29-30, 31-34, 35-37, 38-40, 41-45, 46-55, 56-60, 61-75, 76-90, 91-115, 116-120, 121-150, 151 und mehr PS
(Haltergruppen, siehe oben; nur für Bestand)

normal towing vehicles:
(HP classes; from ... up to ... HP):
12, 13 – 17, 18 –24, 25 – 34, 35 – 40, 41 – 50, 51 – 60, 61 – 100,
101 and more HP
(owner groups see above; only as to existing amount)

articulated road trains
(HP classes; from ... up to ... HP);
24, 25 – 34, 35 – 60, 61 – 100, 101 – 125, 126 – 150, 151 – 175,
176 – 200, 201 and more HP
(owner groups see above; only as to existing amount)

gewöhnliche Zugmaschinen
(PS-Klassen; von ... bis ... PS):
12, 13-17, 18-24, 35-40, 41-50, 51-60, 61-100, 100 und mehr PS
(Haltergruppen, siehe oben; nur für Bestand)

Sattelzugmaschinen
(PS-Klassen, von ... bis ... PS):
24, 25-34, 35-60, 61-100, 101-125, 126-150, 151-175, 176-200, 201 und mehr PS
(Haltergruppen, siehe oben; nur für Bestand)

Existing amount of trucks as per admissible total weight and owner groups

Existing amount:
trucks
(admissible total weight ; from ... up to ... kg):
2,000, 2,001 – 3,000, 3,001 – 3,500,
3,501 – 4,000, 4,001 – 5,000,
5,001 – 6,000, 6,001 – 7,000 7,001 – 7,500,
7,501 – 8,000,
8,001 – 9,000, 9,001 – 10,000, 10,001 – 12,000,
12,001 – 14,000,
14,001 – 16,000, 16,001 and more kg
(owner groups see above)

Bestand an LKW nach zulässigem Gesamtgewicht und Haltergruppen

Bestand:
LKW
(zulässiges Gesamtgewicht; von ... bis ... kg):
2 000, 2 001-3 000, 3 001-3 500, 3 501-4 000, 4 001-5 000,
5 001-6 000, 6 001-7 000, 7 001-7 500, 7 501-8 000, 8 001-9 000, 9 001-10 000, 10 001-12 000, 12 001-14 000,
14 001-16 000, 16 001 und mehr kg
(Haltergruppen, siehe oben)

Existing amount, new vehicle registrations, transfers of property and cancellations of trucks, trailers and loading capacity as per useful load classes and owner groups respectively purchaser groups

Existing amount:
New vehicle registrations:
Transfers of property:
Cancellations:
trucks
trailers
loading capacity for trailers (only existing amount);
totalling
with surface mounting (not/existing amount)
normal-type trailers
in all
single-axle trailers
multi-axle trailers
articulated road trains
(Useful load classes; from ... up to ... kg):
only for existing amount of trucks
999, 1,000 – 1,499, 1,500 – 1,999, 2,000 – 2,499, 2,500 – 2,999,
3,000 – 3,499, 3,500 – 3,999, 4,000 – 4,499, 4,500 – 4,999, 5,000 – 5,499,
5,500 – 5,999, 6,000 – 6,499, 6,500 – 6,999, 7,000 – 7,499, 7,500 – 7,999,
8,000 – 8,999, 9,000 – 9,999, 10,000 – 10,999, 11,000 – 11,999,
12,000 – 12,999, 13,000 – 13,999, 14,000 – 14,999, 15,000 and more kilogramms
(owner groups see above)

Bestand, Neuzulassungen, Besitzumschreibungen und Löschungen von LKW, Kfz-Anhängern und Ladekapazität nach Nutzlastklassen und Haltergruppen bzw. Käufergruppen

Bestand:
Neuzulassungen:
Besitzumschreibungen:
Löschungen:
Lkw
Kfz-Anhänger
Ladekapazität an Kfz-Anhängern (nur Bestand)
insgesamt
mit Normalaufbau (nicht Bestand)
gewöhnliche Anhänger
insgesamt
einachsige Anhänger
mehrachsige Anhänger
Sattelanhänger
(Nutzlastklassen; von ... bis ... kg);
nur für Bestand an Lkw
999, 1 000-1 499, 1 500-1 999, 2 000-2 499, 2 500-2 999,
3 000-3 499, 3 500-3 999, 4 000-4 499, 4 500-4 999, 5 000-5 499,
5 500-5 999, 6 000-6 499, 6 500-6 999, 7 000-7 499, 7 500-7 999,
8 000-8 999, 9 000-9 999, 10 000-10 999, 11 000-11 999,
12 000-12 999, 13 000-13 999, 14 000-14 999, 15 000 u. mehr kg
(Haltergruppen, siehe oben)

(Useful load classes); from ... up to ... kg): only for new vehicle registrations, transfers of property and cancellations of trucks,
in all
999, 1,000 – 1,499, 1,500 – 1,999, 2,000 – 3,999, 4,000 – 4,999, 5,000 – 5,999, 6,000 – 7,499, 7,500 – 8,999, 9,000 – 9,999, 10,000 and more kg
(owner groups respectively purchaser groups see above)

(Nutzlastklassen; von ... bis ... kg):
nur für Neuzulassungen, Besitzumschreibungen u. Löschungen von Lkw
insgesamt
999, 1 000-1 499, 1 500-1 999, 2 000-3 999, 4 000-4 999, 5 000-5 999, 6 000-7 499, 7 500-8 999, 9 000-9 999, 10 000 und mehr kg
(Haltergruppen bzw. Käufergruppen, siehe oben)

(Useful load classes; from ... up to ... kg): only for existing amount of vehicle trailers and loading capacity of the existing amount
in all
999, 1,000 – 1,499, 1,500 – 1,999, 2,000 – 2,999, 3,000 – 3,999, 4,000 – 4,999, 5,000 – 5,999, 6,000 – 6,999, 7,000 – 7,999, 8,000 – 8,999, 9,000 – 9,999, 10,000 – 11,999, 12,000 – 15,999, 16,000 – 17,999, 18,000 – 19,999, 20,000 and more kg

(Nutzklassen; von ... bis ... kg):
nur für Bestand von Kfz-Anhängern und Ladekapazität des Bestandes
an Kfz-Anhängern
insgesamt
999, 1 000-1 499, 1 500-1 999, 2 000-2 999, 3 000-3 999, 4 000-4 999, 5 000-5 999, 6 000-6 999, 7 000-7 999, 8 000-8 999, 9 000-9 999, 10 000-11 999, 12 000-15 999, 16 000-17 999, 18 000-19 999, 20 000 und mehr kg

(Useful load classes; from ... up to ... kg): only for new vehicle registrations, transfers of property and cancellations re multi-axle normal-type trailers
in all
1,999, 2,000 – 2,999, 3,000 – 4,999, 5,000 – 7,999, 8,000 – 9,999, 10,000 – 11,999, 12,000 and more kg

(Nutzlastklassen; von ... bis ... kg):
nur für Neuzulassungen, Besitzumschreibungen und
Löschungen von mehrachsigen gewöhnlichen Anhängern
insgesamt
1 999, 2 000-2 999, 3 000-4 999, 5 000-7 999, 8 000-9 999, 10 000-11 999, 12 000 und mehr kg

(Useful load classes; from ... up to ... kg): only for new vehicle registrations, transfers of property and cancellations of articulated road trains
in all
9,999, 10,000 –11,999, 12,000 – 15,999, 16,000 and more kg

(Nutzlastklassen; von ... bis ... kg):
nur für Neuzulassungen, Besitzumschreibungen und
Löschungen von Sattelanhängern
insgesamt
9 999, 10 000-11 999, 12 000-15 999, 16 000 und mehr kg

Existing amount, new vehicle registrations, transfers of property, and cancellations of trucks, truck loading capacity, special-type motor vehicles and trailers according to superstructure and vehicle types, respectively as well as owner groups and purchaser groups, respectively

Existing amount:
New vehicle registrations:
Transfers of property:
Cancellations:
- *trucks*
- *truck loading capacity*
- *vehicle trailers*
- *special-type vehicles*
  - *(superstructure types and vehicle types, respectively):*
  - *altogether*
  - *for load transport*
    - *normal superstructure (not special-type vehicles and not new vehicle registrations, not transfers of property, cancellations of vehicle trailers)*
      - *altogether*
      - *dumping structure*
      - *platform type*
      - *open box type with/without canvas cover and bow upholstery provided for transport of furniture insulating structure*
      - *other closed surface mounting*
    - *special-type structures (not trucks and not truck loading capacity)*
      - *altogether*
      - *tank trucks respectively trailers for them*
        - *altogether*
        - *for combustible liquids*
        - *for milk*
        - *other purposes*
      - *silo vehicles*
      - *livestock transporting vehicles*
      - *deep-loading vehicles and cable transporting vehicles (until 1972)*
      - *vehicles for long material*
      - *concrete transport mixers*
      - *additional superposed trailing devices*
      - *transfer cars*
      - *others*
  - *for further use (not truck and truck loading capacity)*
    - *in all*
    - *ambulances*
    - *fire-brigade vehicles and trailers, respectively*
    - *street cleaners*
    - *vehicles for cleaning sewers and sludge suckers*
    - *refuse removing trucks*
    - *turntable ladders*
    - *salvage and crane trucks*
    - *stacker and fork lift trucks*
    - *excavators and chargers*
    - *working machines for soil cultivation, road construction and road maintenance*
    - *tool carriers for farming and forestry (until 1972)*
    - *test, measuring, recording, radio and telecommunication cars (until 1972)*
    - *tool and gear cars*
    - *sales and display cars*
    - *caravans*
    - *hearses*

Bestand, Neuzulassungen, Besitzumschreibungen und Löschungen von Lkw, Lkw-Ladekapazität, Sonderkraftfahrzeugen und Kfz-Anhängern nach Aufbauarten bzw. Fahrzeugarten und Haltergruppen bzw. Käufergruppen

Bestand:
Neuzulassungen:
Besitzumschreibungen:
Löschungen:
- Lkw
- Lkw-Ladekapazität
- Kfz-Anhänger
- Sonderkraftfahrzeuge
  - (Aufbauarten bzw. Fahrzeugarten):
  - insgesamt
  - zur Lastenbeförderung
    - Normalaufbau (nicht Sonderkraftfahrzeuge und Neuzulassungen, Besitzumschreibungen, Löschungen von Kfz-Anhängern)
      - insgesamt
      - Kippaufbau
      - Plattform
      - offener Kasten mit/ohne Plane und Spiegel
      - Polsterung für Möbeltransport
      - Isolieraufbau
      - sonstiger geschlossener Aufbau
    - Spezialaufbau (nicht Lkw und Lkw-Ladekapazität)
      - insgesamt
      - Tankkraftwagen bzw. -anhänger
        - insgesamt
        - für brennbare Flüssigkeiten
        - für Milch
        - andere
      - Silofahrzeuge
      - Viehtransportwagen
      - Tieflade- und Kabeltransportwagen (bis 1972)
      - Langmaterialfahrzeuge
      - Betontransportmischer
      - Nachläufer (nicht Sonderkraftfahrzeuge)
      - Kfz-Transportwagen
      - sonstige
  - zur sonstigen Verwendung (nicht Lkw und Lkw-Ladekapazität)
    - insgesamt
    - Krankenwagen
    - Feuerwehrfahrzeuge bzw. -anhänger
    - Straßenreinigungsmaschinen
    - Kanalreinigungs- und Schlammsaugwagen
    - Müllwagen
    - Drehleitern
    - Abschlepp- und Kranwagen
    - Hub- und Gabelstapler
    - Bagger und Lader
    - Arbeitsmaschinen zur Bodenbearbeitung, Straßenbau und -unterhaltung
    - Geräteträger für Land- und Forstwirtschaft (bis 1972)
    - Prüf-, Mess-, Registrier-, Funk- und Fernmeldewagen (bis 1972)
    - Werkstattwagen
    - Verkaufs- und Aufstellungswagen
    - Wohnwagen
    - Leichenwagen

others
owner groups re.pectively purchaser groups (see above)
(for vehicle trailers only existing amount according to owner groups)

übrige
Halter- bzw. Käufergruppen (siehe oben)
(für Kfz-Anhänger nur Bestand nach Haltergruppen)

Existing amount, new vehicle registrations, transfers of properties and cancellations of power-driven buses and trolley buses subdivided into owner groups and purchaser groups

Existing amount:
New vehicle registrations:
Transfers of property:
Cancellation:
power-driven and trolley buses
(seat classes; from ... up to ... seats):
16, 17 – 31, 32 – 40, 41 – 50. 51 and more seats
owner groups and purchaser groups, respectively (see above)

Bestand, Neuzulassungen, Besitzumschreibungen und Löschungen von Omnibussen und Obussen nach Sitzplatzklassen und Haltergruppen bzw. Käufergruppen

Bestand:
Neuzulassungen:
Besitzumschreibungen:
Löschungen:
Omnibusse und Obusse
(Sitzplatzklassen; von ... bis ... Sitzplätze):
16, 17-31, 32-40, 41-50, 51 u. mehr Sitzplätze
Haltergruppen bzw. Käufergruppen (siehe oben)

Existing amount of motor vehicles of varying type and of trailers

Motor vehicles
totalling
motor cycles
in all
light-type motor cycles
passenger cars
power-driven buses including trolley buses
trucks
towing machines
in all
towing machines in farming
articulated road trains
other motor vehicles
in all
working machines without car papers
motor vehicles trailers

Bestand an Kraftfahrzeugen unterschiedlicher Art und Anhängern

Kraftfahrzeuge
insgesamt
Krafträder
insgesamt
Leichtkrafträder
Personenkraftwagen
Kraftomnibusse (einschl. Obusse)
Lastkraftwagen
Zugmaschinen
insgesamt
Zugmaschinen in der Landwirtschaft
Sattelzugmaschinen
übrige Kraftfahrzeuge
insgesamt
Arbeitsmaschinen ohne Brief
Kraftfahrzeuganhänger

Existing amount of motor vehicles of varying type according to cubic capacity and useful load classes as well as according to the type of superstructures; existing amount of trailers

Motor vehicles
totalling
motor-cycles
in all
light motor-cycles
passenger cars
in all
with lifting motor, cubic capacity up to 999 ccm
with lifting motor, cubic capacity from 1 000 to 1 499 ccm
with lifting motor, cubic capacity from 1 500 to 1 999 ccm
with lifting motor, cubic capacity from 2 000 to more ccm
power-driven omnibuses including trolley buses

Bestand an Kraftfahrzeugen unterschiedlicher Art nach Hubraum- und Nutzlastgrößenklassen sowie Art der Aufbauten:
Bestand an Anhängern

Kraftfahrzeuge
insgesamt
Krafträder
insgesamt
Leichtkrafträder
Personenkraftwagen
insgesamt
mit Hubkolbenmotor, Hubraum bis 999 ccm
mit Hubkolbenmotor, Hubraum 1000 bis 1499 ccm
mit Hubkolbenmotor, Hubraum 1500 bis 1999 ccm
mit Hubkolbenmotor, Hubraum 2000 und mehr ccm
Kraftomnibusse einschl. Obusse

trucks
(useful load classes)
in all
in the useful load class up to 999 kg
in the useful load class from 1 000 to 1 499 kg
in the useful load class from 1 500 to 1 999 kg
in the useful load class from 2 000 to 3 999 kg
in the useful load class from 4 000 to 5 999 kg
in the useful load class from 6 000 to more kg
(type of superstructures):
trucks with special surface mounting
in all
tank trucks for combustible/inflammable liquids
cattle transport trucks
concrete transport and supply mixers
conveying vehicles for containers and interchangeable containers
towing machines
in all
towing machines in farming
articulated road trains
further motor vehicles
totalling
working machines without car papers
caravans
ambulances
fire-brigade vehicles
refuse collector trucks
road cleaners
salvage and crane trucks
motor vehicle trailers
in all
caravan trailers

Lastkraftwagen
(Nutzlastgrößenklassen):
insgesamt
in der Nutzlastklasse bis 999 kg
in der Nutzlastklasse 1000 bis 1499 kg
in der Nutzlastklasse 1500 bis 1999 kg
in der Nutzlastklasse 2000 bis 3999 kg
in der Nutzlastklasse 4000 bis 5999 kg
in der Nutzlastklasse 6000 und mehr kg
(Aufbauarten):
Lkw mit Spezialaufbau
insgesamt
Tankwagen für brenn-/entzündbare Flüssigkeiten
Viehtransportwagen
Betontransport- und Liefermischer
Transporter für Container und Wechselbehälter
Zugmaschinen
insgesamt
Zugmaschinen in der Landwirtschaft
Sattelzugmaschinen
übrige Kraftfahrzeuge
insgesamt
Arbeitsmaschinen ohne Brief
Wohnwagen
Krankenkraftwagen
Feuerwehrfahrzeuge
Müllwagen
Straßenreinigungsfahrzeuge
Abschlepp- und Kranwagen
Kraftfahrzeuganhänger
insgesamt
Wohnwagenanhänger

Road Traffic Accidents

Accidents listed according to kind of damage, type of roads involved and locality, killed and injured persons

Accidents
altogether
with bodily injury
with damage to property (1,000 DM and more) (until Dec. 31, 1982)
with damage to property (3,000 DM and more) (as from Jan. 31, 1983)
Accidents with bodily injury
altogether
on federal superhighways
on federal highways
on main roads
on local roads
on other roads
inside places
outside places
Killed persons
Injured persons

STRASSENVERKEHRSUNFÄLLE

Unfälle nach Schadensart, Straßenart und Ortslage, getötete und verletzte Personen

Unfälle
insgesamt
mit Personenschaden
mit Sachschaden (1 000 DM und mehr) (bis 31.12.82)
mit Sachschaden (3 000 DM und mehr) (ab 31. 1.83)

Unfälle mit Personenschaden
insgesamt
auf der Bundesautobahn
auf Bundesstraßen
auf Landstraßen
auf Kreisstraßen
auf anderen Straßen
innerhalb von Ortschaften
außerhalb von Ortschaften
Getötete Personen
Verletzte Personen

ROUGH BREAKDOWN

Characteristics

A Natural environment

AA Areas
AC Distances

B Population

BA Population level
BB Population trend
BC Population migrations

C Public health service

CA Illnesses and causes of death
CB Health service
CC Hospitals

D Teaching, education and culture

DA Schools providing general education and vocational schools
DB Higher education facilities
DH Sports

F Elections

FA Local government elections
FB Elections of the Federal State Government (Landtag)
FC Federal parliamentary elections
FD Elections of the county council
FE European elections

G Occupational activities

GA Economic and social structure of the population
GB Employment and unemployment
GC Shuttle migration
GD Compulsorily insured employees

I Agriculture and forestry

IB Enterprises
IC Labour
IE Land use and harvest
IF Cattle

J Enterprises and places of work

JB Places of work

GROBGLIEDERUNG

Merkmale

A Natürliche Umwelt

AA Flächenangaben
AC Entfernungsangaben

B Bevölkerung

BA Bevölkerungsstand
BB Bevölkerungsbewegung
BC Wanderungen

C Gesundheitswesen

CA Krankheiten und Todesursachen
CB Gesundheitsdienst
CC Krankenhäuser

D Unterricht, Bildung und Kultur

DA Allgemeinbildende und berufsbildende Schulen
DB Hochschulen
DH Sport

F Wahlen

FA Kommunalwahlen
FB Landtagswahlen
FC Bundestagswahlen
FD Kreistagswahlen
FE Europawahl

G Erwerbstätigkeit

GA Wirtschaftliche und soziale Gliederung der Bevölkerung
GB Beschäftigung und Arbeitslosigkeit
GC Pendelwanderung
GD Sozialversicherungspflichtig beschäftigte Arbeitnehmer

I Land- und Forstwirtschaft

IB Betriebe
IC Arbeitskräfte
IE Bodennutzung und Ernte
IF Vieh

J Unternehmen und Arbeitsstätten

JB Arbeitsstätten

K Industry and crafts

KA Industry or manufacturing trade
KB Crafts
KC In-coming orders, turnover, order situation indices

L Building industry, building activities, buildings and dwellings

LA Main building industry
LB Building aktivities
LC Buildings and dwellings

M Trade, catering trade and tourism

MA Trade
MB Catering trade
MC Tourism

O Traffic

OD Road traffic
OI Road traffic accidents

P Money and credits

PA Financial difficulties

R Social insurance benefits

RB National assistance
RD Public youth welfare

S Finances and Taxes

SA Financing of the local authorities and local authority associations
SE Personnel in the public administration
SI Income tax
SM Purchase tax

T Prices

TG Building and building land prices
TJ Wholesale, retail and consumer prices

U Wages and salaries

UA Actual wage-earnings

W National accounts

WA Gross domestic product

K Industrie und Handwerk

KA Industrie bzw. Verarbeitendes Gewerbe
KB Handwerk
KC Indices des Auftragseinganges, Umsatzes, Auftragsbestandes

L Bauwirtschaft, Bautätigkeit, Gebäude und Wohnungen

LA Bauhauptgewerbe
LB Bautätigkeit
LC Gebäude und Wohnungen

M Handel, Gastgewerbe und Fremdenverkehr

MA Handel
MB Gastgewerbe
MC Fremdenverkehr

O Verkehr

OD Straßenverkehr
OI Straßenverkehrsunfälle

P Geld und Kredit

PA Zahlungsschwierigkeiten

R Öffentliche Sozialleistungen

RB Sozialhilfe
RD Öffentliche Jugendhilfe

S Finanzen und Steuern

SA Finanzwirtschaft der Gemeinden und Gemeindeverbände
SE Personal der öffentlichen Verwaltung
SI Einkommensteuer
SM Umsatzsteuer

T Preise

TG Bau- und Baulandpreise
TJ Großhandels-, Einzelhandels- und Verbraucherpreise

U Löhne und Gehälter

UA Tatsächliche Arbeitsverdienste

W Volkswirtschaftliche Gesamtrechnung

WA Bruttoinlandsprodukt

X Protection of the environment

XA Public refuse removal
XB Refuse removal in the producing industries and hospitals
XC Public water supply
XD Public effluent disposal
XE Water supply and effluent disposal in the mining and manufacturing industries
XF Investments for environmental protection in the producing industries

X Umweltschutz

XA Öffentliche Abfallbeseitigung
XB Abfallbeseitigung im Produzierenden Gewerbe und bei Krankenhäusern
XC Öffentliche Wasserversorgung
XD Öffentliche Abwasserbeseitigung
XE Wasserversorgung und Abwasserbeseitigung im Bergbau und Verarbeitenden Gewerbe
XF Investitionen für Umweltschutz im Produzierenden Gewerbe

Supplement

CONVERTED DATA RELATING TO THE REGIONAL STATUS AS OF 1. 1. 1975

P Population

BA Population level
BB Population trend

D Teaching, education, culture

DA Schools providing general education and vocational schools

F Elections

FC Federal parliamentary elections

G Occupational activities

GA Economic and social structure of the population
GC Shuttle migration

I Agriculture and forestry

IB Enterprises
IC Labour
ID Machines
IE Land use and harvest
IF Cattle

J Enterprises and places of work

JB Places of work, employees split up into branches of economic activity

K Industry and crafts

KA Industry

Ergänzung

UMGERECHNETE DATEN ZUM GEBIETSSTAND 1. 1. 1975

B Bevölkerung

BA Bevölkerungsstand
BB Bevölkerungsbewegung

D Unterricht, Bildung, Kultur

DA Allgemeinbildende und berufsbildende Schulen

F Wahlen

FC Bundestagswahlen

G Erwerbstätigkeit

GA Wirtschaftliche und soziale Gliederung der Bevölkerung
GC Pendelwanderung

I Land- und Forstwirtschaft

IB Betriebe
IC Arbeitskräfte
ID Maschinen
IE Bodennutzung und Ernte
IF Vieh

J Unternehmen und Arbeitsstätten

JB Arbeitsstätten, Beschäftigte nach Wirtschaftsabteilungen

K Industrie und Handwerk

KA Industrie

L Building industry, building activities, buildings and dwellings

LC Buildings and dwellings

M Trade, catering trade and tourism

MA Trade
MB Catering trade

S Finances and taxes

SI Income tax

REGIONAL CLASSIFICATION

ZZZ Regional classifications

L Bauwirtschaft, Bautätigkeit, Gebäude und Wohnungen

LC Gebäude und Wohnungen

M Handel, Gastgewerbe und Fremdenverkehr

MA Handel
MB Gastgewerbe

S Finanzen und Steuern

SI Einkommensteuer

REGIONALE ZUORDNUNG

ZZZ Regionale Zuordnungen

III. DATA SELECT SERVICE (DSS LDS)

1. Brief description

The data delivered directly from the special sectors or via the Regional Data Bank are processed in accordance with standardized criteria and combinations of criteria and thus cover the main part of the information demand. However, it always occurs again and again that the data have to be interrelated differently in order to meet the requirements of special planning and research projects. It is not possible to do this manually with about 300,000 individual data types per set of statistics.

It is difficult to create a data processing programme which can be brought into line with the special formulation of a question that might relate to several environmental statistics. These problems arise from the fact that, in general, such a programme can be used only once. Furthermore, in contrast to other statistics, the environmental statistics contain besides the quantitative criteria many logical criteria which require a complex classification of the quantitative criteria depending on the formulation of a question.

This special requirement is met by the

DATA SELECT SERVICE

developed in the Regional Office for Data Processing and Statistics (LDS). This system creates an extraction data file from the data files of the environmental statistics. The extracted data file contains exactly those criteria from the various environmental statistics which correspond to the special logical requirements of a specific investigation. This extracted data file can – practically as a temporary data bank – serve other evaluation programmes as an input.

The following scheme gives an idea of the working method of the DATA SELECT SERVICE:

III. DATA SELECT SERVICE (DSS LDS)

1. Kurzbeschreibung

Die vom Fachbereich direkt oder über die Landesdatenbank gelieferten Daten sind nach standardisierten Merkmalen und Merkmalskombinationen aufbereitet und decken damit den Großteil des Informationsbedarfs ab. Es kommt jedoch immer wieder vor, daß für spezielle Planungs- und Forschungsvorhaben die Daten anders verknüpft werden müssen. Manuell ist das bei ca. 300 000 Individualdaten pro Statistik nicht möglich.

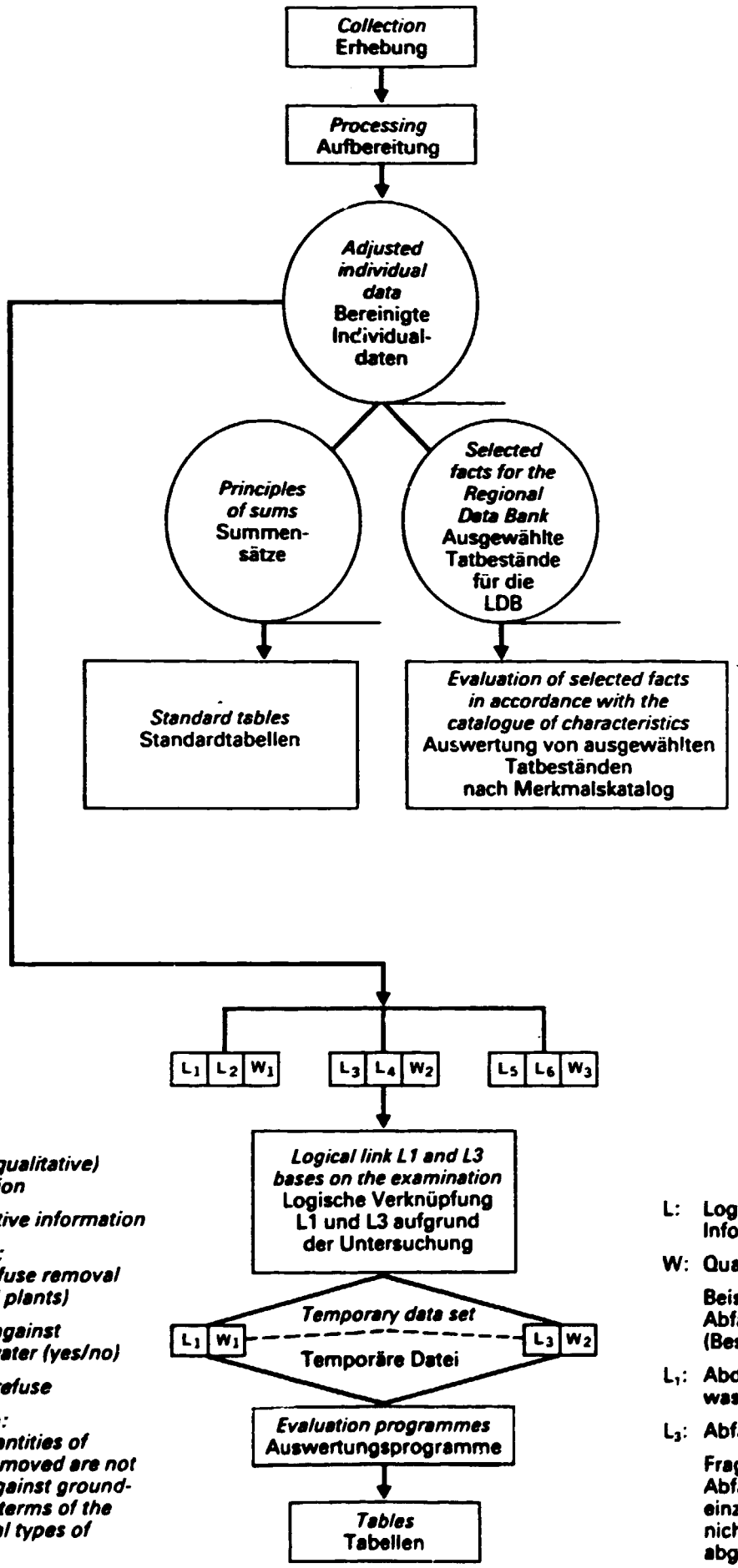
Die Erstellung eines EDV-Programms, das einer speziellen Fragestellung, die sich möglicherweise auf mehrere Umweltstatistiken erstreckt, angepaßt ist, bereitet Schwierigkeiten, die sich daraus ergeben, daß ein solches Programm im allgemeinen nur einmal verwendet werden kann. Hinzu kommt, daß die Umweltstatistiken im Gegensatz zu anderen Statistiken neben den quantitativen viele logische Merkmale enthalten, die je nach Fragestellung eine komplexe Klassifizierung der quantitativen Merkmale erfordert.

Diese spezielle Anforderung erfüllt der im LDS entwickelte

DATA SELECT SERVICE

Dieses System erstellt aus den Dateien der Umweltstatistiken eine Extraktionsdatei, die genau jene Merkmalswerte aus den verschiedenen Umweltstatistiken enthält, die den speziellen logischen Erfordernissen einer gezielten Untersuchung entsprechen. Diese extrahierte Datei kann gewissermaßen wie eine temporäre Datenbank anderen Auswertungsprogrammen als Eingabe dienen.

Das folgende Schema verdeutlicht die Arbeitsweise des DATA SELECT SERVICE:



L: Logical (qualitative) information

W: Quantitative information

Example:
Puplic refuse removal (removal plants)

L_1: Sealing against groundwater (yes/no)

L_3: Type of refuse

Question:
What quantities of refuse removed are not sealed against groundwater in terms of the individual types of refuse?

L: Logische (qualitative) Information

W: Quantitative Information

Beispiel: Öffentliche Abfallbeseitigung (Beseitigungsanlagen)

L_1: Abdichtung gegen Grundwasser (ja/nein)

L_3: Abfallart

Frage: Welche beseitigten Abfallmengen sind bei den einzelnen Abfallarten nicht gegen Grundwasser abgedichtet?

IV. Exchange of information from external data banks

The data exchange service from external (national and international) data banks is part of the UMWIS data offer for the Federal State of North Rhine-Westphalia, described in the first three chapters.

1. Tasks/problems

Every year, approximately 4 million special publications are issued, i. e. about 20,000 publications per working day. This deluge causes information to become desinformation because the classical material from the library and archive is no longer adequate and makes it impossible to collect specific information from the experience and knowledge stored on billions of pages.

The certainly best-known example originates from the field of chemistry. In 1960, 70,000 publications were registered by the Chemical-Abstract-Service (literature service). At present, the data bank of „Chemical-Abstracts" registers approximately 500,000 evaluated publications annually. The „Registry-File" of Chemical-Abstracts contains (among others) structural formulas and chemical terms of more than 7 million chemical compounds.

People say that during the „Sputnik-shock" American scientists were in a position to tap the radio communication of Sputnik but they could not decipher it. A million-dollar programme helped to solve this problem, but a little bit later one found the painstakingly deciphered code in a Califonian archive. It was an American development which had been available for a long time.

Today, for the industries (as well as trade and commerce) to be well-informed about the world-wide new developments and trends has become almost a matter of survival.

However, one cannot ignore the fact that totally new discoveries, inventions and fundamental further developments can be searched for only at a very late stage (if at all) in the special articles of the literature on the subject or as patent applications, due to secrecy classification. Nevertheless, insiders can obtain the necessary information from trade fairs, congresses and searches in data banks by „keeping their ears to the ground".

The utilization of patent data banks can help to save costs for developments. If this potential was used systematically – which was recently worked out by the „VDI" (Association of German Graduated Engeneers) – the German industry alone could save approximately 1 billion DM of development costs annually. The basis of the VDI-calculation is that every year the German Patent Office furnishes proof of the fact that the developments of about 20,000 patent applications are not really new. Taking estimated development costs of approximately 50,000 DM for each project as a basis, the VDI reaches the corresponding 7-digit sum of bad investments.

IV. Informationsvermittlung aus externen Datenbanken

Zum in den ersten drei Teilen beschriebenen Datenangebot von UMWIS für das Land Nordrhein-Westfalen gehört der Informationsvermittlungsdienst aus externen (nationalen und internationalen) Datenbanken.

1. Aufgaben-/Problemstellung

Pro Jahr erscheinen ca. 4 Mill. Fachveröffentlichungen. Das sind rd. 20 000 Publikationen pro Arbeitstag. Diese Flut macht Informationen zur Desinformation, denn die klassischen Mittel der Bibliothek und des Archivs reichen längst nicht mehr aus, um gezielt auf das auf Milliarden Seiten Papier gespeicherte Wissen zuzugreifen.

Das wohl bekannteste Beispiel kommt aus dem Gebiet der Chemie. 1960 wurden vom in Schriftform herausgegebenen Chemical-Abstract-Service (Referatdienst) 70 000 Veröffentlichungen erfaßt. Die Datenbank von „Chemical-Abstracts" nimmt z. Z. jährlich etwa 500 000 ausgewertete Publikationen auf. Dazu gehört das „Registry-File" von Chemical-Abstracts, in dem (u. a.) Strukturformeln und chemische Bezeichnungen von über 7 Mill. Verbindungen gespeichert sind.

Man erzählt sich, daß US-Wissenschaftler während des Sputnik-Schocks zwar in der Lage waren, den Funkverkehr des Sputniks abzuhören, daß sie ihn aber nicht entschlüsselen konnten. Ein Millionen-Dollar-Programm schaffte Abhilfe – aber wenig später fand man den mühsam geknackten Code in einem kalifornischen Archiv: Es handelte sich um eine schon lange vorliegende US-Entwicklung.

Für die Industrie (auch Handel und Gewerbe) ist es heute eine Frage des Überlebens geworden, darüber gut informiert zu sein, was weltweit entwickelt wird, sprich: – sich so tut –.

Dabei darf nicht übersehen werden, daß wegen des Geheimschutzes ganz neue Entdeckungen/Erfindungen/grundlegende Weiterentwicklungen, wenn überhaupt, erst sehr spät in den Fachbeiträgen der einschlägigen Literatur oder als Patentanmeldungen recherchierbar (suchbar) werden. Dennoch können Insider durch die Kombination Messen, Kongresse und Recherchen in Datenbanken „ihre Ohren ans Gras legen".

Die Nutzung der Patent-Datenbanken kann Entwicklungskosten einsparen. Würde dieses Potential systematisch genutzt, so rechnete jüngst der Verein Deutscher Ingenieure (VDI) vor, könnte allein die bundesdeutsche Industrie Jahr für Jahr rd. 1 Mrd. Entwicklungskosten vermeiden. Die Basis der VDI-Rechnung: Allein das Deutsche Patentamt weise jedes Jahr für etwa 20 000 Patentanmeldungen nach, daß die Entwicklungen in Wirklichkeit gar nicht neu sind. Bei Entwicklungskosten von geschätzten 50 000 DM pro Projekt kommt der VDI auf die entsprechende 7-stellige Summe von Fehlinvestitionen.

One is not always dependent on information about the latest developments. It is often much more interesting to make available knowledge really available within a short time. It makes a difference whether in case of important questions one has to rely on the available knowledge and memory of the staff or whether the published knowledge can be indicated on line/in interactive mode on a screen.

Nicht immer ist man auf die Informationen über die allerneuesten Entwicklungen angewiesen. Es interessiert oftmals vielmehr, innerhalb kurzer Zeit verfügbares Wissen tatsächlich verfügbar zu haben. Es ist schon ein Unterschied, ob man sich bei wichtigen Fragestellungen auf das vorhandene Wissen und Erinnerungsvermögen einer Mitarbeiterschaft verlassen muß oder sich das veröffentlichte Wissen on line/im Dialog auf dem Bildschirm anzeigen lassen kann.

Many legal problems would become more transparent, sometimes legal proceedings would not be instituted or cases would not be lost if, for example, searches were made via the JURIS data bank in time.

So manches Rechtsproblem wird durchsichtiger, gar ein Prozeß nicht geführt oder verloren, würde z. B. rechtzeitig in der Datenbank von JURIS recherchiert.

The exchange of information from data banks is particularly necessary for those who have no comprehensive library of their own. But who can call a library his own? And even if so, it is always very time-consuming to select the particular information from the offered knowledge and to work through it until one really knows what one wanted or had to know even if well-informed librarians give their support.

Die Informationsvermittlung aus Datenbanken ist gerade für die nötig, die im eigenen Haus keine umfassende Bibliothek haben. Wer hat die schon? Und wenn doch, so ist es allemale zeitaufwendig, aus dem vorhandenen Wissensangebot genau das herauszusuchen und dann durchzuarbeiten, bis man das weiß, was man wissen will oder gar muß. Selbst wenn einen dabei fachkundige Bibliothekare unterstützen.

On the other hand, it is no longer a utopian idea that such a video terminal – wherever installed – in connection with a normal telephone constitutes an almost impossibly comprehensive library. In addition, the person who is searching for knowledge and information does not have to work through a book, a journal or an article. Mostly, already the abstract/abridged version gives an information about the essential parts of the contents. Very often, this information is already sufficient and the procuring of the original literature or the respective copy is no longer necessary.

Andererseits ist es wirklich keine utopische Vorstellung mehr, daß so ein Bildschirmgerät/Terminal – wo auch immer aufgestellt – in Verbindung mit einem ganz normalen Telefon, eine schier unvorstellbar große Bibliothek ist. Mehr noch: Der Wissens-/ Informationssuchende braucht noch nicht einmal ein Buch, eine Zeitschrift, einen Artikel durchzuarbeiten. Meistens informiert ihn die Kurzfassung/Abstract über das Wesentliche des Inhalts. Häufig weiß man dann schon Bescheid, d. h. die Anforderung der Originalliteratur oder einer entsprechenden Kopie erübrigt sich.

2. Costs/acceptance

The Federal Republic of Germany has already invested several billions of DM in the establishment of data banks. As a result, many millions of special items of information, patent specifications, company- and product-related information as well as statistics are available and retrievable. However, instead of letting the users think for themselves and utilize the information available, information was collected by a higher authority and edited in a manner that was at times bad or even in conflict with the user's interest.

2. Kosten/Akzeptanz

Die Bundesrepublik hat bereits mehrere Milliarden DM in den Aufbau von Datenbanken gesteckt. Als Ergebnis liegen heute viele Millionen Fachinformationen, Patentschriften, Firmen- und Produktinformationen sowie Statistiken abrufbereit vor. Es ist wohl versäumt worden, die Nutzer selbst mundig zu machen und als Informationsbenutzer aufzubauen. Statt dessen wurden von oben her Informationen gesammelt und z. T. nicht nur schlecht, sondern sogar nutzerfeindlich aufbereitet.

Those who are not convinced that the information will help them will not aks for information that is outside their present information procurement range.

Wer nicht überzeugt ist, daß ihm die Informationen nutzen, wird auch nicht nach Informationen fragen, die außerhalb seines jetzigen Informationsbeschaffungsbereiches liegen.

The target cannot be to inundate someone with a volume of knowledge, the evaluation of which will take days. Time is always lacking when solving problems.

Es kann nicht das Ziel sein, einen Informationssuchenden mit Wissen zu überschütten, dessen Aufarbeitung Tage kostet. Zeit –, sie fehlt fast immer bei der Lösung von Problemen.

The medium-sized industry will only pay for edited information. Big industry can definitely cope with the informational raw material.

Der Mittelstand wird nur für „aufbereitete Informationen" etwas zahlen. In der Großindustrie kann man durchaus mit dem Informationsrohstoff fertig werden.

But we have to get away from our „library-mentality" which is used to getting information free of charge.

Aber wir müssen weg von jener weitverbreiteten Bibliotheks-Mentalität, die sich an den Nulltarif für Informationen gewöhnt hat.

In addition, there is the problem of lack of knowledge and skill with regard to the utilization of the equipment and the correct inquiring procedures as well as to the acquaintance with the different searching strategies. Only very seldom will a data bank system be in a position to deliver (after input of a keyword) exactly such information as the user is searching for. As a rule, the so-called „information-brokers" have the special knowledge of how and where they can find the exact information. During the coming years, their share of the market will increase.

Hinzu kommt natürlich das Hemmnis, daß es vielerorts an der Sachkunde mangelt, die sich nicht nur auf den Umgang mit dem Gerät und die Abfrageprozeduren erstreckt, sondern auch auf die Vertrautheit mit verschiedenen Suchstrategien. Nur in seltenen Fällen ist ein Datenbanksystem in der Lage, dem Nutzer auf bloße Eingabe eines Stichwortes hin genau an die Informationen zu führen, die er sucht. Über das „gewußt-wo" und das „gewußt-wie" verfügen in der Regel Informationsvermittler – in den USA Information-Broker genannt –, für die sich in den kommenden Jahren ein wachsender Markt auftun wird.

For years already, North Rhine-Westphalia has been disposing of an excellently developed scheme of information and infrastructure worth of being utilized still more intensely and to be further improved by way of cooperation.

Nordrhein-Westfalen verfügt seit Jahren über eine hervorragend ausgebaute Informations-Infrastruktur, die es noch viel intensiver zu nutzen und durch Kooperation weiter zu verbessern gilt.

An existing cooperation between leading Data Bank Systems in North Rhine-Westphalia will be introduced to the public on the occasion of the ENVITEC '89 under the common title of „Data Bank Network NRW".

Es besteht eine Zusammenarbeit führender Datenbanksysteme in Nordrhein-Westfalen, die sich gesondert auf der ENVITEC 1989 mit dem gemeinsamen „Datenbank Netzwerk NRW" der Öffentlichkeit vorstellen.

Participating are the following organizations:
- *the Gesellschaft für Wirtschaftsförderung*
- *the Technologie-Beratungsstelle Ruhr (tbr)*
- *the Federation of the Chamber of Industry and Commerce of NRW*
- *the Zentrum in NRW für Innovation und Technik (ZENIT)*
- *GENIOS Wirtschaftsdatenbanken*
- *the Bertelsmann Information Service*
- *the Landesamt für Datenverarbeitung und Statistik NRW*
- *the Investitionsbank NRW.*

Beteiligt sind:
- die Gesellschaft für Wirtschaftsförderung
- die Technologie-Beratungsstelle Ruhr (tbr)
- die Vereinigung der Industrie- und Handelskammer NRW
- das Zentrum in NRW für Innovation und Technik (ZENIT)
- GENIOS Wirtschaftsdatenbanken
- der Bertelsmann Informationsservice
- das Landesamt für Datenverarbeitung und Statistik NRW
- die Investitionsbank NRW

The main target is to cater for more transparency on the market of information and to, thus, assure more acceptance through interlinkage of data-bank offering institutions and information brokers. An integrated system has been created whereby access to the various eletronic storage devices will be considerably facilitated for interested parties.

Ziel ist es, für mehr Transparenz auf dem Informationsmarkt und somit für mehr Akzeptanz durch eine Vernetzung von Datenbankanbietern und Informationsbrokern zu sorgen. Es ist ein Verbundsystem geschaffen worden, das Interessierten den Zugang zu den einzelnen elektronischen Informationsspeichern wesentlich erleichtert.

The German Federal Post Office has spent several million DM on a data exchange network (Datex-network) via which one can correspond world-wide with data banks at ridiculously low prices. A 15-minute search in American data banks costs no more than DM 9.--, in Germany only DM 3.--. The access to this network at any time is charged at DM 180.-- per month.

Die Bundespost hat mit einem Aufwand von vielen Millionen DM ein Datenübertragungs-Netz (Datex-Netz) geschaffen, über das man weltweit zu Spott-Preisen mit Datenbanken korrespondieren kann. Für ca. 9 DM Leitungskosten kann man eine Viertelstunde in amerikanischen Datenbanken recherchieren, in Deutschland kostet das nur etwa 3 DM. Für den jederzeitigen Zugang zu diesem Netz zahlt man 180 DM pro Monat.

The net search expenses in the data banks, however, are considerably higher. On an average, the connected hours cost between 100.-- and 300.-- DM. However, in general, well-trained information-brokers need a few minutes only. Their main work is the preparation of the search and the optimum editing of the results taken down.

Die reinen Recherchekosten in den Datenbanken sind da schon wesentlich teurer. Im Durchschnitt kosten die Anschaltstunden 100 DM bis 300 DM. Trainierte Informationsvermittler benötigen jedoch meistens nur Minuten. Für sie liegt die Hauptarbeit in der Vorbereitung der Recherche und in der optimalen Aufbereitung des mitprotokollierten Ergebnisses.

And exactly the last two sentences represent the costintensive problem. For less than 10 searches per month (as a rule of thumb) neither the purchase of the necessary hardware and software nor a full-time working-place is worthwhile. Then it will be safer and more effective to give the order to an information-broker – a scout in the data jungle.

Und genau in den letzten zwei Sätzen steckt die kostenträchtige Problematik. Bei weniger als 10 Recherchen im Monat (Festregel) lohnt sich weder die Anschaffung der notwendigen Hard- und Software, noch ein Full-Time-Arbeitsplatz. Dann ist es sicherer und effektiver, einen Informtionsvermittler – einen Pfadfinder im Datendschungel – mit der Durchführung zu beauftragen.

But it is certainly also a problem to admit that one is not a „know-all".

Nur –, sicher ist es auch ein Problem, jemandem zu offenbaren, daß man nicht der Alleswisser ist.

It goes without saying that for reasons of mutual confidence the information-broker has to maintain strict silence.

Aus Gründen des gegenseitigen Vertrauens ist es selbstverständlich, daß der Informationsvermittler/ Broker Stillschweigen darüber bewahrt,

– A kind of pledge of secrecy about
who
wanted to know
what
why
and when.

– eine Art Schweigepflicht –
was
wer
wann
warum
wissen sollte.

3. Search examples

Within the wide range of topics re environmental compatibility of the motor vehicle, a number of researches were, partly and for demonstrating purposes, carried out in the most varied data banks. As was to be quite expected, many hints came forth, mainly of bibliographical nature. On the last pages, you will find a selection there from accompanied by the indication of the relevant search keys and of the respective data bank.

General sequence of on-line searches:

– Selection of the host (the computer of the respective data bank)
For the computers connected to the data exchange system of North Rhine-Westphalia (DVS) an extra computer as the centre to external data banks has been installed. This automated centre selects the host via the DATEX-P-network of the Federal German Post Office.
Besides, the following solutions are possible, e. g.
personal computer at DATEX-P
personal computer with acoustic coupler in connection with a telephone
and „BTX" (interactive videotex).

– Selection of the data bank/input of the keywords
After input of the user authorization criteria into the host (USER-ID, password) the searcher is requested to select the data bank from the data bank offer.
The data bank then calls for the keywords and reports the respective number or documents concerned (hit number) to be keyed in. In accordance with the Boolean algebra keywords can be linked.

3. Musterrecherchen

Zum Themenkreis/Umweltverträglichkeit des Autos wurden testweise und zur Demonstration eine Reihe von Recherchen in den verschiedensten Datenbanken durchgeführt. Wie nicht anders zu erwarten, erschienen dabei sehr viele vorwiegend bibliographische Hinweise. Eine Auswahl daraus mit der Angabe der Suchbegriffe und der jeweiligen Datenbank finden Sie auf den letzten Seiten.

Prinzipieller Ablauf von On-line-Recherchen:

– Anwahl der HOST (Heimatrechner der jeweiligen Datenbank)
Für die am Datenvermittlungssystem Nordrhein-Westfalen (DVS) angeschlossenen Rechner ist dafür eigens ein Rechner als Kopfstelle zu externen Datenbanken installiert. Automatisiert übernimmt diese Kopfstelle die Anwahl des HOST über das DATEX-P-Netz der Deutschen Bundespost.
Daneben können auch z. B. Lösungen
Personalcomputer am DATEX-P
Personalcomputer mit Akustikkoppler in Verbindung mit einem Telefon
und BTX (Bildschirmtext)
in Frage kommen.

– Auswahl der Datenbank/Eingabe der Suchworte
Nach den Eingaben zur Benutzungsberechtigung beim HOST (USER-ID, Passwort) wird der Rechercheur zur Auswahl der Datenbank aus dem Datenbankangebot aufgefordert.
Die Datenbank fordert dann zur Eingabe der Suchworte auf und meldet dazu die jeweilige Anzahl der in Frage kommenden Dokumente (Trefferzahl). Nach den Regeln der Booleschen Algebra können Suchbegriffe miteinander verknüpft werden.

– *Selection of the documents*
It is mostly advisable to have a look at the less costly partial information (e.g. title, descriptors) at first. Those documents which seem to be interesting can then be completely retrieved.

– *Changing the data bank*
If one intends to change to another data bank in a host, it is advisable to store the previous search process. In the next data bank the previous search can then run automatically without a repeated time-consuming and cost-intensive input of search words.

– *Reprocessing*
Data bank searches are usually also recorded in order to re-run the search process later on. Mistakes can be recognized, unexpected results can be analyzed and texts which were read only briefly or cursorily on the screen can be worked through off-line or can be printed out locally. If the searcher is also the person who is searching the information, a reprocessing will not be necessary in many cases. If the result of a search has to be passed on, reprocessing is urgently recommended. The outward appearance may be very different. It often depends on the customer's desire.
When reprocessing the results of a search it is advisable to erase all characters and lines which are of no significance for the person searching information because depending on his knowledge of the output forms of data bank documents they might lead in many cases to unnecessary queries.

– Auswahl der Dokumente
Meistens ist es ratsam, sich zunächst die kostengünstigeren Teilinformationen (z. B. Titel, Deskriptoren) anzusehen. Die interessant erscheinenden Dokumente können dann vollständig abgerufen werden.

– Wechsel der Datenbank
Soll zu einer weiteren Datenbank innerhalb eines HOST gewechselt werden, sollte man den bisherigen Suchvorgang vorher speichern. In der nächsten Datenbank kann dann die bisherige Suche automatisiert ablaufen, ohne die zeit-/kostenträchtige Suchwörtereingabe erneut tätigen zu müssen.

– Nachbereitung
Datenbank-Recherchen werden üblicherweise mitgeschnitten, um jederzeit später nachvollziehen zu können, wie die Recherche verlaufen ist. Fehler können erkannt werden, unerwartete Ereignisse sind analysierbar und auf dem Bildschirm nur kurz/flüchtig gelesene Texte können off line durchgearbeitet bzw. lokal ausgedruckt werden.
Ist der Rechercheur auch gleichzeitig der Informationssuchende, wird sich in vielen Fällen eine Nachbereitung erübrigen. Soll ein Recherche-Ergebnis weitergegeben werden, ist eine Nachbereitung dringend angeraten. Dabei kann die äußere Form sehr unterschiedlich sein. Sie richtet sich oftmals nach den Wünschen des Kunden.
Bei der Nachbereitung ist, je nach Wissensstand des Informationssuchenden über die Ausgabeform von Datenbankdokumenten, der Grundsatz beachtenswert, möglichst alle Zeichen/Zeilen zu löschen/zu entfernen, die keine Information für den Informationssuchenden beinhaltet. Sie führen in vielen Fällen zu unnötigen Rückfragen.

4. Selected national and international data banks

There are approximately 3.500 data banks world-wide for almost all fields of knowledge.

The following data banks were interrogated for the search examples shown:

VDIN

VDI news

Technology, Economy, Science

Data stock

Period from edition 17/83 until today
Total stock
18,000 documents
Actualization: every week
Yearly increment: 5,000 documents

4. Ausgewählte nationale und internationale Datenbanken

Weltweit gibt es ca. 3 500 Datenbanken für fast alle Wissensgebiete.

Für die hier vorgeführten Musterrecherchen wurden die nachfolgenden Datenbanken abgefragt:

VDIN

VDI-Nachrichten

Technik, Wirtschaft, Wissenschaft

Datenbestand

Zeitraum: ab Ausgabe 17/83 bis heute
Gesamtbestand: 18 000 Dokumente
Aktualisierung: wöchentlich
jährlicher Zuwachs: 5 000 Dokumente

Implementor

VDI-Verlag GmbH

Contents

First German full-text newspaper data bank. It is the Online version of the VDI News, the most important weekly newspaper in German for technology and science, for economy and society. Publisher is the Verein Deutscher Ingenieure (VDI). The data bank contains all editorial contributions. Not contained are illustrations, tables, and advertisements.

Subject matters

- *Production technology, engineering, precision mechanics*
- *Materials processing, plastics technology, textile technology*
- *Structural engineering, building machines, equipment for buildings*
- *Vehicle technology, materials-handling technology*
- *Construction, material technology*
- *Drive technology, technology of automation*
- *Electrical engineering, electronics, data processing, measurement and control engineering*
- *Power enineering, nuclear engineering, evironmental technology*
- *Vocational experience, office and industrial organization*
- *Association matters*
- *Economics and science*
- *Research and research politics*

Hersteller

VDI-Verlag GmbH

Inhalt

Erste deutsche Volltext-Zeitungs-Datenbank. Sie ist die On-line-Version der VDI-Nachrichten, der größten deutschsprachigen Wochenzeitung für Technik und Wissenschaft, Wirtschaft und Gesellschaft. Herausgeber ist der Verein Deutscher Ingenieure (VDI). Die Datenbank enthält alle redaktionellen Beiträge. Nicht enthalten sind Abbildungen, Tabellen und Anzeigen.

Sachgebiete

- Produktionstechnik, Maschinenbau, Feinwerktechnik
- Verfahrenstechnik, Kunststofftechnik, Textiltechnik
- Bautechnik, Baumaschinen, Gebäudeausrüstung
- Fahrzeugtechnik, Fördertechnik
- Konstruktion, Werkstofftechnik
- Antriebstechnik, Automatisierungstechnik
- Elektrotechnik, Elektronik, Datenverarbeitung, Meß- und Regelungstechnik
- Energietechnik, Kerntechnik, Umwelttechnik
- Berufspraxis, Büro- und Betriebsorganisation
- Verbandswesen
- Wirtschaft und Wissenschaft
- Forschung und Forschungspolitik

ULIDAT

ULIDAT, the data bank for environmental literature, is a bibliographical one informing about the literature available in the field of environmental research done in German-speaking countries.

Subject matters

Evironmental research, especially as to
- *water*
- *air*
- *environmental pollution through chemicals*
- *noise*

and with regard to the adjoining-topics:
- *Nature and landscape/Geometric development*
- *Ecology*
- *Environmental economy*
- *Environmental education*
- *General and overlapping environmental issues*

ULIDAT

ULIDAT, die Umweltliteraturdatenbank, ist eine bibliographische Datenbank, die über Literatur auf dem Gebiet Umweltforschung deutschsprachiger Länder informiert.

Sachgebiete

Umweltforschung speziell zu
- Wasser
- Luft
- Umweltverschmutzung durch Chemikalien
- Lärm

und zu den angrenzenden Gebieten:
- Natur und Landschaft/Räumliche Entwicklung
- Ökologie
- Umweltökonomie
- Umwelterziehung
- Allgemeine und übergreifende Umweltfragen

Sources

- *Reviews*
- *Reports*
- *Books*
- *Grey literature*

Data stock

- *1976 – March 1988: 80,000 citations*
- *monthly updating: 1,000 citations*

Implementor/Offerer

- *Umweltbundesamt, Berlin*
- *Fachinformationszentrum, Karlsruhe*

Quellen

- Zeitschriften
- Berichte
- Bücher
- Graue Literatur

Datenbestand

- 1976 bis März 1988: 80 000 Zitate
- monatliche Fortschreibung: 1 000 Zitate

Hersteller/Anbieter

- Umweltbundesamt, Berlin
- Fachinformationszentrum Karlsruhe

UFORDAT

UFORDAT, the data bank for environmental research, informs of current and completed research and development projects of the Federal Republic of Germany, of Austria and of Switzerland in the field of environmental research. The data bank corresponds to the printed Environmental Research Catalogue (UFORDAT) of the Umweltbundesamt (National Bureau of Environmental Research) edited in German language.

Subject matters

Environmental issues, especially as to
- *water*
- *air*
- *environmental pollution through chemicals*
- *noise*

and with regard to the adjoining topics:
- *Soil*
- *Nature and landscape/Geometric development*
- *Ecology*
- *Environmental economy*
- *Environmental aspects of agriculture and forestry/ Food supplies*
- *Environmental aspects of energy and raw materials*
- *General and overlapping environmental issues*

Sources

- *The data concerning research and development projects are covered and recorded partly by means of questionnaires at the executing institutions and partly put at disposal by internal data banks of authorities promoting or financing environmentally relevant F+E projects. Systematic updating of the data bank through investigation by way of questionnaires is being done every two years. Data interchange with the promoting or financing authorities is a continuous one.*

UFORDAT

UFORDAT, die Umweltforschungsdatenbank, informiert über laufende und abgeschlossene Forschungs- und Entwicklungsprojekte der Bunderepublik Deutschland, Österreich und der Schweiz auf dem Gebiet der Umweltforschung. Die Datenbank entspricht dem gedruckten Umweltforschungskatalog (UFORDAT) des Umweltbundesamtes. Die Datenbank ist in deutscher Sprache.

Sachgebiete

Umweltfragen speziell betreffend
- Wasser
- Luft
- Umweltverschmutzung durch Chemikalien
- Lärm

und zu den angrenzenden Gebieten:
- Boden
- Natur und Landschaft/Räumliche Entwicklung
- Ökologie
- Umweltökonomie
- Umweltaspekte der Land- und Forstwirtschaft/Nahrungsmittel
- Umweltaspekte von Energie und Rohstoffen
- Allgemeine und übergreifende Umweltfragen

Quellen

- Die Daten der Forschungs- und Entwicklungsprojekte werden teils mit Hilfe von Fragebogen bei den durchführenden Institutionen erfaßt und teils aus internen Datenbanken der Stellen bereitgestellt, die umweltrelevante F+E-Projekte fördern oder finanzieren. Die systematische Fortschreibung der Datenbank durch Fragebogenerhebung wird alle zwei Jahre durchgeführt. Der Datenaustausch mit den fördernden oder finanzierenden Stellen erfolgt kontinuierlich.

Data stock

- *1974 – March 1988: 21,000 citations*
- *Updating twice or four times per year: 2,600 citations per year*

Implementor/Offerer

- *Umweltbundesamt, Berlin*
- *Fachinformationszentrum, Karlsruhe*

RSWB

The RSWB (geodisposition, town planning, housing, construction engineering) is a bibliographical data bank offering literature in the fields of geodisposition, town planning, housing and construction engineering – with publication in German-speaking and many other European countries, in the United States or in Canada. Most of the citations contain abstracts. Grey literature is particularly appreciated. All citations are in German. Titles in foreign language are indicated in their original text accompanied by the translation in German.

Subject matters

- *Construction industry and building operation*
- *Technical interior works and supply*
- *Foundation engineering, water engineering, and road construction*
- *Building laws*
- *Architecture and building planning*
- *Preservation of ancient monuments*
- *Building material and building physics*
- *Civil engineering superstructures*
- *Town planning and town renovation*
- *Geodisposition and traffic*
- *Politics and economics*
- *Environmental protection and landscape maintenance*
- *CAD*

Sources

- *Reviews and series*
- *Books*
- *Conference reports/essays*
- *Reports*
- *Other grey literature*

Data stock

- *1976 – March 1988: 300,000 citations*
- *12 updatings per year; 26,000 citations in a year.*

Implementor/Offerer

- *Informationszentrum RAUM und BAU (RB) of the Fraunhofer-Gesellschaft, Stuttgart*

Datenbestand

- 1974 bis März 1988: 21 000 Zitate
- Fortschreibung zwei bis vier Mal pro Jahr: 2 600 Zitate pro Jahr

Hersteller/Anbieter

- Umweltbundesamt, Berlin
- Fachinformationszentrum Karlsruhe

RSWB

RSWB (Raumordnung, Städtebau, Wohnungswesen, Bauwesen) ist eine bibliographische Datenbank, die Literatur der Bereiche Raumordnung, Städtebau, Wohnungswesen und Bauwesen nachweist, die in deutschsprachigen und vielen anderen europäischen Ländern, den Vereinigten Staaten oder Kanada veröffentlicht wurden. Die meisten Zitate enthalten Abstracts. Besonderer Wert wird auf Graue Literatur gelegt. Alle Zitate sind deutschsprachig. Titel in Fremdsprachen werden in der Originalsprache und als deutsche Übersetzung angegeben.

Sachgebiete

- Bauwirtschaft und Baubetrieb
- Technischer Ausbau und Versorgung
- Grundbau, Wasserbau und Straßenbau
- Baurecht
- Architektur und Bauplanung
- Denkmalpflege
- Baustoffe und Bauphysik
- Ingenieurhochbau
- Stadtplanung und Stadterneuerung
- Raumordnung und Verkehr
- Politik und Wirtschaft
- Umweltschutz und Landschaftspflege
- CAD

Quellen

- Zeitschriften und Serien
- Bücher
- Konferenzbeiträge
- Berichte
- sonstige Graue Literatur

Datenbestand

- 1976 bis März 1988: 300 000 Zitate
- 12 Fortschreibungen pro Jahr; 26 000 Zitate jährlich

Hersteller/Anbieter

- Informationszentrum RAUM und BAU (IRB) der Fraunhofer-Gesellschaft Stuttgart

ICONDA

The ICONDA (International Construction Data-base) is a bibliographical data bank covering worldwide the literature in the field of construction engineering, architecture and town planning. Most of the citations contain abstracts. ICONDA is the data bank of the International Council for Building Research, Studies and documentation (CIB). The RAUM and BAU Information Centre (RB) of the Fraunhofer-Gesellschaft, as the ICONDA Agency, takes care of the coordination on the international level of a great number of organizations dealing with varying tasks, such as information and documentation centres, research organizations, and professional publishers. Grey literature is particularly appreciated. All citations are in English.

Subject matters

- *Structural design and material testing*
- *Hall structures, industrial structure, floor buildings, towers, etc.*
- *Bridges, tunnels, embankments, etc.*
- *Brickwork structure, concrete construction, structural steel engineering, wood construction work, etc.*
- *Suited technologies for developing countries*
- *Demolition and maintenance of buildings*
- *Foundation engineering and geotechnics*
- *Building physics*
- *Energy saving*
- *Building planning*
- *Interior decoration*
- *Town planning, housing, landscape planning*
- *Building operation and completion of buildings*
- *Building implements, building processes, and industrialized building*
- *CAD*

Sources

- *Reviews and series*
- *Books*
- *Conference reports/essays*
- *Reports*
- *Other grey literature*

Data stock

- *1976 – March 1988: 195,000 citations*
- *12 updatings per year; approx. 35,000 citations in a year*

Implementor/Offerer

- *International Cooperation coordinated by: Informationszentrum RAUM und BAU (RB) of the Fraunhofer-Gesellschaft, Stuttgart*

ICONDA

ICONDA (International Construction Database) ist eine bibliographische Datenbank, die weltweit die Literatur der Bereiche Bauwesen, Architektur und Stadtplanung abdeckt. Die meisten Zitate enthalten Abstracts. ICONDA ist die Datenbank des International Council for Buildung Research, Studies and Documentation (CIB). Das Informationszentraum RAUM und BAU (IRB) der Fraunhofer-Gesellschaft koordiniert als ICONDA-Agentur die internationale Zusammenarbeit zahlreicher Organisationen mit unterschiedlichen Aufgaben, wie Informations- und Dokumentationszentren, Forschungseinrichtungen und Fachverlage. Besonderer Wert wird auf Graue Literatur gelegt. Alle Zitate sind in englischer Sprache.

Sachgebiete

- Baukonstruktion und Werktstoffprüfung
- Hallenbauten, Industriebauten, Geschoßbauten, Türme etc.
- Brücken, Tunnel, Dämme etc.
- Mauerwerksbau, Betonbau, Stahlbau, Holzbau etc.
- Angepaßte Technologien für Entwicklungsländer
- Abbruch und Gebäudeerhaltung
- Grundbau und Geotechnik
- Bauphysik
- Energieeinsparung
- Bauplanung
- Innenarchitektur
- Stadtplanung, Wohnungsbau, Landschaftsplanung
- Baubetrieb und Baudurchführung
- Baugeräte, Bauverfahren und industrialisiertes Bauen
- CAD

Quellen

- Zeitschriften und Serien
- Bücher
- Konferenzbeiträge
- Berichte
- sonstige Graue Literatur

Datenbestand

- 1976 bis März 1988: 195 000 Zitate
- 12 Fortschreibungen pro Jahr; ca. 35 000 Zitate jährlich

Hersteller/Anbieter

- Internationale Kooperation koordiniert durch: Informationszentrum RAUM und BAU (IRB) der Fraunhofer-Gesellschaft Stuttgart

VWWW

VOLKSWAGEN

Automotive engeneering

Data stock

Period from 1971 until today
Total stock
93,000 documents
Yearly increment: 6,000 documents

Implementor

Volkswagen AG

Contents

The data bank gives bibliographical hints as to German and international publications as are important for the automobile industry. The main topics, such as automotive engineering, component suppliers, and road traffic, are dealt with both under technical and economic aspects. All documents contain an abstract in German.

Subject matters

- *National economy and business administration*
- *Data processing*
- *Electric power industry*
- *Electrical engineering*
- *Automotive engineering*
- *Drive technology*
- *Traffic, road safety, roads*
- *Manufacturing engineering*
- *Quality control*
- *Machine elements*
- *Measurement and control engineering*
- *Motor fuels, lubricants*
- *Material*
- *Mathematics, physics, chemistry*
- *Environmental protection*

Sources

Reviews, conference essays, books, research reports

VWWW

VOLKSWAGEN

Kraftfahrzeugtechnik

Datenbestand

Zeitraum: 1971 bis heute
Gesamtbestand: 93 000 Dokumente
Aktualisierung: monatlich
jährlicher Zuwachs: 6 000 Dokumente

Hersteller

Volkswagen AG

Inhalt

Die Datenbank liefert bibliographische Hinweise auf deutsche und internationale Veröffentlichungen, die für die Automobilindustrie von Bedeutung sind. Die Hauptthemen Fahrzeugtechnik, Zulieferindustrie und Straßenverkehr werden sowohl unter technischen als auch unter wirtschaftlichen Aspekten behandelt. Alle Dokumente enthalten ein Abstract in deutscher Sprache.

Sachgebiete

- Volks- und Betriebswirtschaft
- Datenverarbeitung
- Energiewirtschaft, Elektrotechnik
- Fahrzeugtechnik
- Antriebstechnik
- Verkehr, Verkehrssicherheit, Straßen
- Fertigungstechnik
- Qualitätskontrolle
- Maschinenelemente
- Meß- und Regelungstechnik
- Kraftstoffe, Schmierstoffe
- Werkstoffe
- Mathematik, Physik, Chemie
- Umweltschutz

Quellen

Zeitschriften, Konferenzberichte, Bücher, Forschungsberichte

- LANDESAMT FÜR DATENVERARBEITUNG UND STATISTIK NRW -

- INFORMATIONSVERMITTLUNGSDIENST AUS EXTERNEN DATENBANKEN -

IHR ANSPRECHPARTNER:
ORR WALDSCHMIDT
DEZERNAT 212
TELEFON: 0211/4497376
BENACHRICHTIGUNGEN: - - DVS-BRIEFDIENST IM DVS-NUTZERSERVICE
ADRESSE: 1897, ABLAGEFACH: 1101WALD
- - DVS-KUNDENDIENST
TELEFON: 0211/4497350

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MIT FREUNDLICHEN GRÜSSEN

DATENBANK : VDIN VDI-Nachrichten

SUCHWORTE : AUTO
KRAFTFAHRZEUG

UMWELTVERTRAEGLICHKEIT

2
DB VDIN, FIZ Technik Frankfurt: VDIN, Copyright VDI-Verlag GmbH.
AN 198705100205.
YR 1987.
NO 051.
PD 871218.
PA 002.
AC 04.
TI Umwelt: Vorherrschende Praxis verschiebt nur die Probleme.
Sachverstaendige fordern Umdenken der Politik.
Schwerwiegende Versaeumnisse der Vergangenheit im Bodenschutz - Von Michael Peter.
AB VDI-N, Bonn, 18. 12. 87 - In der Umweltpolitik muss umgedacht und konsequenter vorgegangen werden. Mit der vorherrschenden Ausrichtung auf einzelne Problemfelder wie Luftreinhaltung oder Laermschutz werden Probleme nicht geloest, sondern nur verschoben. Dieses Urteil faellen die "Umweltweisen" in ihrem neuen Gutachten. Kurz zuvor hatte Umweltminister Toepfer ein Boden- und Grundwasserschutzkonzept vorgelegt.
TX Die schwerwiegendsten Versaeumnisse in der Umweltpolitik der vergangenen Jahre sieht der Sachverstaendigenrat fuer Umweltfragen im Boden- und Naturschutz. Der Artenschwund bei Pflanzen und Tieren geht weiter, erklaerte der Vorsitzende des Rates, Wolfgang Haber, (Lehrstuhl fuer Landschaftsoekologie der TU Muenchen/Weihenstephan) bei der Vorstellung des Umweltgutachtens 1987 am 9. Dezember in Bonn. Er kann demnach nur durch eine grundlegende Neufassung der Naturschutzgesetze angehalten werden. Und dabei muessen Privilegien fuer die Hauptsuendergruppe, naemlich die Bauern, endlich wegfallen. Aber auch die Verkehrspolitik und der Fremdenverkehr tragen mit dem Strassenausbau und dem Flaechenbedarf fuer Ski- und Wassersportgebiete zur Landschaftszerstoerung bei.
Schlechte Noten stellt der Rat auch der Energiepolitik aus: Einsparpotentiale sind noch nicht in ausreichendem Masse erschlossen. Die Kernenergie halten die Umweltweisen zwar fuer umweltpolitisch verantworthar, doch bei der Entsorgung plaedieren sie gegen eine Wiederaufbereitung und damit fuer die direkte Endlagerung abgebrannter Brennelemente.
Vom selbstgesetzten Ziel noch weit entfernt ist die Regierung in puncto schadstoffarmes Auto, und das trotz steuerlicher Anreize. Fuer voellig verfehlt haelt der Umweltrat die Foerderung von Dieselmotoren, die durch Partikelemissionen Krebs erzeugen sollen. Ausserdem muessen Lastkraftwagen endlich in die Abgasreinigung mit einbezogen werden. Besorgt aeusserten sich die zwoelf Gutachter ueber die gesundheitlichen Gefaehrdungen durch die Umweltverschmutzung. Bei Blei, Cadmium und Nitrat sind die Grenzen des Zumutbaren erreicht und teilweise schon ueberschritten. Vergiftung der Muttermilch und Funktionsstoerungen der Nieren und des Nervensystems sowie die Zunahme von Krebs nennen sie als moegliche Folgen des gegenwaertigen Umweltzustandes. Und dieser Zustand wird in erster Linie nicht durch die grossen Katastrophen wie Sandoz oder Tschernobyl geschaffen, sondern durch die Summe der alltaeglichen kleinen und groesseren Verschmutzungen.
Einen Tag vor Veroeffentlichung des Umweltgutachtens hatte das Bundeskabinett ein Boden- und Grundwasserschutzkonzept verabschiedet. Umweltminister Toepfer machte die Dringlichkeit der beiden Konzepte mit folgenden Zahlen deutlich: Die Versauerung des Bodens hat in den letzten 25 Jahren regional um das Zehnfache zugenommen. Die Siedlungsflaeche nimmt taeglich um 100 Hektar zu, das entspricht pro Jahr der Groesse des Bodensees. Und im Bundesgebiet gibt es zwischen 30 000 und 50 000 Altlastenflaechen mit stark vergifteten Boeden.
Die Massnahmen zum Bodenschutz reichen vom Rueckbau schon versiegelter Flaechen, einschliesslich Brachlegung landwirtschaftlich genutzen Bodens, bis zur Einfuehrung einer Umweltvertraeglichkeitspruefung fuer groessere Bauprojekte und der Mitsprache des Umweltministers bei geplanten Bundesfernstrassen. Ausserdem soll die Gefaehrlichkeit von Altstoffen strikter geprueft und die Verwendung von Pflanzenschutzmitteln weitestgehend eingeschraenkt werden.
Diese und einige ergaenzende Massnahmen wuerden auch fuer den Grundwasserschutz angewendet. Die Qualitaet des Grundwassers wird staendig schlechter und damit auch jene unseres Trinkwassers. Um rechtzeitig das Gefaehrdungspotential erkennen zu koennen, schlug Toepfer eine Grundwasserdatenbank vor. Schliesslich sollen neue kommunale Klaeranlagen und solche, die stark ausgebaut werden, eine dritte Reinigungsstufe erhalten.

DATENBANK : ULIDAT des Umweltbundesamt

SUCHWORTE : AUTO
KRAFTFAHRZEUG

UMWELTVERTRAEGLICHKEIT

L6 ANSWER 1 OF 20
AN LU876888 ULIDAT
TI Besser als sein Ruf.
AU Anon.
SO Test. Sonderheft (1987) Bd 22 S. 96-100 (div. Abb.; 1 Tab.)
DT Zeitschrift
LA Deutsch
IP LIS
AB Auf Probenahmefahrten durch das Bundesgebiet, in Berlin und auf den Transitstrecken durch die DDR wurden unangemeldet und unauffaellig 79 Proben von bleifreiem Benzin in einen Spezialkanister gefuellt und auf die Motorvertraeglichkeit und Umweltvertraeglichkeit untersucht. Die Ergebnisse werden tabellarisch zusammengestellt. Fast alle Proben entsprachen den DIN-Bestimmungen hinsichtlich zB Research-Oktanzahl, Motor-Oktanzahl, Dampfdruck, Dichte des Kraftstoffes. Die Bleigehalte lagen in allen Proben unter 5 mg/l. Der Grenzwert betraegt 13 mg/l. Mit Ausnahme von einer Probe wiesen alle Schwefelgehalte von 250 mg/kg oder darunter auf. Sie unterschritten damit weit den Grenzwert von 1000 mg/kg. Die Konzentrationen an Benzol und polycyclischen aromatischen Kohlenwasserstoffen im unverbleiten Benzin, die ebenfalls bestimmt wurden, sind so hoch wie im verbleiten. Diese Stoffe werden durch den Katalysator aus dem Kraftfahrzeugabgas entfernt.
CC *LU51 Luft: Emissions- und Immissionsminderungsmassnahmen: Verkehr
CT Benzin (bleifrei); Marktuebersicht; Brennstoffzusammensetzung; Schadstoffgehalt; Bleigehalt; Benzol; Grenzwert; Probenahme; Schwefelgehalt; Kohlenwasserstoff (polyzyklisch); Umweltvertraeglichkeit; Katalysator; Kfz-Abgas

L6 ANSWER 3 OF 20
AN UA876428 ULIDAT
TI Niemand will auf die Vorteile des Autos verzichten.
AU (Porsche, Stuttgart)
SO Phoenix International (1987) Bd 5(1) S. 6-9 (4 Abb.; 9 Lit.)
DT Zeitschrift
LA Deutsch
IP UBA
CC *UA20 Umweltpolitik; UA40 Sozialwissenschaftliche Umweltfragen
CT Verkehrspolitik; Schadensverursachung; Umweltvertraeglichkeit; Kraftfahrzeug; Oekonomisch-oekologische Effizienz; Kfz-Verkehr; Kfz-Abgas; Schadstoffemission; Interessenkonflikt; Waldschaden; Saurer Niederschlag; Emissionsgrenzwert

DATENBANK : UFORDAT des Umweltbundesamt

SUCHWORTE : AUTO
KRAFTFAHRZEUG

UMWELTVERTRAEGLICHKEIT

L12 ANSWER 2 OF 2
AN 23085 UFORDAT DN UFOKAT 85*LU51-012
TI Technologiebewertung zu Problemen der Luftverschmutzung durch Stassenfahrzeuge.
A technology assessment of the problem of air pollution by road vehicles.
SF Projektleiter: Braun, E., Prof.Dr.
Leiter der Institution: Braun, E., Prof.Dr.
CSP Oesterreichische Akademie der Wissenschaften, Institut fuer Sozio-Oekonomische Entwicklungsforschung und Technikbewertung
Fleischmarkt 20
A-1010 Wien
Oesterreich
Tel: (0222) 527153
CSS (1) Bundesministerium fuer Wissenschaft und Forschung Oesterreich, Sektion Forschung
DB 01 Nov 1984
DE 31 Jan 1985
FU OES 300000
AB Der derzeitige Stand der Wissenschaft laesst vermuten, dass das Waldsterben durch eine Kombination von Wirkungen des Schwefeldioxids, der Stickoxide und Kohlenwasserstoffe verursacht wird. Letztere beide Schadstoffe werden in beachtlicher Menge von Kraftfahrzeugen verursacht. Drei technische Entwicklungen koennen zur Loesung dieser Probleme beitragen. Der Magermotor, der emissionsarme Dieselmotor und der Dreiwegkatalysator. Langfristig sind die ersten beiden Loesungen vorzuziehen, da sie guenstiges Abgasverhalten mit Energiesparsamkeit und Zuverlaessigkeit verbinden. Kurzfristig sind die extrem hohen Anforderungen der US Gesetzgebung nur mit Hilfe des Dreiwegkatalysators erreichbar. Laengerfristig waere es wuenschenswert, moeglichst hochoktaniges (etwa 96 ROZ, 86 MOZ) bleifreies Benzin auf den Markt zu bringen, um die Energiesparsamkeit zu beguenstigen. Es wird vorgeschlagen, die Moeglichkeit eines Ausgleichs zwischen Sparsamkeit und Umweltbelastung innerhalb geringer Grenzen zu erwaegen. Zu bedenken ist auch die Tatsache, dass z.B. der Magermotor seine Emissionseigenschaften ziemlich konstant haelt, waehrend die Funktion des Katalysators im Laufe der Zeit nachlaesst, wobei die routinemaessige Ueberpruefung im Moment kaum technisch durchfuehrbar ist. Um eine schnellere Entlastung der Umwelt zu erreichen als dies durch Verordnungen fuer Neufahrzeuge moeglich ist, koennten verkehrspolitische Massnahmen gesetzt werden. Z.B. Beguenstigungen des oeffentlichen Verkehrs, Tempolimits und autofreie Tage. Auch Nachruestung bestehender KFZ ist moeglich, wenn auch nicht so wirksam wie Dreiwegkatalysatoren.
CC *LU51 Luft: Emissions- und Immissionsminderungsmassnahmen: Verkehr
CT Katalysator; Luftverunreinigung; Stickstoffoxid; Kraftfahrzeug; Kohlenwasserstoff; Emissionsminderung; Dieselmotor; Benzin (bleifrei); Kraftstoff (bleifrei); Emission; Geschwindigkeitsbeschraenkung; Verfahrensvergleich; Verkehrspolitik; Umweltpolitische Instrumente; Umweltvertraeglichkeit; Umweltschutzauflage

DATENBANK : RSWB des IRB Stuttgart

SUCHWORTE : AUTO
KRAFTFA[illegible]UG

UMWELTVERTRAEGLICHKEIT

L18 ANSWER 1 OF 6
AN 1987(11):9400166 RSWB
TI Die Umweltpolitik der EG und ihre Auswirkungen auf die Bundesrepublik Deutschland im Hinblick auf die Verabschiedung des Chemikaliengesetzes, die Einfuehrung der Umweltvertraeglichkeitspruefung und die Diskussion um das schadstoffarme Auto
AU Ebbing, Reinhold
CS TU Berlin, Fachbereich 14 Landschaftsentwicklung, Institut fuer Landschaftsoekonomie (Herausgeber)
SO Berlin/West (Deutschland, Bundesrepublik): Selbstverlag. 1985, 135 S., Abb.,Tab.,Lit.
Ser. Titel: Werkstattberichte - Institut fuer Landschaftsoekonomie, Technische Universitaet Berlin; 8
AV DEBfLR C 18 054
DT Monographie
CY Deutschland, Bundesrepublik
LA Deutsch
CC 61.260
CT Recht; Umweltpolitik; EG; Umweltschutzrecht; Umweltvertraeglichkeitspruefung; Emissionskontrolle; Personenkraftwagen
law; environmental policy; European Community; environmental-protection law; environmental compatibility test; emission control; motorcar
ST International
international
Geoindex: EG-Staaten; Deutschland, Bundesrepublik

L18 ANSWER 2 OF 6
AN 1987(8):9000293 RSWB
TI Verkehrsplanung zwischen Vision und Realitaet
AU Hoppe, K.
SO Strasse und Verkehr (1985) Jg.71, Nr.11, S.563-572, Abb.,Lit.
ISSN: 0039-2189
AV DEDS 33825
DT Zeitschrift
CY Schweiz
LA Deutsch
AB Die in der heutigen Zeit notwendigen und machbaren Massnahmen der Verkehrsplanung werden am Beispiel der Stadt Bern dargestellt. Dabei werden Hoffnungen auf den Ersatz von Autofahrten durch Radfahren genauso als Illusion abgetan wie die Erwartungen, die vielfach in unkonventionelle Nahverkehrstechniken gesetzt werden. Die Zukunft wird vielmehr auch von den heute bekannten Verkehrsmitteln gepraegt. Dabei wird dem Auto durchaus auch weiterhin seine heutige grundsaetzliche Rolle zugebilligt. Trotzdem sind noch viele Verbesserungen moeglich. Vor allem gilt es, diejenigen Verkehre, die aus der Region in die Kernstadt stroemen, moeglichst weitgehend auf den OEPNV zu verlagern. Dem dienen Verbesserungen wie tangentiale Buslinien, Ausbau des Strassenbahnnetzes, Taxi-Busse, vor allem aber ca. 2600 neue Park-and-Ride-Abstellplaetze. Interessant ist dabei ein Parkhaus ueber der Autobahn mit eigener Anschlussstelle. Innerhalb der Stadtgebiete soll vor allem die Verkehrssicherheit und die Umweltvertraeglichkeit des Verkehrs verbessert werden. Dazu dienen flaechenhafte Verkehrsberuhigungen, die Parkraumbewirtschaftung, Sicherheitsmassnahmen fuer Radfahrer und Fussgaenger sowie eine Neuinstallation des Verkehrsrechners fuer die Lichtsignalsteuerung. (DS)
CC 67.010
CT Verkehrsplanung; Individualverkehr; Oeffentlicher Verkehr; Prognose; Zukunft; Verbesserungsmassnahme
traffic planning; individual traffic; improvement measure; public traffic; prognosis; future
ST Realitaet; Vision

DATENBANK : ICONDA des IRB Stuttgart

SUCHWORTE : AUTO
KRAFTFAHRZEUG

UMWELTVERTRAEGLICHKEIT

L27 ANSWER 1 OF 5
AN 1987(1):1002151 ICONDA
TI Die Umweltvertraeglichkeitspruefung vor Strassenbaumassnahmen, dargestellt am Beispiel einer Autobahnanschlussstelle
(Test of environmental accord in roadplanning, examplified for a motorway connexion)
AU Kaule, Giselher; Schoenharting, Joerg; Pischner, Thomas
SO Strasse und Autobahn (1986) v.37, no.10, p.450-457, figs.,tabs.,refs.
ISSN: 0039-2162
AV DEIRB Z 161
DT Journal
CY Germany, Federal Republic of
LA German SL German
CT traffic; road traffic; road construction; motorway; connection; construction measure; environmental compatibility test; analysis of effects; evaluation; environmental protection; criteria catalogue
ST Heidelberg; Baden-Wuerttemberg; Germany, Federal Republic of; Germany, Federal Republic of
OS RSWB 1986(12):9353919 IP DEIRB

L27 ANSWER 2 OF 5
AN 1986(12):1000258 ICONDA
TI Umweltvertraeglichkeitspruefung -UVP-. Am Beispiel eines Autobahnabschnittes
(Environmental compatibility test -UVP-. Shown with the example of a section of Autobahn route)
AU Itschner, Fred
SO Schweizer Ingenieur und Architekt (1986) v.104, no.18, p.430-433, figs.,refs.
ISSN: 0251-0960
AV DEIRB Z 11
DT Journal
CY Switzerland
LA German SL German
CT road construction; traffic; road traffic; planning; road planning; motorway; environmental protection; environmental compatibility test; method
ST content; Switzerland
OS RSWB 1986(8):9000689 IP DEIRB

DATENBANK : VWVV Volkswagen Kfz-Technik

SUCHWORTE : AUTO

UMWELT

1
DB VWVV, FIZ Technik Frankfurt: VOLKSWAGEN, Copyright Volkswagen AG.
AN LDO880001243.
TI DAS AUTO BRAUCHT KEINEN VERGLEICH ZU SCHEUEN : UMWELTBELASTUNGEN HABEN DEUTLICH ABGENOMMEN.
LG DE German.
AB VERGLEICH DER VERKEHRSMITTEL AUTO, EISENBAHN, FLUGZEUG ZUR PERSONENBEFOERDERUNG AUF DER STRECKE WOLFSBURG - INGOLSTADT (LUFTLINIE 410 KM). ANGABEN FUER ENTFERNUNG IN KM, REISEZEIT, MITTLERE REISEGESCHWINDIGKEIT, REISEKOSTEN. VERBESSERUNG DER VERKEHRSSICHERHEIT SEIT 1970 UM 303 PROZENT.
AU FIALA-ERNST.
IN VW ; FORSCH. U. ENTWICKL.
SO VDI NACHR. 41 (1987) H. 52/53, S. 10, PP 1, ABB:3.
AV BESTELL-NUMMER: 87VDN52010(F).
ED 8802.
YR 1987.
CC 656.022.

5
DB VWVV, FIZ Technik Frankfurt: VOLKSWAGEN, Copyright Volkswagen AG.
AN LDO850003004.
TI AUTO UND UMWELT : DAIMLER-BENZ NIMMT STELLUNG ZUM NUTZFAHRZEUG.
LG DE German.
AB EMISSIONEN VON NUTZFAHRZEUGEN, ANTEILE AN DEN GESAMTEMISSIONEN. ENTWICKLUNG UND STAND DER EUROPAEISCHEN GESETZGEBUNG ZU ABGASEMISSIONEN. ENTWICKLUNGSZIELE BEI DIESELMOTOREN, MOEGLICHKEITEN ZUR REDUZIERUNG VON SCHADSTOFFEN. STAND DER RUSSFILTERTECHNIK, KATALYSATOREN, KRAFTSTOFFVERBRAUCH. STAND DER ENTWICKLUNG BEI GERAEUSCHGESETZGEBUNG UND ASBESTFREIEN BREMSBELAEGEN. STELLUNGNAHME VON DAIMLER-BENZ ZU DEN EINZELNEN THEMEN. BEDEUTUNG DES NUTZFAHRZEUGES FUER DIE WIRTSCHAFT.
IN DAIMLER-BENZ.
SO STUTTGART : DAIMLER-BENZ AG, 1985. PP 43, ABB:18, ZEICHN:3, DIAGR:10, TAB:5.
AV BESTELL-NUMMER: DBAG000043(F).
ED 8508.
YR 1985.
CC 628.5.
656.13.
621.436.068.

6
DB VWVV, FIZ Technik Frankfurt: VOLKSWAGEN, Copyright Volkswagen AG.
AN LDO850003205.
TI AUTO UND UMWELT.
LG DE German.
AB EINFLUSS DES AUTOMOBILS AUF UNSERE UMWELT, MASSNAHMEN UND TECHNIKEN ZUR MINDERUNG DER BELASTUNG. SCHADSTOFFEMISSIONEN VON OTTOMOTOREN, EIGENSCHAFTEN, ENTSTEHUNG, MINDERUNG, AUFBAU UND WIRKUNGSWEISE DES KATALYSATORS. EMISSIONEN VON DIESELMOTOREN. MOEGLICHKEITEN DER NACHRUESTUNG, ABGAS- SONDERUNTERSUCHUNG (ASU). UMWELTSCHUTZ IM KFZ-BETRIEB. UMWELTBEWUSSTES AUTOFAHREN. KONZEPT DER BUNDESREGIERUNG ZUR EINFUEHRUNG SCHADSTOFFARMER AUTOS, VERFAHREN.
AU MEYER-INGO; SLOTTA-GERHARD.
IN ZENTRALVERB. KFZ-GEWERBE.
SO BONN : ZENTRALVERBAND D. KRAFTFAHRZEUGGEWERBES (ZDK), 1985. PP 71 (ZDK-SCHRIFTENREIHE ; 20) 628.5/ZDK/85, ABB:40, FOTO:7, ZEICHN:16, DIAGR:12, TAB:5.
AV BESTELL-NUMMER: 0000088906(B).
ED 8508.
YR 1985.
CC 628.5.
628.512.
621.43.068.
351.811.122 : 621.43.068(430).

Abbreviations of cities and shires

Übersicht über die in den Karten verwendeten Kraftfahrzeug-Kennzeichen der kreisfreien Städte und Kreise

AC	Kreisfreie Stadt und Kreis Aachen
BI	Kreisfreie Stadt Bielefeld
BM	Erftkreis
BN	Kreisfreie Stadt Bonn
BO	Kreisfreie Stadt Bochum
BOR	Kreis Borken
BOT	Kreisfreie Stadt Bottrop
COE	Kreis Coesfeld
D	Kreisfreie Stadt Düsseldorf
DN	Kreis Düren
DO	Kreisfreie Stadt Dortmund
DT	Kreis Lippe
DU	Kreisfreie Stadt Duisburg
E	Kreisfreie Stadt Essen
EN	Ennepe-Ruhr-Kreis
EU	Kreis Euskirchen
GE	Kreisfreie Stadt Gelsenkirchen
GL	Rheinisch-Bergischer Kreis
GM	Oberbergischer Kreis
GT	Kreis Gütersloh
HA	Kreisfreie Stadt Hagen
HAM	Kreisfreie Stadt Hamm
HER	Kreisfreie Stadt Herne
HF	Kreis Herford
HS	Kreis Heinsberg
HSK	Hochsauerlandkreis
HX	Kreis Höxter
K	Kreisfreie Stadt Köln
KLE	Kreis Kleve
KR	Kreisfreie Stadt Krefeld
LEV	Kreisfreie Stadt Leverkusen
ME	Kreis Mettmann
MG	Kreisfreie Stadt Mönchengladbach
MH	Kreisfreie Stadt Mülheim a. d. Ruhr
MI	Kreis Minden-Lübbecke
MK	Märkischer Kreis
MS	Kreisfreie Stadt Münster
NE	Kreis Neuss
OB	Kreisfreie Stadt Oberhausen
OE	Kreis Olpe
PB	Kreis Paderborn
RE	Kreis Recklinghausen
RS	Kreisfreie Stadt Remscheid
SG	Kreisfreie Stadt Solingen
SI	Kreis Siegen-Wittgenstein
SO	Kreis Soest
ST	Kreis Steinfurt
SU	Rhein-Sieg-Kreis
UN	Kreis Unna
VIE	Kreis Viersen
W	Kreisfreie Stadt Wuppertal
WAF	Kreis Warendorf
WES	Kreis Wesel

If you want to obtain more information, please phone us:

Environmental statistics	*Mr. Leitloff* *Mr. Foerster*	*0211-44 97 669* *0211-44 97 688*
Regional Data Bank	*Mr. Plewa*	*0211-44 97 525*
Data Select Service	*Mr. Florkowski*	*0211-44 97 568*
External data banks	*Mr. Waldschmidt*	*0211-44 97 376*

or
write to:

Landesamt für
Datenverarbeitung und Statistik
Nordrhein-Westfalen
– UMWIS LDS –
Postfach 1105

4000 Düsseldorf

Wenn Sie mehr wissen wollen, rufen Sie uns einfach an

Umweltstatistiken	Herr Leitloff Herr Foerster	0211-44 97 689 0211-44 97 688
Landesdatenbank	Herr Plewa	0211-44 97 525
Data Select Service	Herr Florkowski	0211-44 97 568
Externe Datenbanken	Herr Waldschmidt	0211-44 97 376

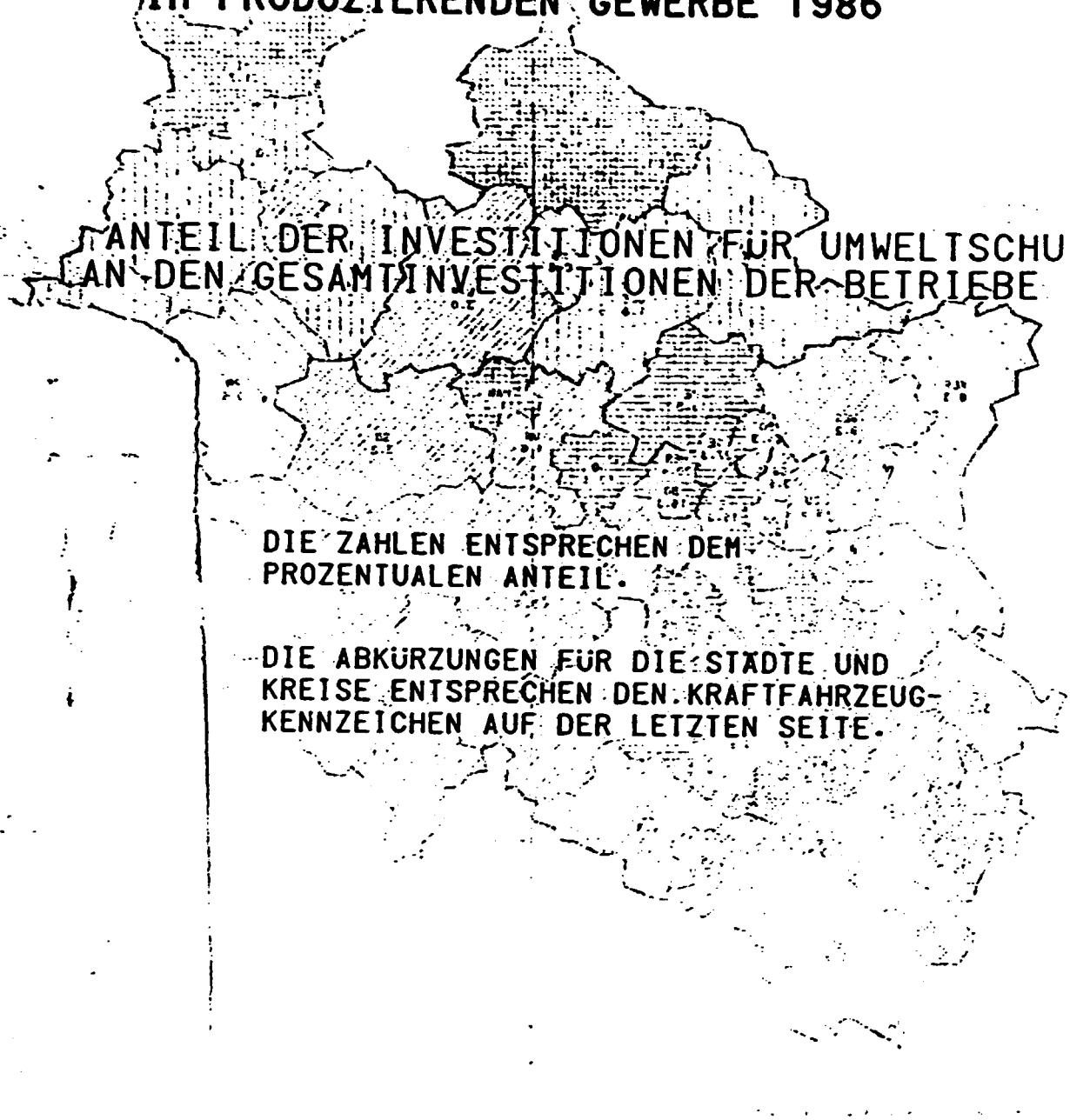
oder
schreiben Sie an das

Landesamt für
Datenverarbeitung und Statistik
Nordrhein-Westfalen
– UMWIS LDS –
Postfach 1105

4000 Düsseldorf

INVESTITIONEN FÜR UMWELTSCHUTZ IM PRODUZIERENDEN GEWERBE 1986

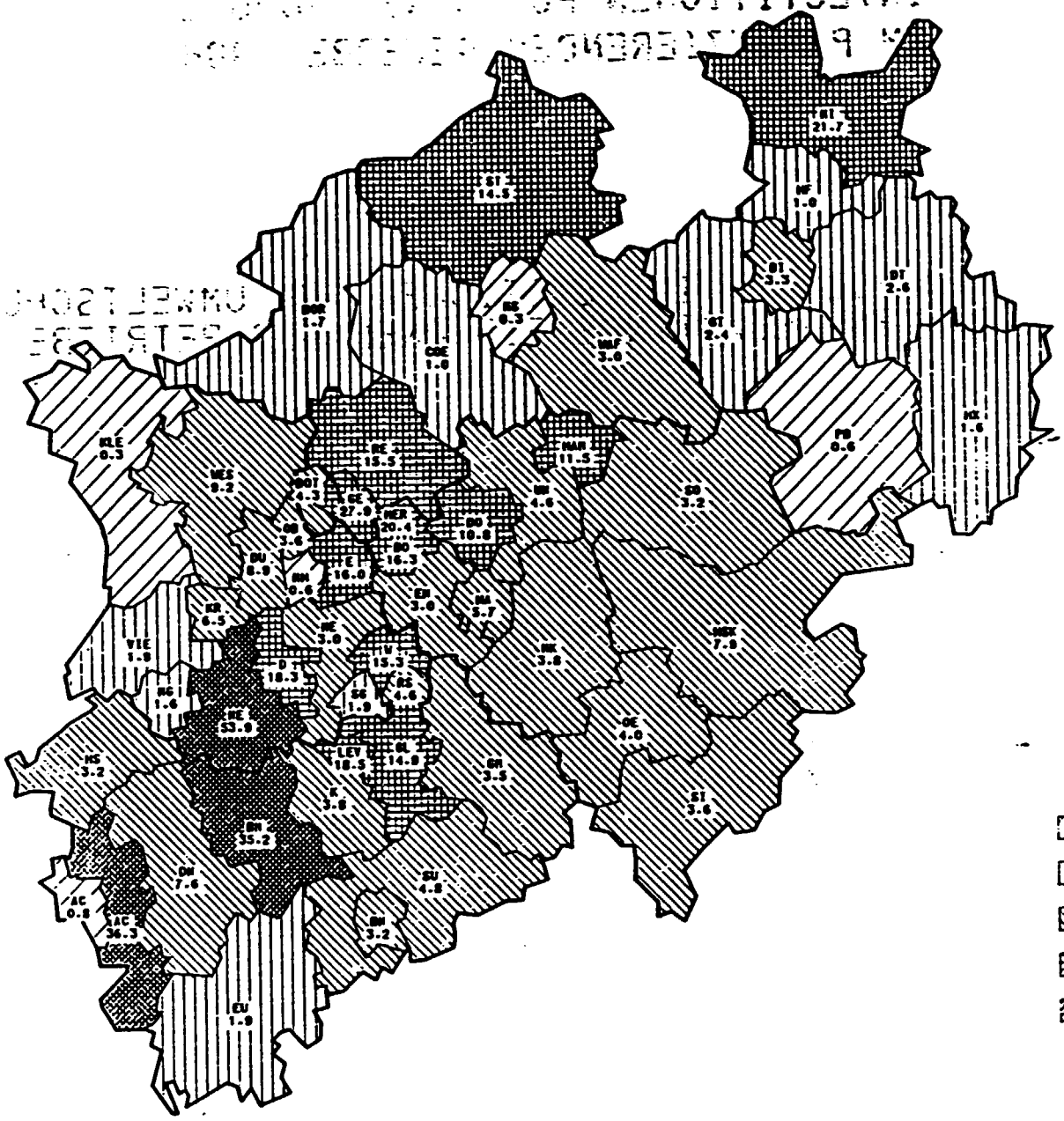
ANTEIL DER INVESTITIONEN FÜR UMWELTSCHUTZ AN DEN GESAMTINVESTITIONEN DER BETRIEBE 1986



DIE ZAHLEN ENTSPRECHEN DEM PROZENTUALEN ANTEIL.

DIE ABKÜRZUNGEN FÜR DIE STÄDTE UND KREISE ENTSPRECHEN DEN KRAFTFAHRZEUG-KENNZEICHEN AUF DER LETZTEN SEITE.

- BIS UNTER 1%
- 1 BIS UNTER 3%
- 3 BIS UNTER 10%
- 10 BIS UNTER 30%
- 30% UND MEHR



GRAFISCHE DATENVERARBEITUNG LDS NW

BIS UNTER 1%

1 BIS UNTER 3%

3 BIS UNTER 10%

10 BIS UNTER 30%

30% UND MEHR

INVESTITIONEN FÜR UMWELTSCHUTZ IM PRODUZIERENDEN GEWERBE 1986

DIE ZAHLEN ENTSPRECHEN DEN ABSOLUTEN WERTEN IN 1000 DM.

DIE ABKÜRZUNGEN FÜR DIE STÄDTE UND KREISE ENTSPRECHEN DEN KRAFTFAHRZEUG-KENNZEICHEN AUF DER LETZTEN SEITE.

UNTER 5 MILL. DM

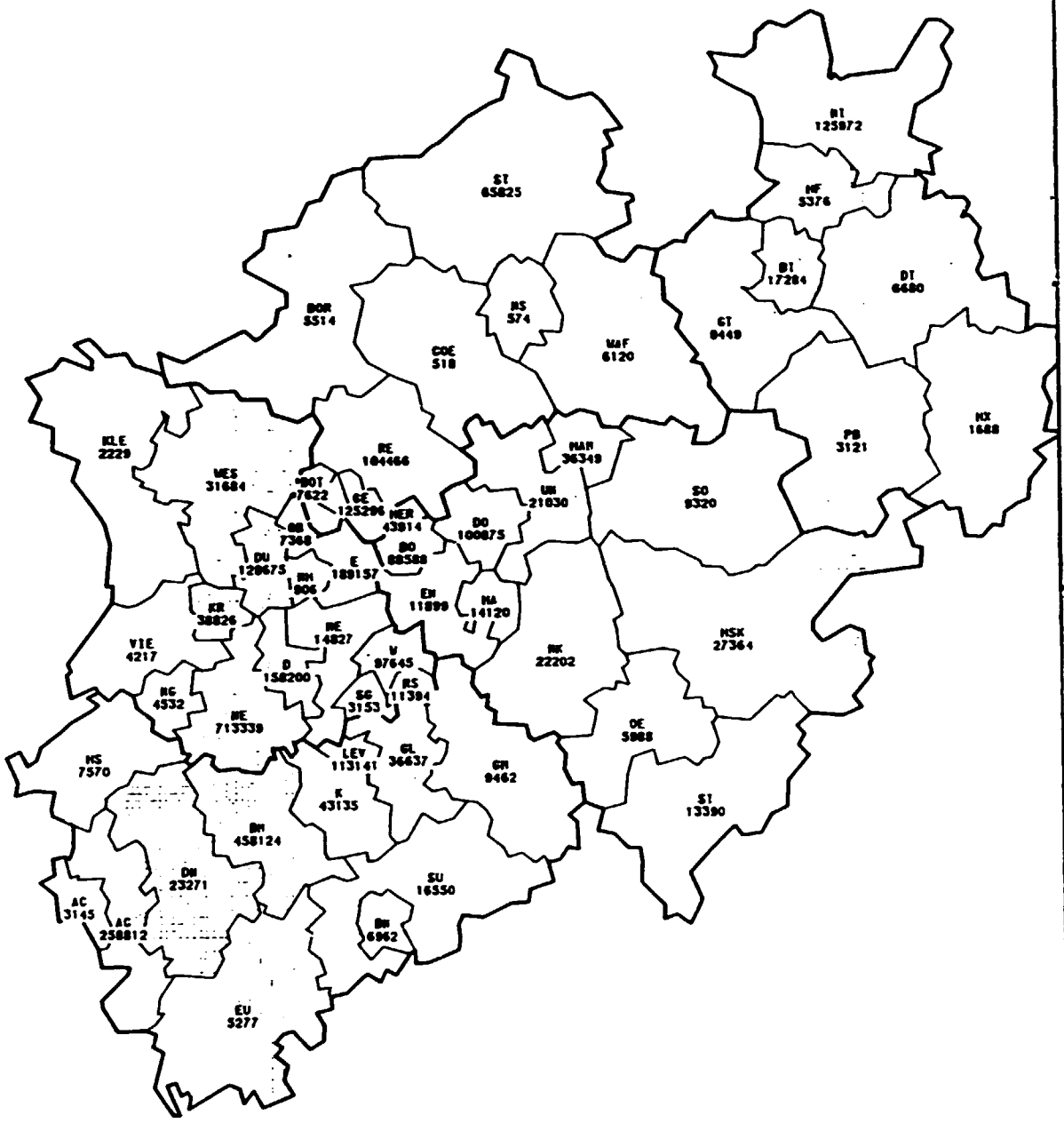
5 BIS UNTER 10 MILL. DM

10 BIS UNTER 20 MILL. DM

20 BIS UNTER 50 MILL. DM

50 BIS UNTER 200 MILL. DM

200 MILL. UND MEHR



GRAFISCHE DATENVERARBEITUNG LDS NW

Training Course

on

Establishment and Promotion of Land Information Systems

THE AGRICULTURAL MASTERPLAN OF BAVARIA

and

THE BAVARIAN AGRICULTURAL LAND INFORMATION SYSTEM (BALIS)

- October 1986 -

Editor: Bavarian Institute of Agricultural Economics and Structures, Dr. Rintelen

Address: Infanteriestraße 1, D 8000 München 40

BALIS

BALIS (Agricultural-land-information-system) is an hierachical data bank (IBM-IMS) system, that contains several data about farms (cattle, crops, machines) special supports, communities and interactive dialog programs for the agricultural advisory service. It is used for collecting data, for calling informations and specific calculations.

Primary Statist.				
Specialized St.	ISALP	agricultural structure and planning		
Mapping (GIS)				
Modelling	ISPLAN			
Petrol				B
Mountain pasture	ISFÖRD	special supports		A
.				L
.				I
.				S
Farmers bookk.	ISBUCH			B
Statefarms book.		economics / bookkeeping		A
.				V
.				A
.				R
Farm development	ISBETRIEB			I
Net returns				A
Minimization of feeding costs			B	N
.			A	
.			L	A
Building expense			I	G
Structural parts	ISBAU	agricultural buildings	S	R
Documentation				I
Modelling				C
.	ISPFLANZ	Plants		U
.				L
.	ISTIER	Animals		T
.				U
.	ISMARKT	Market		R
.				A
Economics				L
Agricultur. pol.	ISDOC	Documentation of literature		
Plant protection				I
.				N
.	.			F
.	.			O
.				R
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				A
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BALIS SUBSYSTEMS ISALP and ISPLAN

The History

Until now, there has been no complete survey for planning in the agricultural scene. Only some detailed informations concerning the land use and the soil's potential was available, but their overall coverage was limited. It includes:

- land taxation maps for farmers (1 : 5,000)
- geological surveys (1 : 500,000)
- soiltype survey maps (1 100,000)
- maps about average rainfalls, temperatures etc (1 : 1,000,000)
- areal photos and topographical maps in different scales

To improve the fundamental knowledge of agricultural land use and the soil's potential in Bavarian landscapes as well as to obtain knowledge its further development, the Ministry of Agriculture and Forests of Bavaria decided to map the agricultural resources based on topographic maps 1 : 25,000 .

At this point our institute had the task to find a way of accomplishing such a demanding project.

The high number of men-years for the field survey on one side deserves an equivalent and optimal evaluation on the other side, that enables permanent updating of the maps to make them available in a short time. This demands an automated system. So, beginning in 1974, a graphic information system (GIS) was programed and installed in the Bavarian Ministery of Agriculture in Munich. This system in its basic structure has been completed in 1976. But to the increasing demands of its users and to the rapidly developing technology of hardware and software, this system is being adapted continuously.

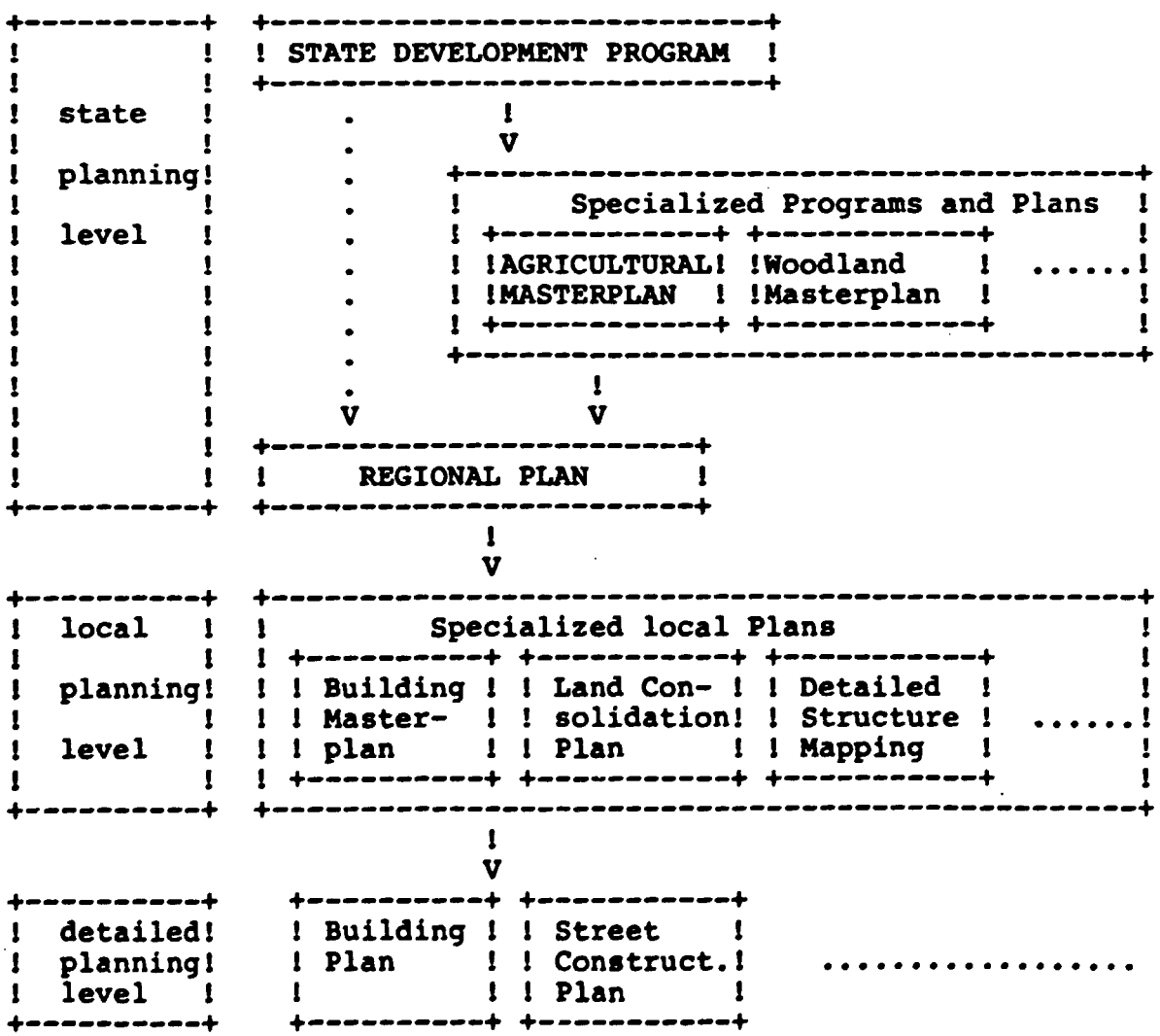
THE AGRICULTURAL MASTERPLAN OF BAVARIA

In our dynamic, multi-functional society, it is necessary for the individual disciplines to document their specific fields of interest. Therefore, the objectives and concepts of agriculture and the land which it uses are expressed in the form of a specialized plan. The reasons for preparing an agricultural plan and therewith its legal basis in land use planning are manifested in the Bavarian Agricultural Act and the Bavarian State Planning Act. The agricultural masterplan is compulsory for public authorities in rural areas (and for the agricultural administration itself).

The objectives of the agricultural framework plan can be stated as follows:

- To ensure a minimum food production
- To safeguard suitable soils for agricultural use
- To develop proposals for the use of land unsuitable for agricultural use
- To create a basis for direct regional support
- To safeguard the requirements of agriculture in the planning process

LEVELS OF PLANNING

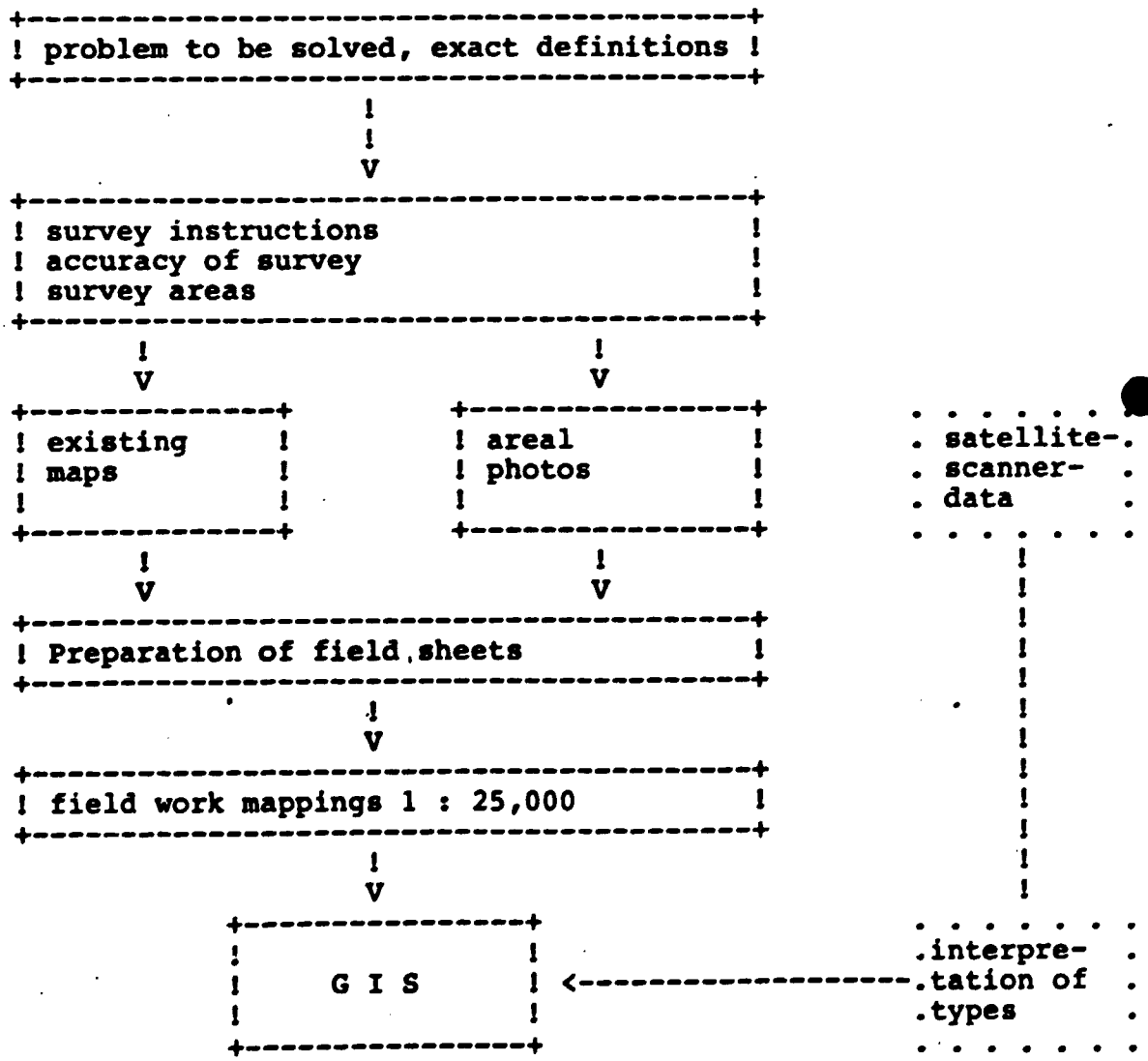


FIELDWORKS

First an exact list must be prepared of what is to be mapped and how plots are to be marked off with respect to each other. In the Agrarian Masterplan of Bavaria (AMP) three criteria were chosen for the agricable land:

- the soil's crop potential
- the resulting yields of these crops under ideal production conditions
- the average slope

For preparation of the field sheets one had to look at the available data, such as geology, soils, climate etc.. If this informations proved acceptable, it was copied directly to the topographical map, and, if necessary, corrected during fieldwork. In fieldwork, an area with the same three criteria is to be delineated and with the found criteria, in the plot characterized.



CRITERIA FOR THE INVENTORY OF AGRICULTURAL LAND

For the agricultural masterplan there are three criteria for characterizing the agricultural land.

1. SUITABILITY

The suitability of agricultural land (1st criterion of mapping) is dependent for the greatest part on natural factors; special circumstances of a single farm are not considered. The suitibility is to define by geology, soils and vegetation, under the regard of the following favorite crops:

t Arable Land - Wheat (triticum)

areas which enable a various intensive plant production such as wheat, barley, sugar beet, maize with high yields; there are presumed good climate and soils.

h Arable Land - Barley (hordeum)

areas named 'h' enable a relatively intensive and variable use, but there is no expect of a pretentions use because of soil and climate conditions: the crop yield is modest. Flat, stony soils that mainly planted with cereals, especially barley.

s Arable land - Potatoes (solanum), Rye (secale)

areas which are predominantly planted with potatoes, or fruits with similar pretensions, such as rye or oats: cultivated lowland bogs or sandy, acid-stony soils.

b Grassland, limited arable

areas which are pretentionsly used as grassland. Arable use (barley, rye, oats, potatoes) is limited by quality of soil (clay, moisture) or climate (precipitation a year more than 900 mm, average temperature under 7 degree C). Fodder plant production can be important (maize!).

a Natural grassland - pasturable (arrhenatheretalig)

m Natural grassland - not pasturable (molinietalia)

this grassland is moist from groundwater and sometimes overflowed.

v Viniculture (vinetum)

CLASSES OF YIELDS

Classes	t,h (Cereals)	s (Potatoes)	a,m (Starch equivalent)
1	<30 dt/ha	<200 dt/ha	<2500 KStE/ha
2	30-35 dt/ha	220-250 dt/ha	2500-3100 KStE/ha
3	35-40 dt/ha	250-300 dt/ha	3100-3700 KStE/ha
4	40-45 dt/ha	300-350 dt/ha	3700-4400 KStE/ha
5	45-50 dt/ha	350-400 dt/ha	4400-5000 KStE/ha
6	>50 dt/ha	>400 dt/ha	>5000 KStE/ha

For b use the yield classes of the dominant use

Instead of yield classes, please use the following:

B for fallow
F for rough grazing (festuco-brometea)
P for litter meadow (phragmitetea)
Z for special agricultural using

CLASSES OF SLOPE

Classes	1	2	3	4	5	6
Slopes	<12%	13-17%	18-24%	25-35%	36-50%	>50%

Plots without agricultural use

A water (aqua)
E extraction
M fen (not cultivated)
N other areas, that are not under agricultural use
O built up area
R traffic area
W woodland
X waste land
Y military area

AGRICULTURAL MASTERPLAN OF BAVARIA

SURVEY MAP

SCALE 1:25,000 SHEET NO 7147

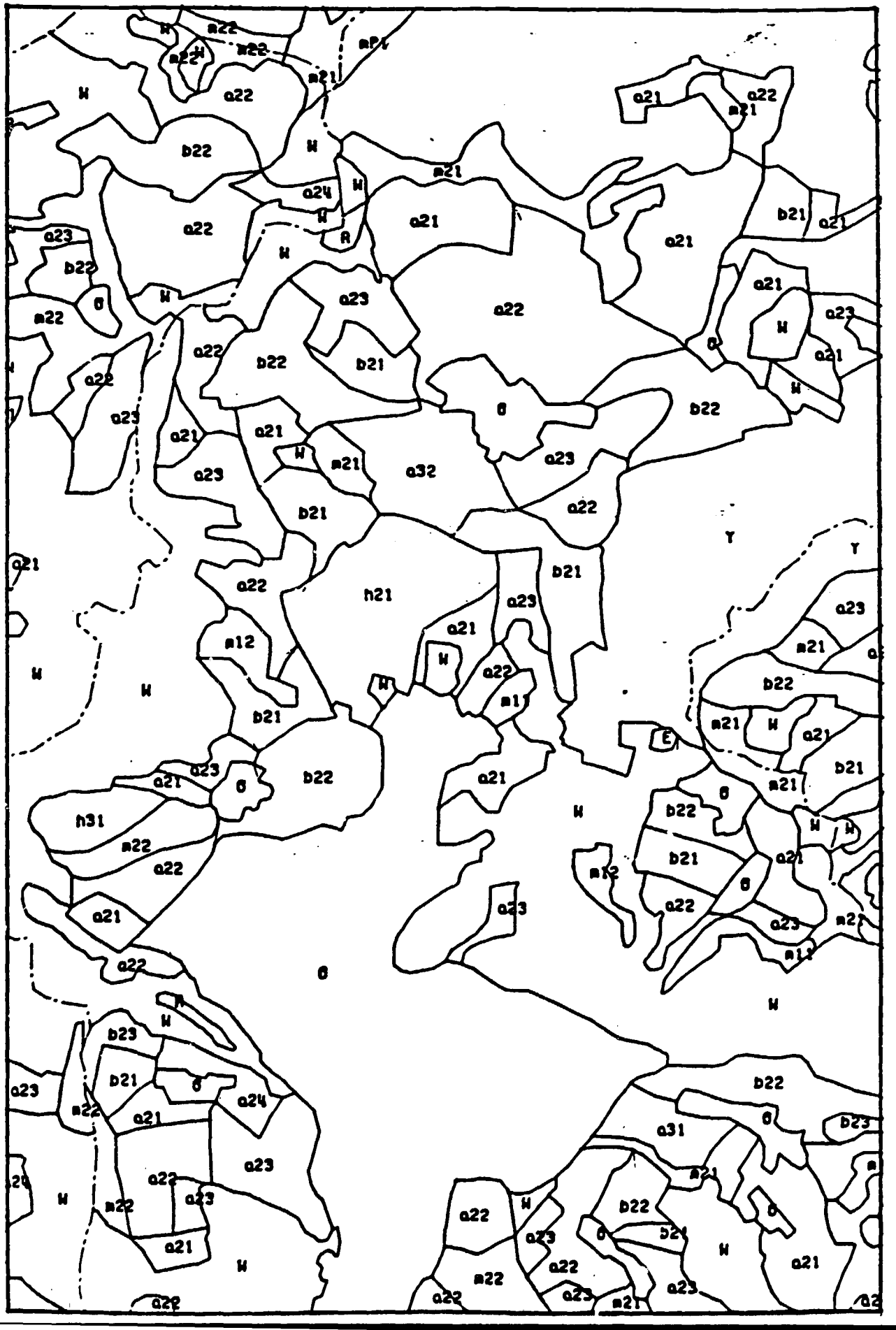


TABLE OF AREA SURVEYED (COMMUNITY OF PENZBERG)

190141 PENZBERG, ST. LK WEILHEIM-SCHONGA	T 9.0-01	ALP
AGRARLEITPLAN: BESTANDSAUFNAHME DER FLAECHEN		
(Gebietsstand: 1.5.1978)		Blatt 1

NUTZUNGS-EIGN.	ERTRAGS-KLASSE	GEFÄLL-STUFE	INTENSITÄT	SUMMEN RELATIV LF=100	SUMMEN RELATIV LN=100	SUMMEN RELATIV GMDE=100	ABSOLUT IN ha
1	2	3	4	5	6	7	8
a	1	3		.75	.75		6.2
a	2	1		17.45	17.45		144.7
a	2	2		3.76	3.76		31.2
a	2	3		1.83	1.83		15.2
a	2	4		1.17	1.17		9.7
a	3	1		21.29	21.29		176.6
a	3	2		3.91	3.91		32.4
a	3	3		.29	.29		2.4
m	1	1		8.80	8.80		73.0
m	2	1		13.03	13.03		108.1
m	3	1		2.30	2.30		19.1
m	P	1		25.42	25.42		210.8
Summe LF				100.00	100.00	32.13	829.4
Summe LN					100.00	32.13	829.4
A Wasserflächen						16.21	20.2
E Entnahmestellen						.06	1.6
M Moorflächen						13.60	350.9
O Ortsbereich						21.40	552.4
W Wald						31.40	810.4
X Ödland, Unland						.62	16.1
Summe G E M E I N D E						100.00	2581.0
Summe GRÜNLANDSTANDORT					100.00	32.13	829.4
davon Nutzungseignung a					50.45		418.4
Ertragsklasse 1					.75		6.2
Ertragsklasse 2					24.21		200.8
Ertragsklasse 3					25.49		211.4
davon Nutzungseignung m					49.55		411.0
Ertragsklasse 1					8.80		73.0
Ertragsklasse 2					13.03		108.1
Ertragsklasse 3					2.30		19.1
Ertragsklasse P					25.42		210.8
davon Gefällstufe 1					88.29	28.37	732.3
davon Gefällstufe 2					7.67	2.46	63.6
davon Gefällstufe 3					2.87	.92	23.8
davon Gefällstufe 4					1.17	.38	9.7

Bayer. Landesanstalt für Betriebswirtschaft und Agrarstruktur	
Abteilung Agrarstruktur und Agrarplanung	12 NOV 84

THE PROGRAM PACKAGES USED FOR COMPUTERIZED LANDUSE PLANNING

THE GRAPHIC INFORMATION SYSTEM (GIS)

After the fieldworks the sheets are digitized by hand and the x/y coordinates of each point of a line surrounding a plot and their defined numbers, are stored in the computer. The same method is used for polygons (like plots), lineplots (like hedges), and for singularities (like trees).

After the plotting the digitized data, each with its own number, the attributes of each element must be stored and linked to the geometric element. In this way, the connection between the geometric element and its attribute, is completed.

Therefore, for each geometric element there are two main files:

- the coordinates and labels
- the attributes (including the amount), i.e. soil description and the number of the community

There are a lot of modules within this GIS:

- Transforming of the coordinates and rectification
- Automated correction of broken lines, if neighboured maps are merged together
- Scaling routines
- Thematical selection of all kinds of geometric elements
- Windowing
- Shading and symboling routines
- Overlay (since 1984)

THE STATISTIC PACKAGES

We mostly use SPSSX (Statistic programs for social science, version X) for preparing and evaluating primary statistics and special statistics, stored in BALIS.

Nearly all statistic facilities are to be engaged, beginning with mean and standard deviation until cluster analysis and plotting routines for bar chards, line chards etc.

THE LINEAR PROGRAMMING FACILITIES (LP)

In order to process the vast number of data to describe the farming and to make predictions about the development of rural areas and farms, we use linear programming technique for modelling (MPSX/370 and MIP/370).

The conception of this models is bound on the assumption that natural situations and their interactions can be described in the form of equations.

A number of powerful algorithms and programs is available

- sensitivity checking of the stability of solutions
- parameterizing: one or more coefficients can be changed (discrete or continuous)
- the scope of variables can be limited to a given range
- the recursive facility enables simulations of future developments (i.e. prices, labor costs, yields, farm size, the available existing potential energy ect.)

This LP program was primarily conceived to be used in finding solutions to micro - and macroeconomic problems, but it also enables us to investigate for non economic questions.

VALUATION OF SOILS AND FARM MODELLING

After completing and storing spatial data concerning land use potential, real act of planing begins and the knowledge of the agricultural specialist proves essential. All basic information for planing is stored in the information system BALIS and can be aggregated at different planning levels and stages.

In drawing up proposals for agricultural development, particular stress must be given to regional differences. This provides a much better overall picture of the planning process. For this reason, a mapping of homogenuous production areas was undertaken for the whole state of BAVARIA at the community level.

By selecting evident variables, multivariant statistic operations are used to get at least three variables out of BALIS:

- out of primary statistics:
  - percentage of grassland
  - average farmsize
- out of G I S - statistics:
  - average yield classes

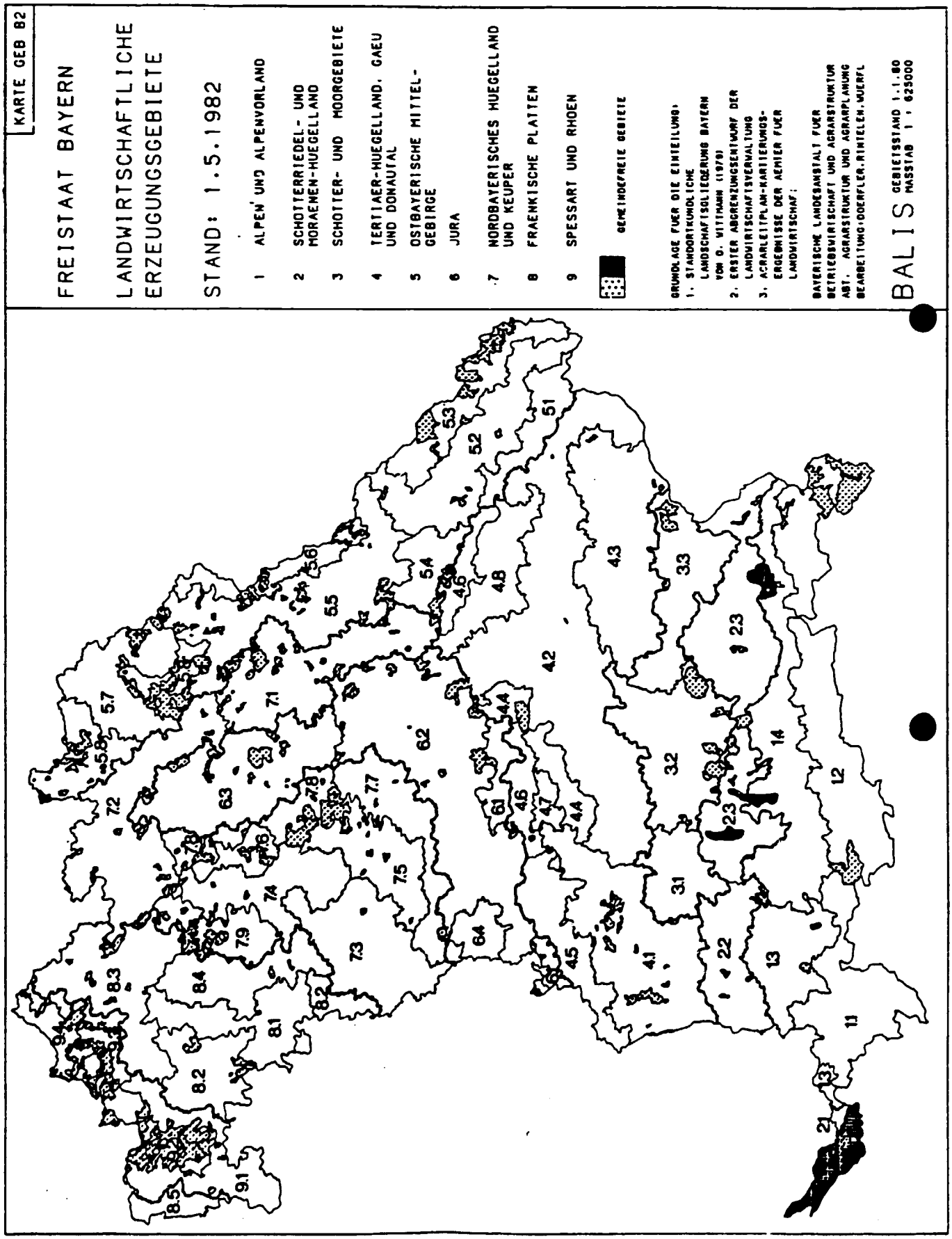
In overlaying this information with geological situation and climate, 48 different production areas were determined for the state of BAVARIA.

A subsequent stage involves the definition of regional farm types based on the classification of the production areas. Information about costs and prices, stored in BALIS , were added. As mathematical procedure, the linear programming has been used. The economic results are helpful for an objective discussion concerning potential development of farms in different agricultural areas. This also enables one to evaluate the outmapped soils with the same land use possibilities, using the same data base and the same optimizing procedures.

The purpose of these procedures is to get a relative economic grouping of soiltypes and not to get an absolute amount of farm income. The valuation diagram gives the computing order for the AMP-maps. Besides this, all agricultural statistic values, which are important for AMP-statements, are plotted in community border maps. This enables users to get very quick impressions of the distribution of statistic values.

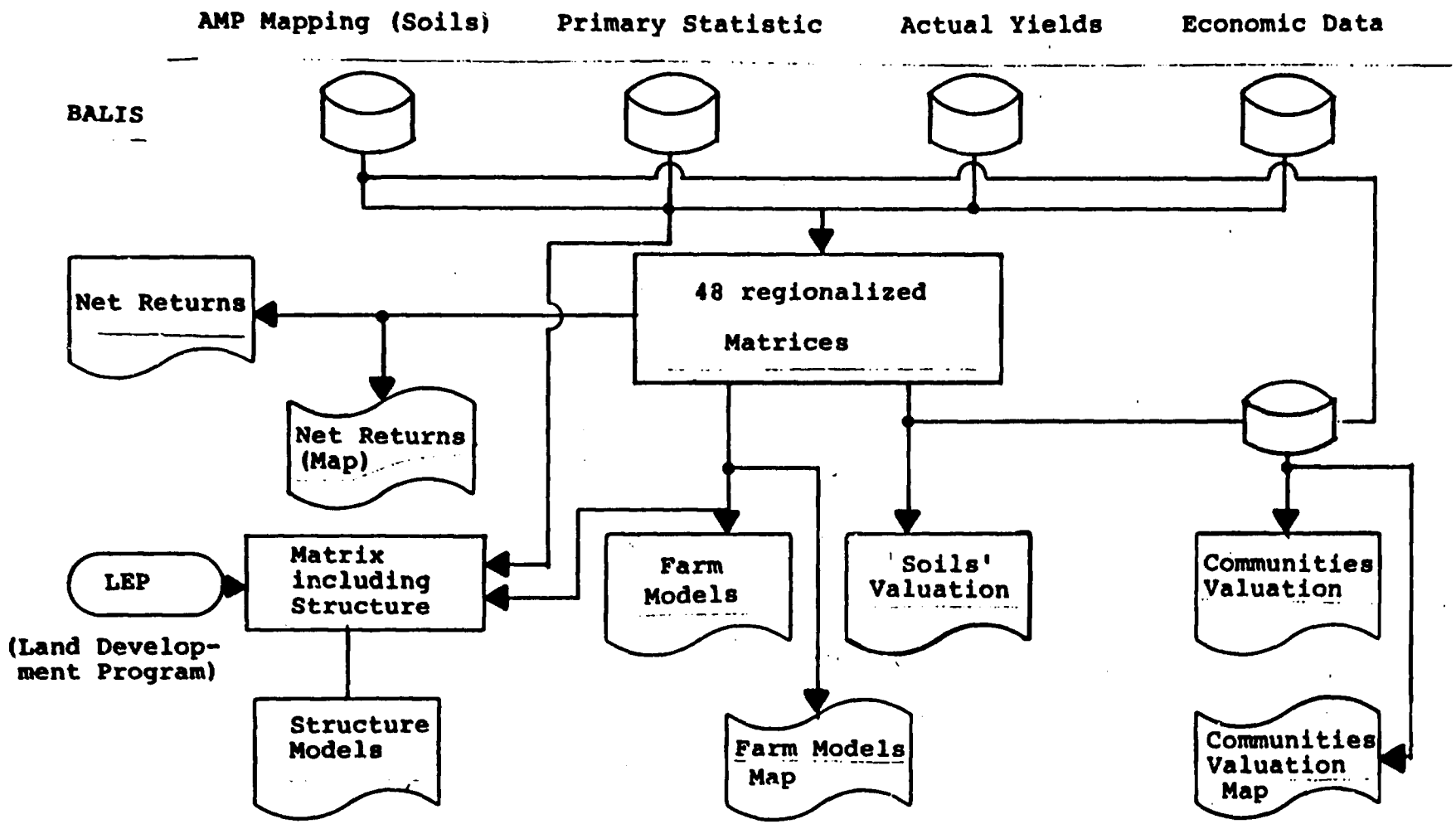
THE 48 PRODUCTION AREAS OF BAVARIA

Within each area there are very similar conditions for farming



FLOWCHART AMP OF BAVARIA

(VALUATION)



NET RETURNS

REGION 4.2 SOILTYPE t5					
Net returns - CROP PRODUCTION					
		1	2	3	4
Kind of Production		WHEAT - WINTER	WHEAT - SUMMER	BARLEY- WINTER	BARLEY- SUMMER
Yields (gross)	dt DM	48.0 48.0	46.0 48.0	48.0 44.0	43.0 49.0
(net)	KSTE				
Output	DM	2304.0	2208.0	2112.0	2107.0
Seeds	DM				
Seeds	dt DM	.6 90.0	.7 90.0	.5 85.0	.5 85.0
Seeds	dt DM	1.2 48.0	1.4 48.0	1.0 44.0	1.0 49.0
Fertilizer N	kg DM	135.3 1.40	129.7 1.40	99.3 1.40	78.2 1.40
P	kg DM	65.2 1.25	62.5 1.25	62.8 1.25	58.4 1.25
K	kg DM	82.0 .45	78.6 .45	92.1 .45	64.5 .45
Plant Protection	DM	97.0	107.0	90.0	41.0
Risk/insurance	DM	34.0		41.0	36.0
Machine costs (var)	DM	121.0	115.0	121.0	115.0
(rented)	DM	150.0	150.0	150.0	150.0
Other Costs		42.0	41.0	42.0	39.0
Input	DM	863.0	838.0	789.0	684.0
Net Return t5.1	DM	1441.0	1370.0	1323.0	1423.0
Net Return t5.2	DM	1387.0	1319.0	1269.0	1372.0
Net Return t5.3	DM	1322.0	1257.0	1204.0	1310.0
Net Return t5.4	DM	1227.0	1186.0	1109.0	1239.0
t5.5	DM				
t5.6	DM				

Prices : At the Farm including tax
Yields : from GIS

Fertilizing : like soils of deprived
Plant protection: not regionalized
Insurance : regionalized
Mechanics : only variable costs
Other costs : drying, sorting etc

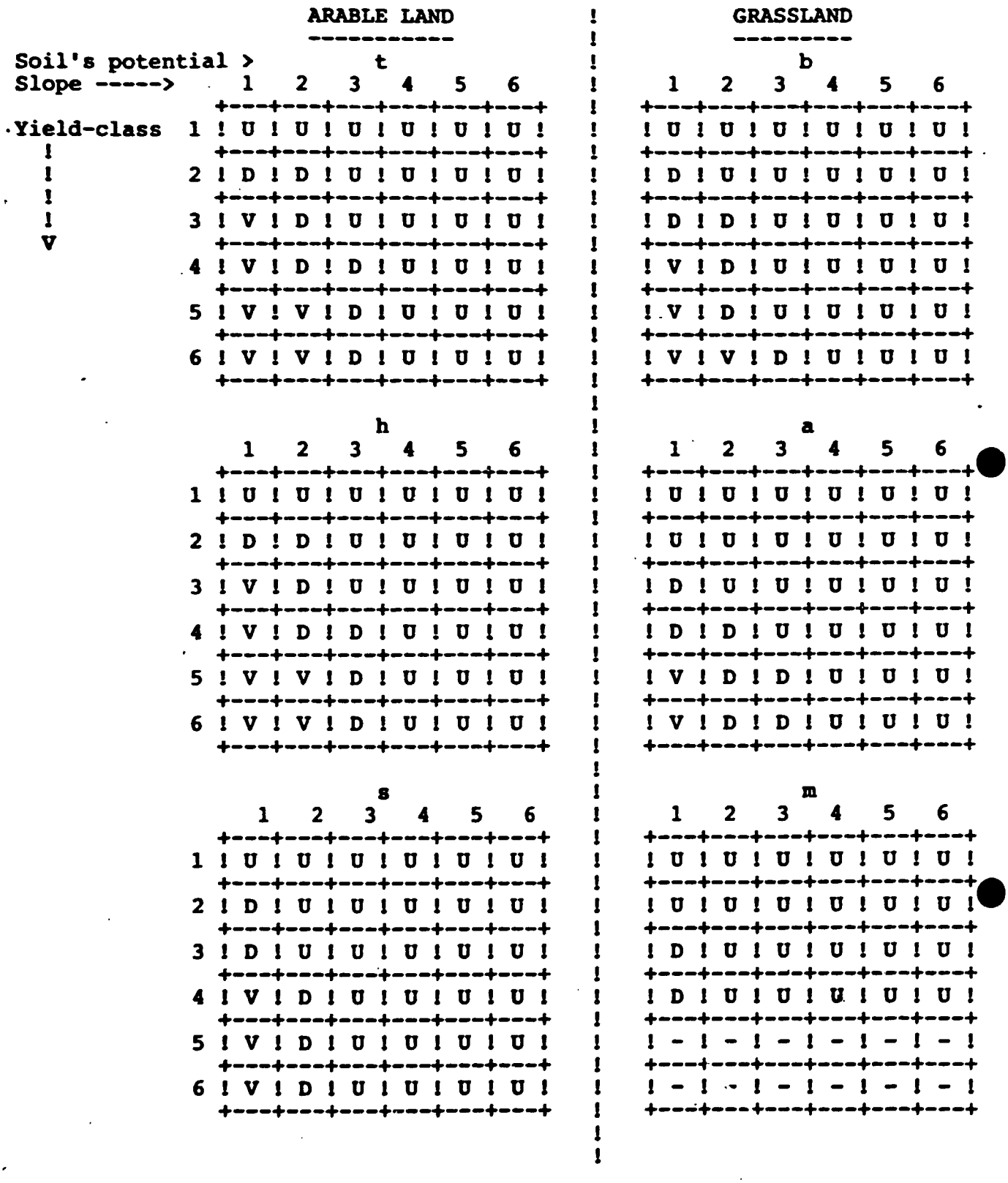
Net returns : The differences between slope classes are caused by higher variable costs of machine work

MODELLING FOR DIFFERENT SOILTYPS

Type of Soil		t4.1	t4.2	t5.1	
Labour	h	4441.33	4831.80	3771.13	
Cultivated area	ha	20.00	20.00	20.00	
Grassland	ha	.	.	.	
Arable Land	ha	20.00	20.00	20.00	
Wheat	ha	1.44	1.39	1.54	
Barley	ha	.	.	.	
Rye	ha	.	.	.	
Maize	ha	4.74	3.96	3.44	
Fodderbeets	ha	2.94	3.36	.	
Potatoes	ha	2.72	2.24	4.57	
Other foddercrops	ha	7.15	8.63	6.18	
Sugar beets	ha	.99	.42	4.27	
Dairy Cows	NO.	27.53	29.19	18.74	
Calves	Unit	6.88	7.29	4.68	
Fatstock	Unit	.	.	.	
Pigs for fattening	Unit	.	.	.	
Breeding pigs	NO.	.	.	.	
Fixed Capital(excl.Soil	DM	408778.33	425818.77	323081.90	
Total of net return	DM	76637.69	75660.08	75156.70	
Cross Return	DM	110505.09	111198.57	108174.04	
Fixed Costs	DM	20901.64	21429.29	18783.14	
Variable Costs	DM	33867.40	35538.49	33017.34	
Gross Income	DM	55736.04	54230.78	56373.55	
Labour/day Summer	h	6.38	7.73	5.33	
Winter	h	5.88	6.13	4.53	
Restriction of Manure	DGV	23.85-	21.68-	35.40-	
" of Livestock-Un.	VE	162.13-	159.85-	174.22-	
Yields- Fodder	KStE	81331.74	86334.63	55357.25	
Wheat	dt	61.00	58.59	73.94	
Barley	dt	.	.	.	
Maize (grain)	dt	.	.	.	
Sugar beets	dt	495.85	210.73	2268.02	
Potatoes	dt	871.07	717.25	1602.18	
Energy: Input (+)	GJ	923.73	1027.82	908.47	
Output(-)	GJ	658.28-	577.59-	1135.37-	
Balance	GJ	265.45	450.23	226.89-	

Remarks
- There is no connection to the actual land use
- The yields of the crops based on the AMP- mapping
- The other data based on regionalized statistics about
  - prices
  - yields of livestock production
- Not regionalized data based on the KTBL

VALUATION DIAGRAM:



V = Land with best conditions for crop-production. There are very minor or no physical limitations, yields are consistently high and most of crops can be grown. (Z = V)

D = Land with limitations to V: Yields are average, there are restrictions growing of crops.

U = Land with severe limitations due to soil, slope or yields. The economic results of farming are very low. (P and F = U)

AGRICULTURAL MASTERPLAN OF BAVARIA

VALUATION MAP

SCALE 1:25,000

SHEET NO 7147

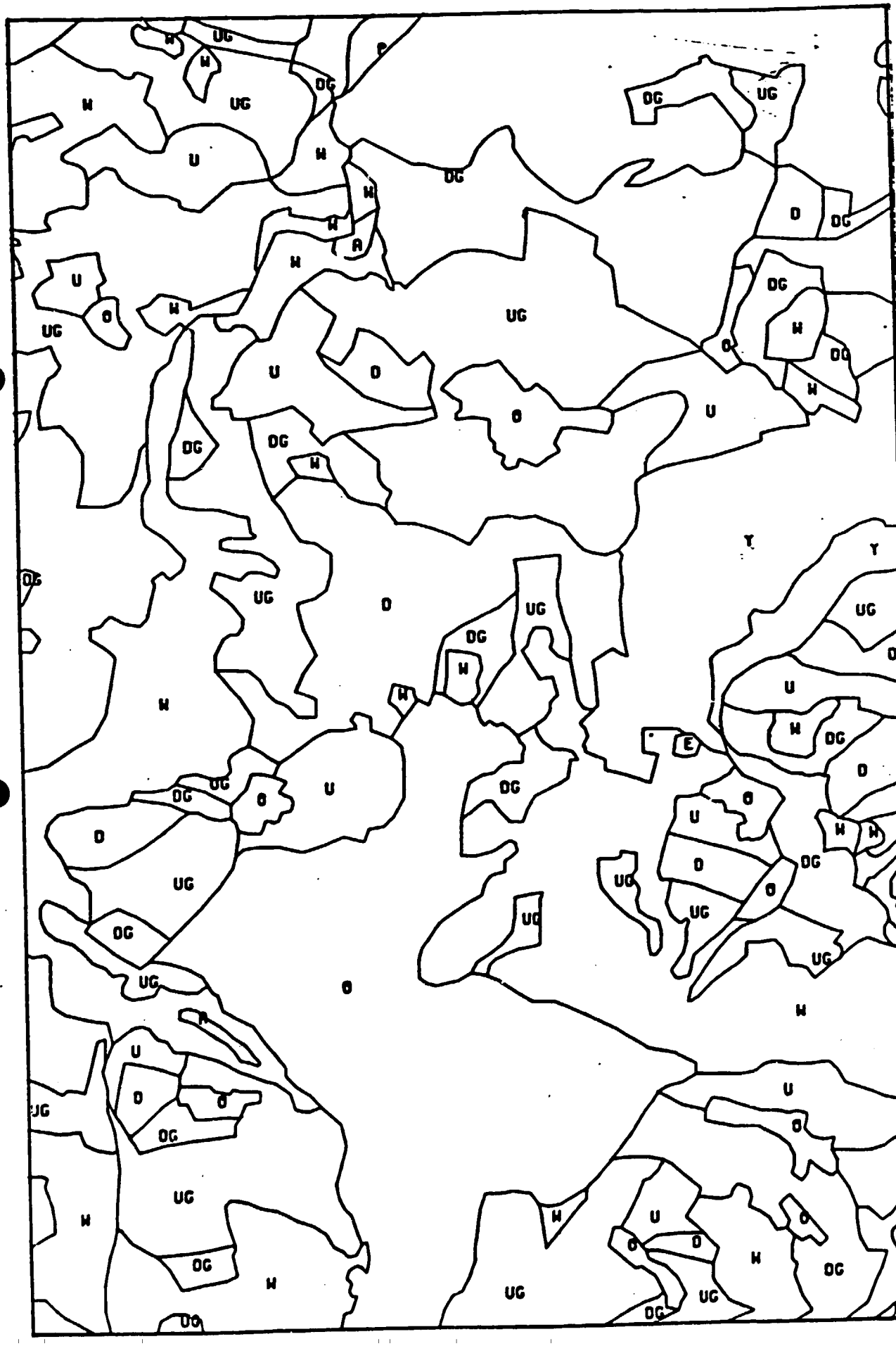


TABLE OF AREA VALUATED (COMMUNITY OF PENZBERG)

190141 PENZBERG, ST. LK WEILHEIM-SCHONGA	T 9.0-02	ALP
AGRARLEITPLAN: WERTUNG DER FLÄCHEN		
(Gebietsstand: 1.5.1978)	Blatt 1	

WERTUNG	SUMMEN RELATIV LF=100	SUMMEN RELATIV LN=100	SUMMEN RELATIV GMDE=100	SUMMEN ABSOLUT IN ha
1	2	3	4	5
DG	23.60	23.60	7.58	195.7
Summe DA+DG	23.60	23.60	7.58	195.7
UG	76.40	76.40	24.55	633.7
Summe UA+UG+Almen/Alpen	76.40	76.40	24.55	633.7
SUMME LF	100.00		32.13	829.4
SUMME LN		100.00	32.13	829.4
A Wasserflächen			.78	20.2
E Entnahmestellen			.06	1.6
M Moorflächen			13.60	350.9
O Ortsbereich			21.40	552.4
W Wald			31.40	810.4
X Ödland, Unland			.62	16.1
Summe GESAMTGEBIET				2581.0

Bayer. Landesanstalt für Betriebswirtschaft und Agrarstruktur	
Abteilung Agrarstruktur und Agrarplanung	12 NOV 84

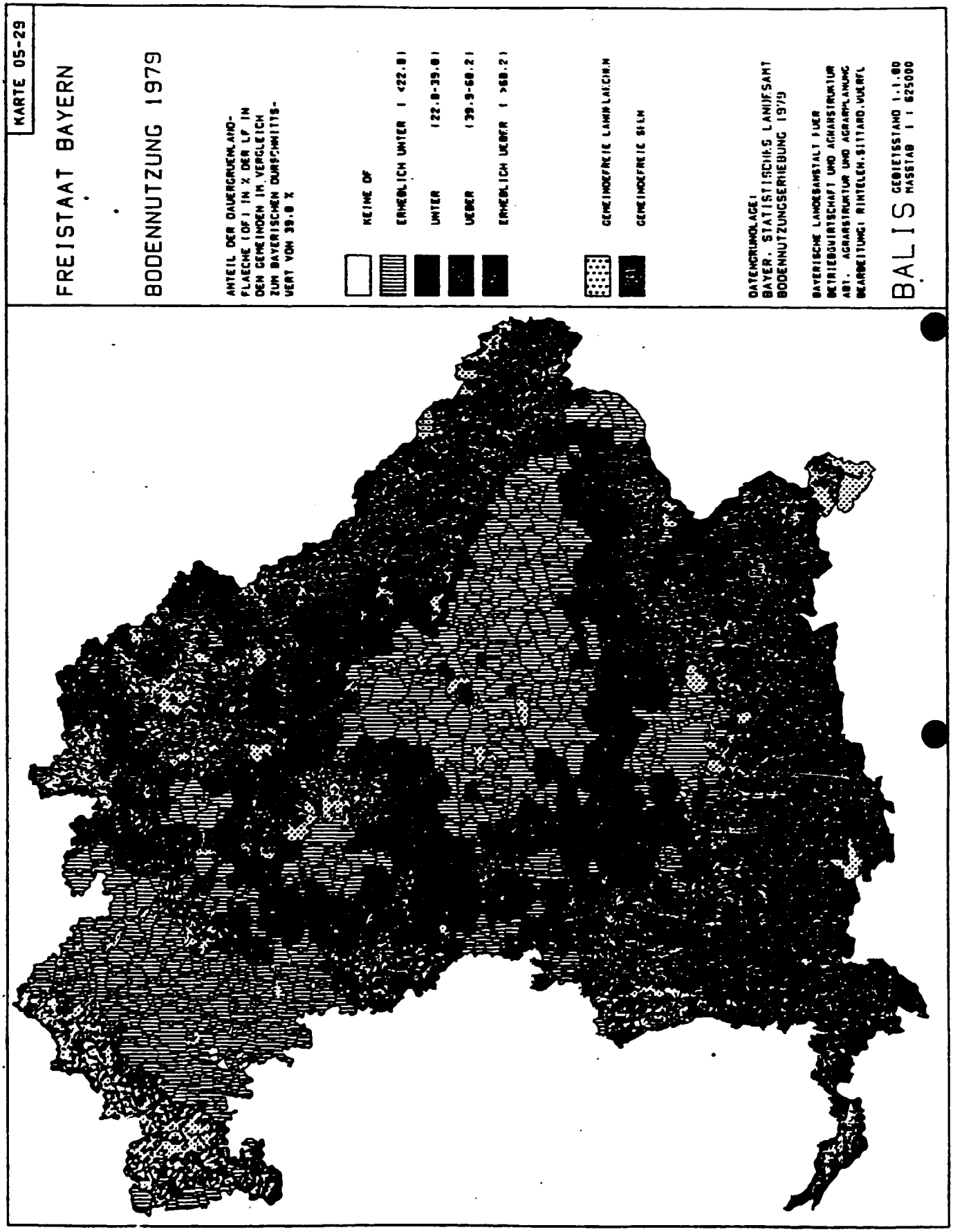
STRUCTURE MAPS

All agricultural statistic figures, that are important for AMP-statements, are plotted in community bordered maps.

The data have been sorted into groups. Community borders are shown in the maps as well. This enables users to get very quick impressions of the disribution of variable figures.

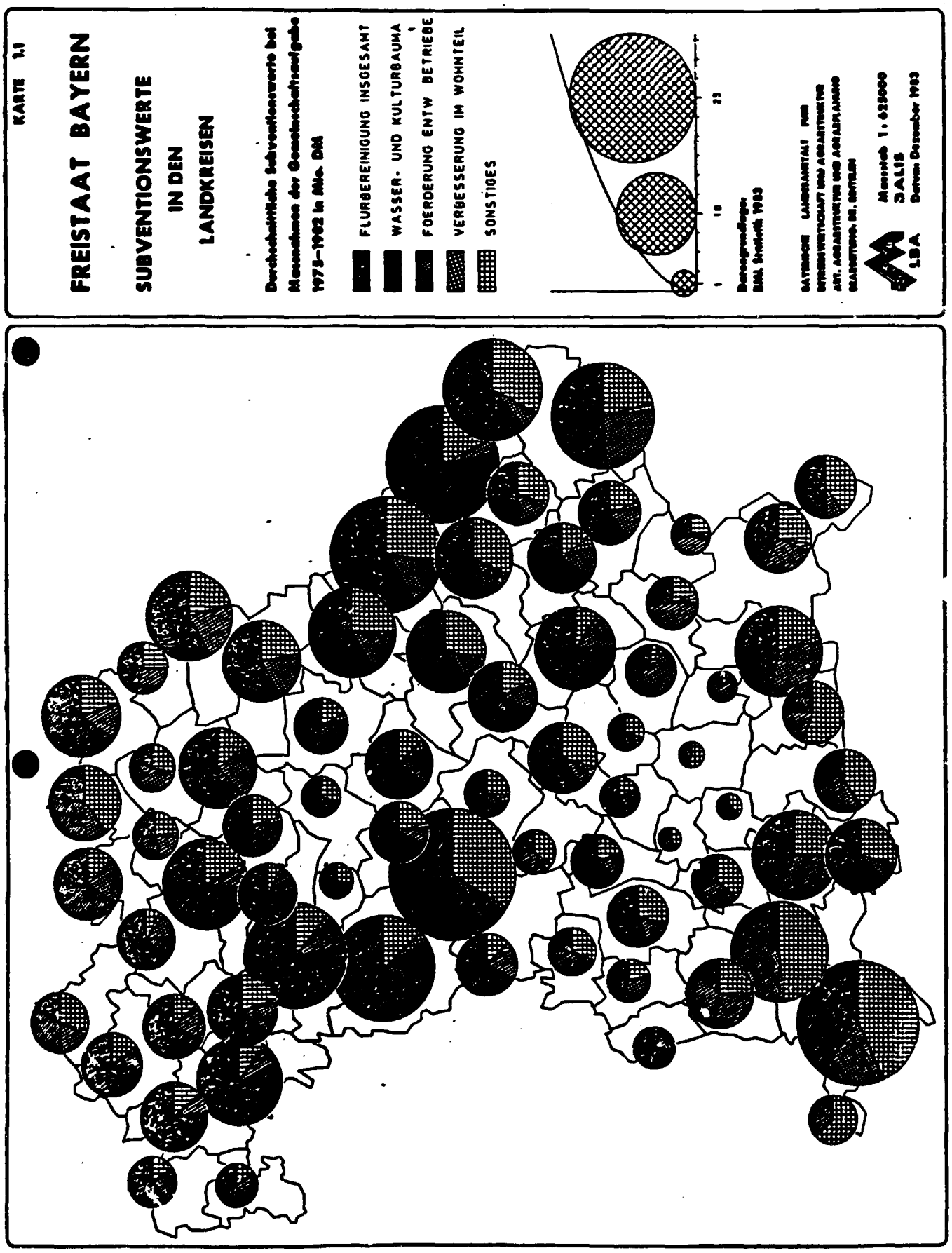
MAP OF COMMUNITIES

% OF GRASSLAND OF THE LAND IN AGRICULTURAL USE



MAP OF COUNTIES OR DISTRICTS

SPECIAL SUPPORTS (LAND CONSOLIDATION, FARM BUILDINGS, HOUSING ...)



DETAILED STRUCTURE MAPPING

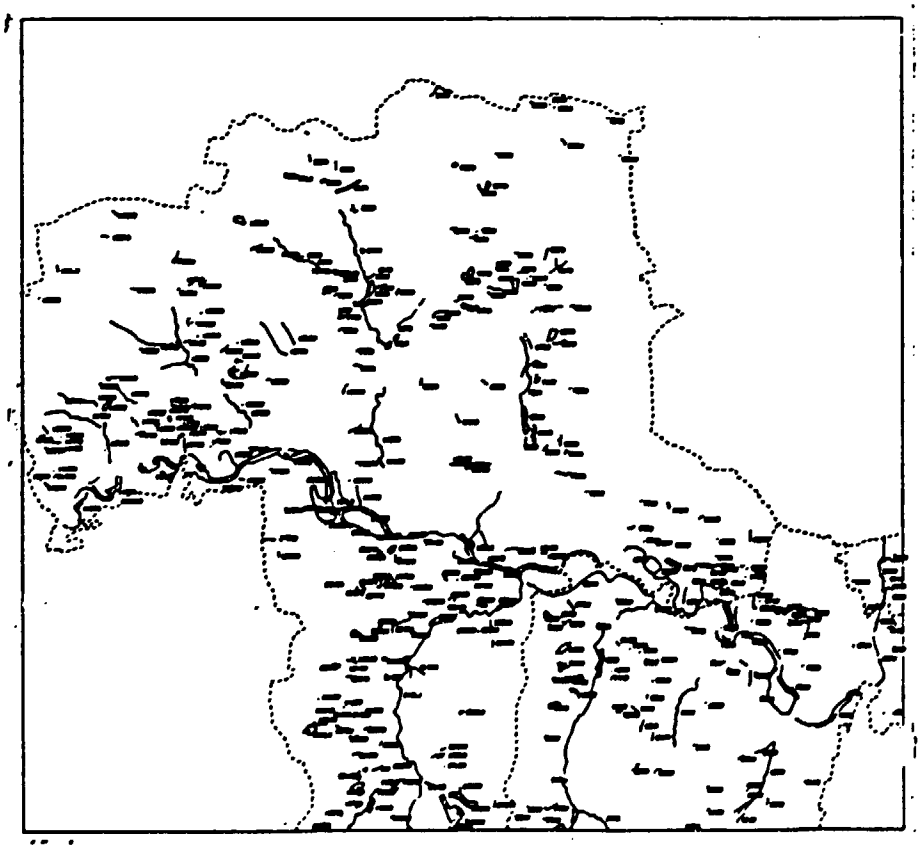
The purpose of detailed structure mapping (DSM) is the systematic coverage, evaluation and description of small scale landscape elements, e.g. field boundaries, hedges, individual trees, small water courses etc, for use in specific planning projects, for example land consolidation. It, therefore, supplements the larger scale planing (for example AMP).

The main task of detailed structure mapping is to decide which small structures should be seen as part of the basis fabric of the landscape, and are therefore to be conserved, and in addition to these, which other features are called for.

The small structures, that have been mapped and evaluated are represented by lines and symbols, and a combination of numbers and letters.

The descriptive and evaluation data can be produced in list form using different sorting characteristics. Apart from the basic list which is sorted by its numbers and according to districts, lists with other reference factors or sequence (type or value) are important for practical application. Statistical treatments and analyses are running by SPSS.X.

Detailed Structure Map



THE COMPUTING AND PRINTING AMP COLOUR MAPS

As a consequent continuation of the computerized land use planning, the preparation of the colour map printings is carried out to accommodate for all necessary information.

In a first step, all relevant maps are merged to a new geometric file. After this the desired community based information must be selected. In using the stored element and community number one can also extract each geometric element (polygon, line, point).

The second step is an updating of the attributes of the resulting geometry in following the valuation diagram orders. Then the delimination lines between similar plots are dropped. In a next step, only these so weighted polygons are extracted and a covering shading computed (in the resulting map they will get the same colour).

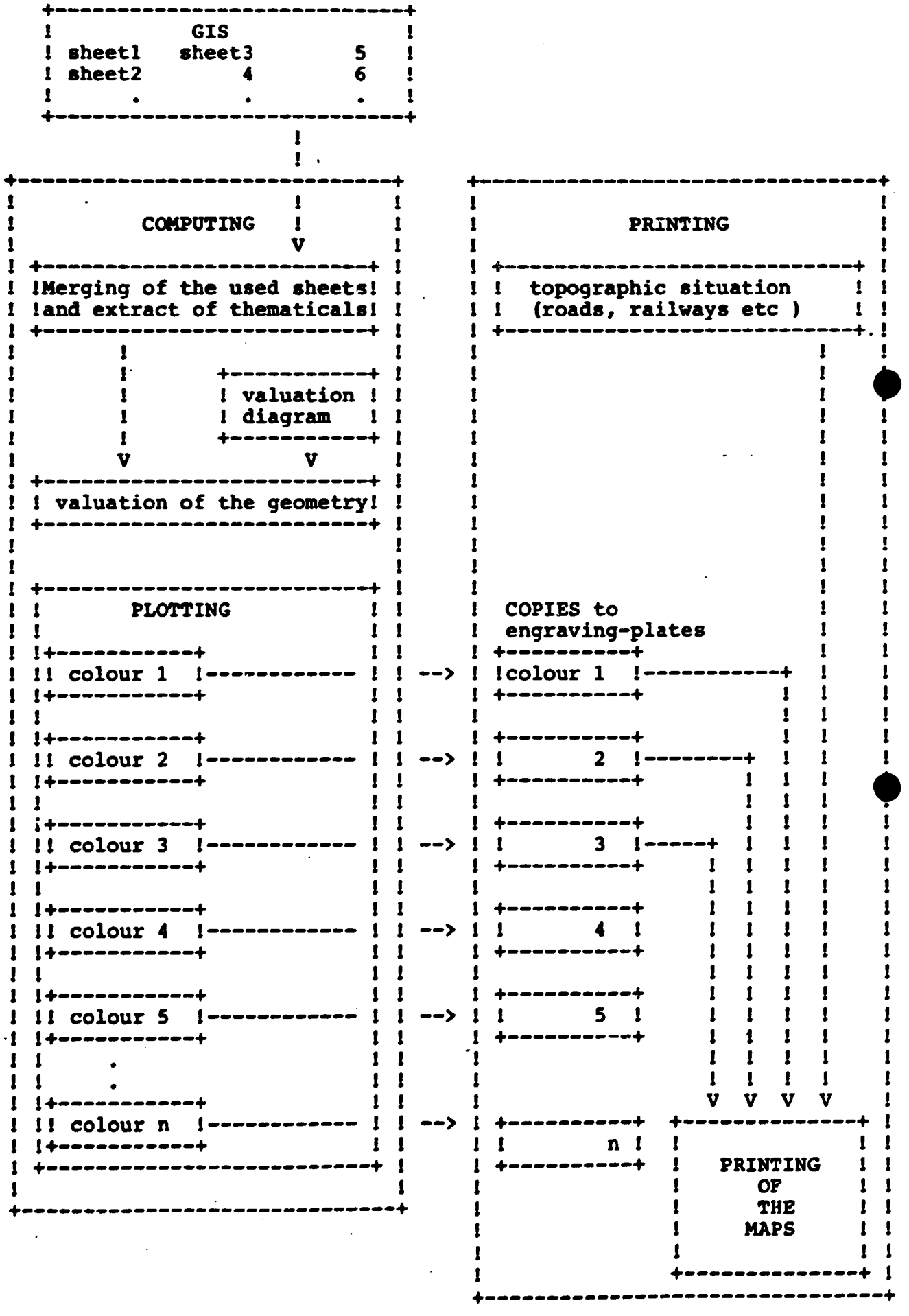
The polygon-files, figured out in this way, were plotted on a flatdeck plotter.

The basic material for plotting is a two-layered foil. With a tangential tool the colour layers are plotted with the computed shadings. Later on these results are directly copied onto the engraving plates for each colour. In case of the AMP-maps eleven different thematic plots must be engraved and copied.

A visual (manual) control between computed plots and printed maps is not necessary.

When compared with a common, manual orientated map production (i.e. = 100) the amount of costs are only 18%. Compared with a half automatic way, in using a peeling technology, respective percentage amounts 53 %.

MAP PREPARATION PROCESS



PROJECTS IN WHICH THE AMP-SOFTWARE HAS BEEN USED

- Master Study of Hydrological Topics in the Area of Danube-Main '78. As a contribution to this study, valley-sections were considered in order to determine the areas to be watered and to compute the amount of water needed in extrere dry years. Stored descriptive data and geometries of the AMP were used.

- Water Resources and Soil Potential Development Project New Valley, Arab Republic of Egypt, 1981/1982.

- MAB (Man and biosphere) Project 6: National Park Berchtesgaden. The problem of human impact on mountain eco-systems

- HAM (Biotop Mapping of Bavaria + Hessen) A survey of structures and species typical of the landscape to ensure genetic informations, in all of Bavaria.

- DSM (Detailed Structure Mapping) The purpose of DSM is the systematic coverage, evaluation and description of small scale landscape elements.

GEMIS: Konzeption und Ergebnisse

U. Fritsche, L. Rausch, K.-H. Simon

Das Öko-Institut bearbeitet z.Zeit zusammen mit der Forschungsgruppe Umweltsystemanalyse der Gesamthochschule Kassel das Projekt Gesamt-Emissions-Modell integrierter Systeme (kurz GEMIS), bei dem Umweltaspekte verschiedenster Energiesysteme analysiert und vergleichend gegenübergestellt werden. Bereits im früheren Beitrag »Energiesysteme im Umweltvergleich« wurde in den ÖKO-Mitteilungen (Heft 2/87) auf die Grundlagen bei umweltbezogenen Vergleichen näher eingegangen. Im folgenden werden Ergebnisse des kurz vor Abschluß stehenden GEMIS-Projekts dargestellt.

Das GEMIS-Programm

Kernstück von GEMIS ist ein eigens für die Umwelt-Simulation entwickeltes Computerprogramm. Der Programmablauf wurde folgendermaßen konzipiert:

Zu Beginn erfolgt die Definition von Brennstoffen (Kohle, Öl, Biogas usw.), im zweiten Schritt werden Energieanlagen definiert. Hierbei verstehen wir unter Energieanlagen einerseits alle Techniken, die zur Energiebereitstellung dienen (z.B. Heizungen, Solarzellen). Andererseits werden auch solche Systeme zu den Anlagen hinzugerechnet, die zur Bereitstellung der Brennstoffe benötigt werden (z.B. Kohlebergwerke, Öltanker usw.). Als Umweltaspekte werden gasförmige Schadstoffe, feste Reststoffe sowie Flächeninanspruchnahme erfaßt. Die Anlagen werden hierzu mit Emissionsdatensätzen versehen (SO_2-, NO_x-, Staub- und CO_2-Emissionen sowie Reststoffe und Flächenbedarf).
Dritter Schritt im Programmablauf ist die Definition von Szenarien. So können z.B. einzelne Heizsysteme wie Ölheizung, Stromheizung und Nahwärme einander gegenübergestellt werden, ferner lassen sich Szenarien für Stadtteile, Gemeinden, Landkreise, usw. eingeben. Auf diese Weise können die in einem Energiekonzept bestimmten Optionen mit unterschiedlichen Heizsystemen verglichen werden, wobei auch die Energiequelle »Energieeinsparung« berücksichtigt werden kann.
Ergebnis der Szenarien ist eine Bilanz für die im Emissionsdatensatz enthaltenen Umweltaspekte für die gesamten Prozeßketten.

Neben der Anwendung bei der Erstellung von Energiekonzepten kann GEMIS zur Energieberatung, Energieanlagen-Förderung sowie bei der Umweltverträglichkeitsprüfung von Energieanlagen eingesetzt werden.

Über die Emissionen hinaus

In der Regel sind die aus den Emissionen resultierenden Immissionen nicht zu betrachten, da einerseits die hierzu verwendeten Rechenmodelle umstritten sind, andererseits Immissionsanalysen, die auf einfachen Ausbreitungsrechnungen beruhen, in den Ergebnissen sehr unsicher sind.
In wenig vorbelasteten Gebieten außerhalb der Ballungsräume reicht es aus, bei den Emissionsbilanzen zwischen den lokal freigesetzten (»Standort«) und den überregional emittierten Schadstoffmengen zu differenzieren. Diese Unterteilung liefert grobe Hinweise auf die mit »vor-Ort«-Emissionen verbundenen Immissionen, die in überschlägige Be- und Entlastungsrechnungen eingehen können (ÖKO-INSTITUT 1988a).

Die oft aufgestellte Forderung, zwar Luftschadstoffe in den Mittelpunkt der Umweltanalyse zu stellen, andere Umweltaspekte aber nicht zu vergessen (z.B. EU LER 1987), können wir nur unterstützen. Hierbei sind insbesondere die Aspekte Boden- bzw. Flächenbelastung, feste Reststoffe, Gefährdung von Tier- und Pflanzenarten sowie Unfallrisiken zu beachten.
Das GEMIS-Programm übernimmt die Quantifizierung von festen Reststoffen sowie der Flächeninanspruchnahme auf allen Prozeßstufen. Diese Kenngrößen sind wegen Datenunsicherheiten allerdings als »weich« anzusehen und somit eher für qualitative Aussagen nutzbar.

Die oft verfolgte quantitative Einbeziehung von Risiken (z.B. verlorene Lebenstage je GWh) ist von Methodik und Datenlage her kontrovers, da

— praktisch alle Wirkungen (»Risiken«) auf den Menschen bezogen werden, wobei direkte gesundheitliche Aspekte dominieren, d.h. »Umwelt« wird anthropozentrisch definiert und so ein

großer Teil des Problems (z.B. bedrohte Arten) von vornherein ausgeblendet
- die Häufigkeit des Eintritts von Schäden umstritten ist (z.B. GAU)
- das Schadensausmaß unsicher ist, da die Faktoren zur Verknüpfung von Emissionen und Wirkung (z.B. Krebs durch Radioaktivität) eine große Bandbreite (bis Faktor 13) aufweisen
- die resultierenden Belastungen eine starke Variation zeigen (geographisch, sozial, zeitlich)

Daher wurde anstelle quantitativer Analysen im GEMIS-Projekt eine qualitative Einbeziehung der Risiken verfolgt. Ebenfalls nur qualitativ kann die Gefährdung von Tier- und Pflanzenarten behandelt werden, wobei hier eine starke Standort-Abhängigkeit auftritt, die Vergleiche erschwert. Solche qualitativen Umweltaspekte können vom GEMIS-Programm für die betrachteten Energiesysteme aufgezeigt werden, die Bewertung bleibt dem Nutzer überlassen.

Bewertung und Entscheidung

Die Ergebnisse des GEMIS-Programms liefern ein »Umweltprofil« für Energiesysteme — allerdings besteht dieses Profil aus Einzelwerten für Schadstoffe und Belastungen. Eine Gewichtung und Aggregation zu einem »Wert« ist nach unseren Ergebnissen nicht anzustreben, da die Methoden zur Aggregation einer kritischen Analyse nicht standhalten.
Ihre Aussagekraft zu ökologischen Wirkungen ist definitionsgemäß gering, da die zur Normierung verwendeten Immissionsbegrenzungen in erster Linie am Schutz der menschlichen Gesundheit orientiert sind und ökologische Wirkungen kaum abbilden. Für wichtige Schadstoffe wie CO_2 sind zudem keine Grenzwerte definiert, ebenso fehlen sie für krebserregende Substanzen, so daß die Methode der Aggregation und Gewichtung versagt.

Ergebnisse von Umweltanalysen sind daher unaggregiert den Entscheidern zu präsentieren. Die Entscheider müssen ihre eigenen Werturteile zur Gewichtung der unterschiedlichen Aspekte einbringen, die Umweltanalyse darf allein mit Sensitivitätsbetrachtungen helfen. Diese politische Dimension verlangt zudem, daß die Wertung im politischen Prozeß der Meinungsbildung zu diskutieren sein muß. Dennoch bleiben Fragen, die wissenschaftlicher Methodik zugänglich sind:
- welchen Entscheidungsspielraum gibt es?
- welche Voraussetzungen erleichtern eine Entscheidung?

Szenarienorientierte Entscheidung

Die Frage nach dem Spielraum dient der Klärung, welche positiven/negativen Beiträge zur Erfüllung von Zielen der Entscheider durch die Optionen geleistet werden. Die Klärung läßt sich unterstützen, indem Szenarien formuliert werden, die jeweils einen Zielbereich optimal erfüllen. Durch die Gegenüberstellung der Szenarien wird erkennbar, welche Optionen gegenüber mehreren Zielen positive Beiträge leisten, und ob es Optionen gibt, die robust und gegenüber mehrfacher Zielsetzung sind. Szenarien können den Entscheidungsspielraum ausloten.
Die szenarienorientierte Bewertung wird von einem Elektrizitätsversorgungsunternehmen in Seattle (USA) verwendet, um das zukünftige Mix von Stromerzeugungsoptionen zu bestimmen (SCL 1987). Ein deutsches Beispiel hierzu ist die Arbeit der Berliner Energie-Enquête-Kommission, die u.a. ein »ÖKO«-Szenario entwickelte.
Hier zeigt sich die Stärke von GEMIS: der Computer-Einsatz erlaubt es, schnell solche Szenarien zu entwerfen und verschiedene Gewichtungen »durchzuspielen«, sogar im direkten Dialog mit Entscheidern!

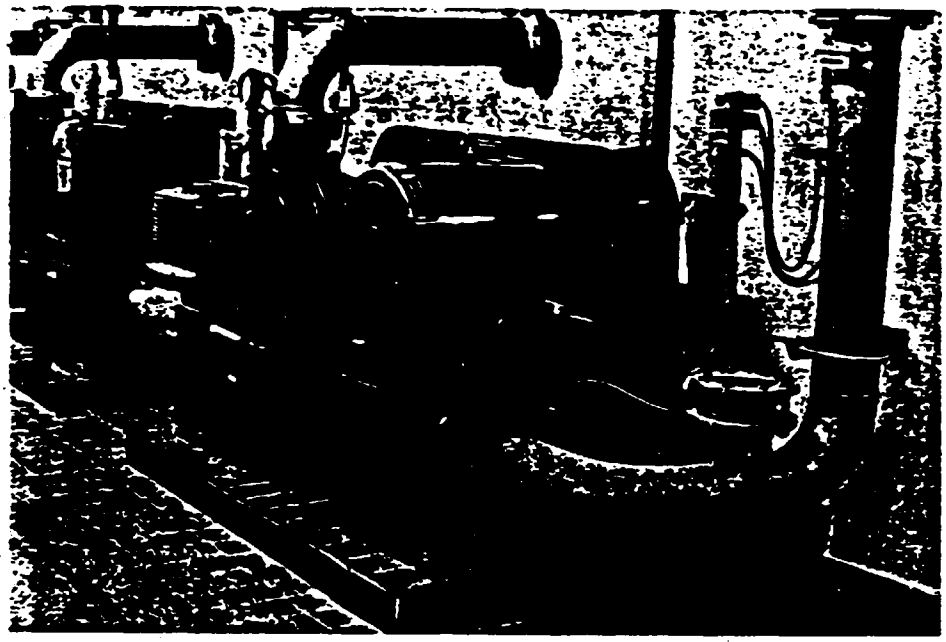
Vorbedingungen als Hilfe zur Entscheidungsfindung

Darüber hinaus kann durch Festlegung von geeigneten Vorbedingungen die Vielfalt der Umweltprobleme reduziert und so die Entscheidung erleichtert werden. Die Idee ist dabei, nicht etwa Aspekte zu ignorieren, sondern Umweltaspekte durch Minderungsmaßnahmen und Nutzungsschranken so weit zu reduzieren, daß sie nicht mehr entscheidungsrelevant sind.
Dies bietet sich besonders für qualitative Umweltaspekte der regenerativen Energien sowie der Energieeinsparung an:
- Bei der Biomasse-Gewinnung dürfen nur Flächen ohne Erosionsgefahr und (Grund)Wasserprobleme genutzt werden. Weiterhin ist der Biomasse-Entzug auf die Menge zu begrenzen, die das jeweilige Ökosystem ohne nachhaltigen Nährstoffverlust anbietet.
- Solaranlagen (thermisch und elektrisch) sind vorrangig auf schon genutzten Flächen (z.B. Dächer) zu installieren. Standorte dürfen nicht zu

Gefährdungen der Tier- bzw. Pflanzenwelt führen, sondern sind im Gegenteil als Biotope zu gestalten (STOY 1987)
- Umweltrelevante Einsatzstoffe für stromsparende Geräte (z.B. FCKW-Kältemittel in Kühlschränken, Quecksilber in Leuchtstoff-Lampen) sind zu rezyklieren, Materialien für Maßnahmen zur rationellen Energienutzng dürfen keine Gefährdung der Nutzer (z.B. Asbest, PU-Schäume) hervorrufen.

Zum einen wird durch diese Vorbedingungen das technisch-wirtschaftliche Potential der Ressourcen reduziert, zum anderen kann das verbleibende Potential als »generell umweltfreundlich« bewertet werden. Durch die Ausdämmerung wird also erreicht, wichtige qualitative Aspekte aus der Bewertung herauszuziehen und damit die Bewertung zu vereinfachen.

Die gleiche Methode kann auch bei quantitativen Umweltaspekten zur Erleichterung der Entscheidung dienen: z.B. kann eine Energieoption wenig SO_2, dafür aber hohe Reststoffmengen abgeben und eine andere wenig Reststoffe, dafür aber viel SO_2. In solchen Fällen ist zu prüfen, ob nicht durch Minderungsmaßnahmen diese Gegenläufigkeit soweit verringert werden kann, daß eine Option robust gegenüber dem Ziel einer Minimierung von SO_2 und Reststoffen ist.
Somit ist die umweltbezogene Bewertung von Energiesystemen kein »Einmal-Durchlauf«, sondern ein rekursiver Pro-



zeß, der mit EDV-gestützten Instrumenten wie dem GEMIS-Programm sinnvoll gestaltet werden kann.

Erste Ergebnisse

Im folgenden werden die bisherigen Ergebnisse unseres Projekts zusammengefaßt, wobei hier »Standard«-Daten zugrunde liegen, d.h. im Einzelfall sind diese Daten den konkreten Bedingungen anzupassen. Die Resultate werden summarisch erläutert, Einzelheiten gibt die Literatur (ÖKO-INSTITUT 1989b).

Rationelle Wärme- und Stromnutzung
Am umweltverträglichsten sind alle Energieoptionen, die zur rationelleren Nutzung von Endenergien (Strom, Treibstoffe...) führen. Der Grund hierfür liegt darin, daß die mit der Herstellung der Komponenten (Dämmaterialien, Elektronik usw.) verbundenen Emissionsmengen gegenüber den eingesparten vermeidbaren gering sind, wenn moderne Herstellungsverfahren eingesetzt und anfallende Reststoffe minimiert/rezykliert werden.
Ohne diese Voraussetzungen sind auch Optionen zur rationellen Energienutzung nicht per se umweltfreundlich. Vielmehr ergibt sich dann als Problem, die Umweltaspekte der Maßnahmen gegenüber denen der eingesparten Energieträger zu bewerten, was nicht generell möglich ist.

Konventionelle Heizsysteme
Ausgehend von modernen Anlagenkonzepten wurden im GEMIS-Projekt typische Zentralheizsysteme vergleichend analysiert.
Bei herkömmlichen Heizsystemen emittieren gasbetriebene Systeme die wenigsten Schadstoffe und weisen auch bei anderen Umweltaspekten die geringsten Belastungen auf. Hierbei verursachen Gas-Gebläsebrenner, die sogar mit NO_x-Katalysatoren erhältlich sind, die geringsten Umweltbelastungen. Ölheizungen bilden das Mittelfeld, sie emittieren mehr SO_2- und CO_2 als Gassysteme und weisen auch höhere NO_x- und Staubwerte auf. Nachtstrom-Heizungen werden überwiegend mit Strom aus Steinkohlekraftwerken betrieben, daher sind die Emissionen deutlich höher als bei Öl- und Gasheizungen (vor allem bei NO_x, Staub, CO_2), auch die Reststoffmengen sind drastisch höher. Sollten zukünftig Atomkraftwerke Heizstrom bereitstellen, sinken zwar die »klassischen« Emissionen, dafür muß aber das Unfallrisiko berücksichtigt werden. Weiterhin verschärft sich das Reststoffproblem wegen der ungelösten »Entsorgung« des Atommülls, sodaß die Umweltbeurteilung des elektrischen Heizens nicht besser wird.

Am schlechtesten schneiden Kohle-Heizungen (Stein- und Braunkohle-Brikett) ab, ihre Emissionen sind nochmals höher als die der Stromheizung. Hinzu kommen erhebliche Mengen an krebserregenden Stoffen, die in niedriger Quellhöhe abgegeben werden. Dies spricht dafür, Heizungen nicht mit fossilen Festbrennstoffen zu betreiben (ÖKO-INSTITUT 1987).

Kraft-Wärme-Kopplung
Gegenüber konventionellen Heizsystemen sind Anlagen mit Kraft-Wärme-Kopplung (KWK) aufgrund der rationelleren Energienutzung in der Regel weniger umweltbelastend. Deshalb ihr verstärkter Einsatz z.B. vom Sachverständigenrat für Umwelt nachdrücklich gefordert wird (SRU 1987). Diese Aussage bedarf jedoch einer Differenzierung:

- KWK-Anlagen zur Nutzung von Kohle sind nur dann emissionsseitig günstig gegenüber konventionellen Heizsystemen, wenn sie mit leistungsfähigen Abgasreinigungssystemen ausgestattet sind. Dies gilt üblicherweise nur für große Heizkraftwerke (HKW) über 300 MW_{th} Feuerungswärmeleistung. Beim Einsatz modernster Emissionsminderungstechnik sind dagegen alle HKW-Systeme als umweltfreundlich gegenüber normalen Heizsystemen zu bezeichnen. Kohle-HKW erreichen geringere CO_2-Emissionen je Nutzwärmeeinheit als selbst Gasheizungen, und auch die Netto-Reststoffmengen liegen im Bereich der bei Gas- und Ölheizungen.

- Kleinere KWK-Anlagen, sog. Blockheizkraftwerke (BHKW), nutzen meist Erdgas als Brennstoff, womit geringe SO_2-, Staub- und CO_2-Emissionen erreicht werden. Dafür erzeugen Gasmotoren und Gasturbinen z.T. sehr hohe NO_x-Mengen, die durch Entstickungsmaßnahmen stark gesenkt werden müssen, um in den Bereich anderer Systeme zu kommen. Am Standort der Anlagen sind die NO_x-Emissionen üblicher BHKW etwa 5 mal höher als bei Gas- oder Ölheizungen, woraus bei hoher Vorbelastung Immissionsprobleme resultieren können. Unter Einrechnung der Stromerzeugung liegen die NO_x-Werte dagegen im Bereich der Gasheizungen. Beim Einsatz modernster Emissionsminderungstechnik (3-Wege-Katalysator) können Gasmotor-BHKW trotz Stromerzeugung sogar am Standort geringere NO_x-Werte erzielen als Gasheizungen und so zu drastischen Immissionsverbesserungen führen. Da Gas-BHKW auch bei anderen Umweltaspekten (Reststoffe, Schwermetalle, Flächenbedarf) extrem geringe Belastungen zeigen, sind sie unter fossil betriebenen

Energiesystemen die ökologisch günstigsten.

— BHKW auf der Basis von Dieselmotoren dagegen können trotz guter Energieauslastung nur mit extrem aufwendigen Maßnahmen (SCR-Entstickung, Rußfilter) vergleichbar niedrige Schadstoffwerte erzielen, wobei solche Minderungsmaßnahmen aus ökonomischen Gründen nur bei Großanlagen (Größenordnung 5 MW_{el}) sinnvoll sind. Kleine Diesel-BHKW sind daher aus Umweltsicht z.Zt. nicht attraktiv.

Regenerative Energien

Im Vergleich zu fossil betriebenen Energiesystemen sind regenerative Energiequellen generell umweltfreundlicher (OECD 1988), da Solar-, Wind- und Wasserkraft praktisch keine direkten Schadstoffabgaben aufweisen.
Unter den o.g. Voraussetzungen und Nutzungseinschränkungen sind diese Energiesysteme, neben rationeller Energienutzung, die wirklich umweltfreundlichen Systeme, da auch qualitative Umweltaspekte im Vergleich zu fossilen Energieanlagen gering sind. Selbst die Einbeziehung der bei der Herstellung der Energiewandler freigesetzten Emissionen ändert diese Beurteilung nicht.

Bei Systemen zur Nutzung von Biomasse (Holz, Stroh, Biogas) hängt die Beurteilung dagegen stark vom jeweiligen Nutzungssystem ab. Während Biogas — nach Entschwefelung — ein emissionsarmer Brennstoff ist und sein Einsatz in Gasmotoren umweltseitig positiv wirkt, führt die direkte Verbrennung von Stroh und Holz in konventionellen Einzelöfen zu hohen Schadstoffbelastungen. Wird Holz und Stroh dagegen in modernen für diese Brennstoffe konzipierten Feuerungen oder Heizwerken eingesetzt, ist ein umweltfreundlicher Betrieb im Vergleich zu fossilen Brennstoffen möglich. Günstig ist Biomasse generell hinsichtlich CO_2, da die bei der Verbrennung freigesetzte CO_2-Menge der beim Pflanzenwachstum eingebundenen CO_2-Menge entspricht (keine Netto-Emission), und nur geringe Schwermetall-, Halogen- und Reststoffbelastungen auftreten.
Diese Ergebnisse gelten für die Nutzung von Restbiomassen (Waldrestholz, Reststroh, tierische Exkremente), nicht aber für sog. Energieplantagen — hier kommen andere Umweltaspekte ins Spiel, die derzeit nicht abschließend zu beurteilen sind.
Abgegrenzt werden muß die Beurteilung der Biomasse auch gegenüber der Verbrennung von Reststoffen wie Haus- oder Gewerbemüll, da hier die Belastungen in der Regel höher sind und andere — z.T. extrem toxische — Schadstoffe emittiert werden. Die energetische Beurteilung der Müllverbrennung ist daher ungünstig (ÖKO-INSTITUT 1988) — ihre Beurteilung muß vielmehr im Rahmen von abfallwirtschaftlichen Alternativen erfolgen.

mit Porto anbei 25.6.

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Autoren

Uwe Fritsche, seit 1982 Mitarbeiter im Energiebreich (Büro Darmstadt), Projektleiter für GEMIS, Schwerpunkte: Umweltaspekte und (Energie)Modellfragen

Lothar Rausch, seit 1987 Mitarbeiter im GEMIS-Projekt, z.Zt. tätig am WZ III der GH Kassel, Schwerpunkte: Software-Entwicklung und Stromnetz-Fragen

Dr.Karl-Heinz Simon, Mitarbeiter der Forschungsgruppe Umweltsystemanalyse an der GH Kassel, Schwerpunkte: Planungs- und Bewertungsmethodik, EDV-Hochsprachen (Künstliche Intelligenz)

Lothar WINKELBAUER

IIASA
International Institute for Applied Systems Analysis □ A-2361 Laxenburg □ Austria
Telephone: (0 22 36) 715 21 * 0 □ Telex: 079 137 iiasa a □ Telefax: (0 22 36) 71313

Advanced Computer Applications (ACA)

Abstract

The ACA project integrates several completely externally funded research and development projects in the field of model-based decision support and applied Artificial Intelligence (AI). The project's results are customized software systems, implemented at client institutions, as well as more general methodological contributions. The intended users of the results, other than the well-defined clients and sponsors, are decision and policy makers and their technical and scientific advisers at the level of international, national, and regional institutions, governments as well as industries.

Issue and Project Objectives

The problem addressed here is the gap between the ever increasing complexity and volume of scientific and technological information relevant to large socio-technical and environmental systems, and the information requirements at a strategic planning and policy level.

The objective of the project is to help bridge this gap with a new generation of intelligent information and decision support systems by taking advantage of the rapid developments in computer technology. These systems integrate methods and approaches of operations research and applied systems analysis with elements of AI and advanced information and computer technology. The project's easy-to-use software tools are designed to provide direct and interactive access to a large volume of information and the powerful methods of scientific analysis for planners and policy makers.

IIASA's Advantage

IIASA has extensive experience in fields such as environmental systems analysis, technology assessment, risk analysis, and decision support methodology. ACA's integrative research and software development is based on the Institute's rich set of results from numerous past and ongoing projects and its extensive and worldwide network of collaborators, adding a broad international perspective to the research approach.

Approach and Activities

With the computer (dedicated graphics and AI workstations) as the central tool, the approach can be described as knowledge engineering and rapid prototyping in a number of client-specific studies. The methodologies employed span the whole range from traditional algorithmic approaches of mathematical programming to new and emerging techniques of AI. They are combined and integrated in an entirely problem-oriented and eclectic methodological pluralism.

The individual externally-funded tasks and sub-projects (see below) are tightly interwoven. The project team works on all tasks more or less simultaneously to exploit the high degree of synergism created by the careful selection of the project portfolio.

Current application areas include:

- technological risk assessment, transportation risk/cost analysis
- hazardous substances and waste management
- water quality and groundwater management
- environmental impact and ecological risk assessment
- regional development planning and resource management.

The development work on these externally-funded applications is used as a vehicle for parallel methodological research.

Current research topics include:

- hybrid (symbolic-numerical) information and decision support systems
- model integration, aggregation, and multiple problem representation
- approximate and symbolic simulation
- user interface technology, interactive graphics
- automated knowledge acquisition and machine learning.

Current Activities

- Under contract to the City of Hannover, FRG, ACA is designing an *environmental information system* for planning and management tasks. Funded by the Federal Ministry for Research and Technology (BMFT), the study involves a large number of research groups and departments in the City's administration in an attempt to develop and implement an information and ultimately decision support system for the routine use by the City of Hannover. The system is to treat all environmental media, and land use, and should consider aspects of spatial planning, with the objective of enhancing current planning and management procedures so as to facilitate ecologically oriented urban planning.

- Under contract to the Dutch Ministry of Housing, Physical Planning, and the Environment (VROM), an *interactive, graphics-based intelligent interface* to a large *fault-tree analysis and consequence modeling system* is being developed, which is applied to problems of industrial risk and hazardous substances management in Netherlands. This project continues and extends, in a specific Dutch case study, the development of *decision-oriented software for the management of hazardous substances and industrial risk*, sponsored by the Commission of the European Communities' Joint Research Centre (JRC), Ispra, Italy. The current phase concentrates on accidental spills of toxic materials.

  A further extension consists of the inclusion and display of noise-related data in the above framework, including adaptation of path generator and railway data, coupling with the dutch railway noise data base, and extensions on retrieval, display, and plotter support.

- In collaboration with the University of Colorado (CU), and sponsored, through CU, by the US Bureau of Reclamation, the US Environmental Protection Agency (EPA), and the United States Geological Survey (USGS), the project on *Intelligent Decision Support for Natural Resources Management* and a project on *Advanced Decision Support Systems for River Operations in the West* are continuing. The current project phase concentrates on hybrid decision support tools for the analysis of complex alternatives.

- The Austrian research foundation Fonds zur Förderung der wissenschaftlichen Forschung has sponsored a project on *Automatic Learning in Expert Systems*. The aim is to develop new hybrid concepts and approaches in machine learning and their test implementation in an operational expert system, with automated knowledge acquisition during operation, and conversational data and knowledge acquisition supported by dynamically updated meta-rules.

- A set of software tools for *Urban/Industrial Air Quality Management* (regional and local) designed for local authorities, city administrators or large industrial enterprises is currently under development, featuring an extensive information system on pollution sources, environment affected, etc.

- Under contract to an international river basin authority in Bangkok, Thailand an *Expert System for Environmental Screening* is under design. The system will allow for interactive rule based environmental impact assessment, combining qualitative and quantitative reasoning techniques with databases and geographical information display.

- In collaboration with REGINFORM Ltd., Miskolc, Hungary, a *Regional Development Information- and Decision Support System* for the Miskolc area will be implemented. The system will draw on software tools and experiences acquired during the development of the *Expert System for Integrated Development*, in a case study of China's coal-rich Shanxi Province, PRC, such speeding up development and extending the applicability of the developed tools.

Expected Results

The major results of the projects are available in the form of operational computer software, installed at client's institutions. While these products are specific and customized software systems, the approach and the building blocks of ACA's developments are general and can be reused, reconfigured and extended for a large number of similar applications. In addition to software documentation and related reports to the funding agencies, ACA's research results have been presented at numerous international conferences, as invited lectures, keynote speeches and software demonstrations.

External Collaborators, Clients and Sponsors

* City of Hannover, FRG (funded by the Federal Ministry for Research and Technology, FRG)

* Ministry of Housing, Physical Planning, and the Environment (VROM), Leidschendam, Netherlands

* City of Vienna, Environmental Protection Division (MA22)

* Center for Advanced Decision Support for Water and Environmental Systems, University of Colorado, Boulder, Colorado, USA

* United States Bureau of Reclamation, Division of Water and Land Technical Services, Denver, Colorado, USA

* United States Environmental Protection Agency, Environmental Research Laboratory, Athens, Georgia, USA

* United States Geological Survey, Water Resources Division, Denver, Colorado, USA

* Institut National de Recherche sur les Transports et leur Sécurité (INRETS), Arcueil Cedex, France

* Fonds zur Förderung der wissenschaftlichen Forschung, Vienna, Austria

* REGINFORM Ltd., Miskolc, Hungary

- State Science and Technology Commission of the People's Republic of China (SSTCC), Beijing, PRC
- Science and Technology Commission of Shanxi Province, Taiyuan, Shanxi Province, PRC
- Delft Hydraulics Institute, The Netherlands
- National Physical Planning Agency, Zwolle, The Netherlands
- Systems Research Institute, Polish Academy of Sciences, Warsaw
- Institute for Control and Systems Engineering (ICSE), Academy of Mining and Metallurgy, Cracow, Poland
- VITUKI, State Water Research Institute, Budapest, Hungary

The above institutions marked with * provide direct monetary or manpower support.

DISTRIBUTION OF INDUSTRIAL PLANTS AND THEIR INFLUENCE ON ENVIRONMENT

V.S. Mikhalevich, A.A. Bakaev

V.M.Glushkov Institute of Cybernetics,
Academy of Sciences of the Ukrainian SSR,
252207, Kiev 207, USSR

Rational distribution of productive forces is one of the most important factors for ecological problems solution in a country as a whole and also in its separate regions. This provides the efficient system approach to the use of the natural resources and the optimal conditions for population dwelling, and is of the great significance for ecologization of social production. In the USSR, the search for the trends of solution of ecological problems stipulated by the consequences of development and siting of large industrial plants in the country's regions cultivated by economic activity, and by the results of the planned programs realization for new equipment and technologies implementation, is conducted at the "stage of strategic design", i.e., at the stage of forecasting performed while designing the regional schemes of development and distribution of productive forces for the periods of 20-30 years. One of the central moments in methodology of working out of territorial forecast schemes is estimation of the influences of industrial plants under conditions of the restricted possibilities of the further growth of industrial potential in a long ago cultivated regions with already too high a level of technogenic load on biophysical environment (such a region, for example, as the Ukrainian SSR).

This estimation implies the process of determination and forecasting of the influence, exerted by an industrial plant being stationed (reconstructed) or a group of plants on territorial resources and region-wide resources, including the impacts on the social and industrial

infrastructure of the territory, biophysical environment, health of population, etc. And ce, the discussion should be concerned with prediction of the essence and intensity of a certain spectrum of principal effects: qualitative and quantitative, positive as well as negative ones.

Any effects of industrial plants are classified among the technogenic impacts, the latter may be of premeditated, i.e., envisaged by technology character and non-premeditated (for example, emergency situations). Due to a large scale of industrial plants' impact on the natural resources, these effects may be of local, regional and even global character, in a number of cases this is a decisive factor for the choice of a territory's rank within the boundaries of which the peculiar effects should be investigated in a forecast methodology of stationing.

During various time periods the force and the manner in which technogenic impacts manifest themselves can vary. Many of them last during the entire period of a plant's operation, and some remain even after its term of service had expired (negative effect of the consequence). Hence the necessity arises for investigating and evaluating the impacts with due regard for the dynamic nature of their manifestation. Solving the distribution problems, the estimate should actually include the medium-term as well as long-term forecasts related to construction period and the complete term of an industrial plant service, the aftermath period, inclusive. Moreover, any industrial process associated with utilization of the primary natural resources (for example, water, land, atmospheric air) is of a dual nature: on the one hand, their quantitative use, and on the other hand, their usage as "natural reservoirs" for heaping and storage of production wastes, which brings about the change of qualitative parameters of the state of biophysical environment components. So it is necessary for estimation of the spectrum of influences to include the forecasts not only of quantitative but also of qualitative impacts on the environment, paying attention to dynamic

nature of their manifestation. It is worth noting that just qualitative influences (due to insufficient knowledge about the processes occurring in biophysical environment as a result of its pollution with different ingredients) feature most often (as compared with other influences) the uncertainty in forecast estimates during distribution problems solution.

Evaluation of impacts implies the necessity to study the influence exerted by industrial plants on various types of production structure and also forecasting of impacts with drastically displayed social character. Influence of economic-social impacts is exercised by a number of channels related to the necessity of enlisting additional manpower to the given territory, expanding its social infrastructure. Social impacts group includes also the influences caused by industrial plants on the health and safety of population, additional effects exerted by population over the environmental components, i.e., accumulation of domestic wastes, personal transport, etc.

The other but no less significant moment in methodology of evaluation of influences during solution of forecasting problems of distribution resides in the necessity to evaluate the total impacts of industrial plants when they are distributed in groups over a limited territory. In this case, despite the preferability of constructing and operating of industrial plants with minimum expenses, the problem is to prevent the excessive group influence on the environment and to meet the established standards for its qualitative state. The solution of this problem necessitates the search for possible ways of reducing the negative complex influences caused by a group of industrial plants as a consequence of their rational territorial localization.

Fig.1 shows the schematic diagram of interrelations accounted for when making forecasts of impacts by industrial plants in the process of solution of tactical distribution problems. The figure shows direct as well as feedback relations stipulated by quantitative and qualitative

interactions among individual elements of a local ecologic-economic system.

In the general case, estimation of possible impacts by industrial plants during solution of forecast problems of distribution is based on system investigation of technological, energetic, ecological, social-economic and economic factors (with due regard fo public opinion) determining the most important aspects in the process of substantiation of solutions concerned with distribution of industrial plants in a country's region involved in economic activity.

The group of technological factors includes: a factor of waste-free technology characterizing the amount and qualitative composition of wastes; factors determining various technological possibilities of the accumulated wastes utilization; factors of interaction between the basic and utilization technologies; a number of derivative technological factors associated with a plant's need in natural, labour, material, energetic resources. The group of energetic factors includes the factors associated with active regional policy of technological energy saving: implementation of energy saving technologies, combination of productions, choice of economical types of energy carriers for industrial production processes, utilization of the recycled power resources (RPR) and other energetic factors stipulating essentially the energetic influence of an industrial plant on biophysical environment. The social-economic group treats the factors of health and safety of population, provision of a concrete territory with labour resources, house-building and creation of social, cultural and everyday facilities infrastructure, accumulation of house-hold wastes and their impacts on quantitative and qualitative parameters of the natural resources. In the group of economic factors, the analysis embraces: economic estimates of availability and costs of various natural resources, expenditure on creation and operation of the primary and utilization technology capacities, creation

of projects with different production and social, cultural and everyday life infrastructure, expenditure on water supply and water disposal, engineering development of a territory, expenses on labour (payment inclusive), material and power resources, transport expenses of various kind, estimates of economic damage (payment for the environment pollution) owing to industrial and house-hold wastes, estimates of agglomeration effect due to siting of industrial plants in groups over the territory being considered, etc.

The group of ecological factors includes, first of all, the factors characterizing the availability of the natural resources in a region and the efficiency of a system for their utilization by an industrial plant. When investigating the quantitative impacts of industrial plants (and population) on land resources, it is necessary to take into account the factors determining the differences among the latter with respect to their purpose and conditions of cultivation, i.e., the territories allotted to industrial and civil construction, and also possibilities to apportion the plots of various categories depending on the level of expenditure on the site development and the measures taken for its engineering preparation. Different variants of organization of water supply (water intake without regulation of surface water sources, construction of water reservoirs with the aim to replenish the water reserve, making use of underground water, etc.) are considered which are characterized by different levels of water intake and expenditure on the systems of water supply. Similarly, by conditions of water disposal, in each particular case the variants are discussed of direct throwing off the sink flows into reservoir, conservation of sink flows with subsequent draining into the high water, long-term conservation, etc., which differ from one another by the level of expenses on organization of water disposal systems.

The direct qualitative influence is also exerted by a situated or

reconstructed industrial plant on such a resource as atmospheric air. In modern conditions of industrial development, there is observed the intensive use of oxygen from atmospheric air for technological needs, stipulated by the processes of burning of organic fuel, enrichment of the blast by oxygen, etc. Among these should be included the effects caused by the large energetic objects (for example, nuclear power stations (NPS), hydroelectric power stations (HPS)) upon local climate conditions with regard to possible formation of heat islands in atmospheric air due to large NPS capacities concentration over a limited area, water-cooling towers' work, ecological influence of water areas (in case of HPS and hydroelectric pump storage power stations (HPPS)), etc. Nowadays, quantitative impacts of industry on atmospheric air as well as on the other types of natural resources can be reduced in our country only by way of transformation towards correlation of the efficient administrative and economic measures for controlling the environment protection. Within the system of economic measures the most important are the measures defining the payment for the use of natural resources. Naturally, the payment fixed for the natural resource being used should reflect the damage experienced by the national economy as a result of losing this resource.

In the USSR, the most widely spread method of economic estimate of the natural resource is the method based on the value of the effect obtained with the use of this resource. The use of any estimated unit of the natural resource saves the national economy from the necessity to involve yet nonengaged resources into economic circulation. In the general case, economic estimate $Э_р$ for the considered resource type is determined as difference $Э_р = Ц_р - З_р$ between the shadow $Ц_р$ and individual expenses $З_р$ per unit of the national resource. From theoretical viewpoint the value of $Э_р$ represents the potential differential rent return brought in by a unit of the given resource type owing

to the better natural conditions as compared to the same type of resource with the maximum admissible for the national economy level of expenditure. The higher is the economic estimate of the national resource, the more valuable it is, and the more damage to the national economy is caused by its loss. The natural resources of the Ukrainian SSR (land, water, in particular) are characterized by the high level of economic estimates for these resources in various regions of the republic. It is expected that the value of the natural resources in the Ukrain will dras tically grow. The economic estimates for lands and water resources will increase two times by 2000 (as compared with the current estimates).

The extensive group of factors to be investigated during solution of forecast problems of distribution is represented by the factors associated with qualitative state of biophysical environment in a region of an industrial plant siting. Estimation of qualitative indices of the environment condition on the basis of harmful substances ejection into atmospheric air, water source, land comprises rather a complex highly undeterminate forecast problem. The process of its solution takes account of such a factor, first of all, as background pollution of biophysical environment components brought about by impacts of industrial facilities in operation in long-ago cultivated regions, transport, population and other types of anthropogenic activity. When all available technologic means preventing the detrimental effects of an industrial plant are exhausted, background pollution of biophysical environment may prove to be the primary factor determining inadmissibility of new construction on the reserved territory or regulating the power of an industrial plant being reconstructed. As far as the environment pollution results from the joint action of a number of harmful substances inherent in a composition of efflux, so this fact stipulates the necessity of taking account of factors of detrimental action additivity from

several contaminants, the antagonism and synergism phenomena when the joint effect of the respective contaminants in effluents into water, air, land is present. Solving the problems of the joint siting of the group of industrial plants over a particular area, these factors connected with possible interactions among different contaminants in biophysical environment should be subjected to careful analysis, since the most efficient method to fight pollutions is to prevent their action just at the stage of the siting problem statement.

Using modern technologies, industrial enterprises cause "non-uniform qualitative effect on various components of biophysical environment. The data of table 1 give the idea of the character of "advantageous qualitative impact", this table shows the classes of industry branches with respect to their influence on the environment. For example, with the modern engineering level of products output at ferrous metallurgy enterprises of the republic, production of 1 ton of rolled stock is accompanied finally by outbursts of 45 Kg of dust into atmospheric air, 95 Kg of carbon monoxide, about 13 Kg of sulphur oxide, 5.5 Kg of nitrogen oxide and approximately 1.7 Kg of other harmful substances per a ton of rolled stock.

Effluents of cotton industry contain: caustic soda - 632.6 mg/l ; sulphuric acid - 31.2 mg/l ; sulphuric sodium - 110 mg/l ; magnesium chloride - 51.7 mg/l, etc.

Owing to storage of solid wastes and also migration of harmful substances from other media, the maximum pollution of soil and plants by iron, manganese, titanium is observed near industrial plants within the limits of 1 km ; by calcium, magnesium, phosphorus - within the distance up to 3-5 km. The most quantity of sulphur (up to 69 mg per 100 g of soi is accumulated in the upper layers on the depth of 60cm and at the distance of 0.5-5 km from the sources of outbursts. Stability of retaining the harmful substances in the soil which pertain to the first class of

danger (heavy metals, such as mercury, arsenic, selenium, etc.) makes up 12 months; to the second class of danger (cobalt, vanadium, boron, nitrogen fertilizers, etc.) - 6-12; to the third class of danger (compounds of lead, zinc, copper, petroleum products, etc.) - less than 6 months, this fact stipulates their accumulation with time in the given component of biophysical environment.

This data confirm the fact that the applied technologies operating in open-loop cycle are so powerful source of harmful wastes formation that even accelerated development of utilization technologies cannot prevent (can only weaken) a harmful qualitative influence that these wastes exert upon various components of the environment.

Of great importance during investigation of distribution problems with consideration for interaction of economic and natural processes and phenomena become the factors characterizing the regenerative ability of biophysical environment components and also their interactions which bring about the changes in the condition of the environment. It should be noted that the predicted state of the environment cannot be considered only as a function of contaminants concentrations contained in it. Here the great significance acquires also the problem of investigating the path (trajectory) which led the environment to this state. It is necessary to evaluate how far the given state lies from the critical one, when irreversible consequences may take place in the environment. Hence, the principal conclusion actually transpires concerned with the difference in consequences caused by the same contaminants concentrations occurring in the environment which is characterized by different prehistory of conditions alternation. It should be added here that evaluating the state of the environment, it is necessary to include into the estimate the notion of desirability, admissibility and usefulness of the given state of the environment for a human being.

At present, the only active administrative measure in the USSR

Table 1

I group	II group	III group	IV group
Miscellaneous effects on environment(air & water pollution,noise, etc.)	Considerable pollution of air in the main	Considerable pollution of water in the main	Considerable deterioration of land in th main
1	2	3	4
Chemical industry (primary) Ferrous metallurgy Synthesized fibre production Plastic material production Sugar refining industry	Thermal power stations Non-ferrous metallurgy Cement production Oil-refining Cake and by-product process	Wood-pulp & paper industry Nuclear power stations Dairy & meat industry Oil production	Open-cast coa mining industry Industry of non-ore build ing materials

capable of limiting the qualitative influence of industry on biophysical environment is the established system of sanitary norms of maximally admissible concentrations (MAC) of contaminants in atmospheric air, wate ground. The norms of maximally admissible emission (MAE) nf contaminant in atmosphere and of maximally admissible effluents into water sources were accapted on the basis of MAC. However, despite regulations of the pollutions the established norms are often violated, i.e., administrative measures are quite insufficient for restriction of qualitative impacts of enterprises on the environment. So the system of economic measures for control and protection of the environment quality adopted by the government and the local authorities foresees to impose the tax on emissions and effluents of contaminants by industrial enterprises and other plants. This tax system envisages the payment for emission of detrimental substances along with keeping strictly to MAE norms and fixes the progressive tax for the cases when these norms are transgressed. In prir

ciple, the taxes on contaminants efflux should be fixed with respect to economic damage to the environment and the national economy as a result of qualitative impacts of industrial enterprises. However, in some cases this principle is practically difficult to observe since despite the substantial progress in the development and application of the economic damage estimates in the specific analysis, still a lot of questions concerned with identification of these estimates remain insufficiently studied and poorly developed. This situation holds true for the methods of estimation of a totality of social consequences in the result of environmental pollution, of the losses of unique, non-restorable natural resources. It is not simple to estimate a number of other manifestations of damage the estimation of which by a principal methodical approach is sufficiently clear. For example, the damage in the result of heat air and water pollution, radiation, the pollution of soil by various ingradients, etc. It is evident that without regard for the estimates of the damage incurred by all qualitative and quantitative effects of an induatrial plants no decision made with respct to its siting (or power increase) in a develpped region can be sufficiently proved.

To work out substantiated recommendations as to the development and siting of industrial plants in the process of making forecasting terriotorial schemes of development and distribution of productive forces an expert-simulation system is developed which incorporates ecological-economic models of forecasting the influence of industrial plants as central simulation units. This system also comprises optimization models solving the problems of substantiating combined rational variants of development and distribution of industrial plants in a region with the acount of restrictions on a number of factors of

production and possibilities of the use of region-wide resources. The implemented blocks of the system have been used to study effects of a number of industrial plants equipped with new technologies and to study the problem of ecological-economic efficiency of the introduction of new technologies, the consequences of the concentration of capacities on a limited territory under conditions of the Ukrainian SSR, etc.

When considering the Ukrainian SSR as a large ecological-economic system it should be noted that the distinguishing feature of its functioning is connected with a very intensive antropogenic (technogenic) "load" on the environment (approximately the order as high as in the average for the Soviet Union, proceeding from the density of population and concentration of main resources). As a consequence, principal ecological problems in the Republic are related to:

- solution of water economy problems;
- solution of power saving problems;
- necessity for high rates of ecologization of production in largest industrial regions and centers;
- struggle with qualitative draining of water resources;
- comprehensive utilization of mineral raw materials and timber resources;
- intensification of using land resources in agricultural production.

A high efficiency of ecologization of industrial productions under the present state of the biophysical environment can be exemplified by the use of the advanced technology of air-stream granulation of blast-furnace slag at metallurgical works. This technology implements the most effective method of comprehensive utilization and

processing of industrial waste. By this mentod recycled energy resources are used during the processing of recycled material resources (blast-furnace slag) to obtain commodity products (slag alcaline binder). The technology of air-stream granulation of blast-furnace slag is very effective as compared to the water-stream granulation technology employed at metallurgical works of the Republic. In spite of the growth of extraordinary or current expences connected with introduction and use of power technological equipment, the technology of air-stream granulation is very effective mainly due to the reduction of energy expenditures for drying, grinding of slag and alcaline components through utilization of physical heat of the melted-down blast-furnace slag. With the account of all constituents of costs (power costs and other costs) in technological cycles of production of slag alcaline binder and with estimation of the used energy media by corresponding shadow costs a specific production effect due to the introduction of new technologies comes to nc' less than 2,2 rouble per ton of slag.

The introduction of the given technology at ferrous metallurgy works should be considered as a multipurpose measure which provid not only production effect but also environmental protection effect. Figs 2-4 show curves which, on the basis of simulation experiments under comparable conditions, illustrate the change of dynamic antropogenic load on the envirnnment in the result of substitution of the operating technology (water-stream granulation of blast-furnace slags) by new, more efficient one (from the production vewpoint). Here the minimal time interval of the "life" of dry-stream granulation technology, 10 years, is adopted, taking into account the possibility of liquidation of a blast-furnace process at matallurgical works

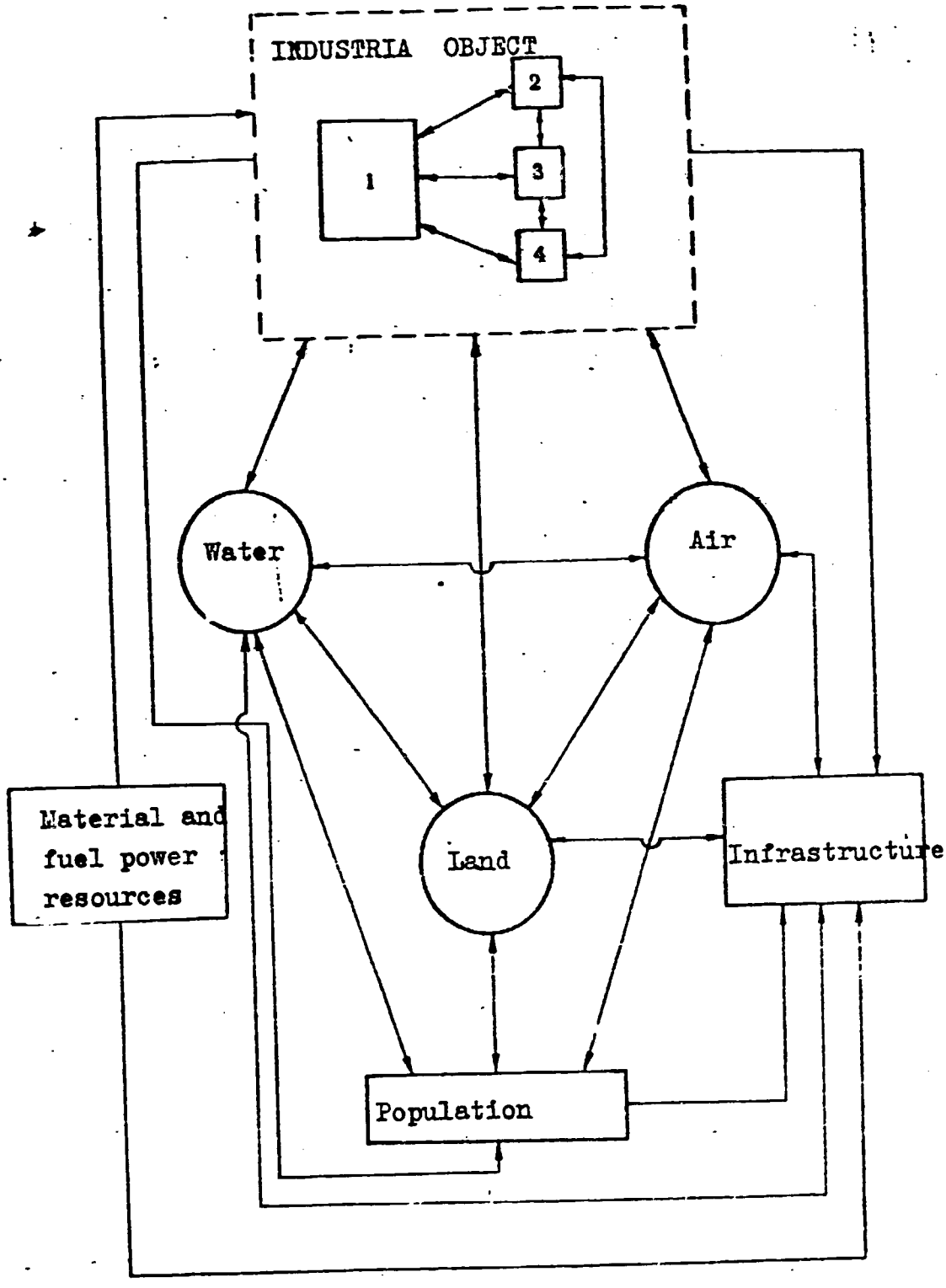

Fig.1. Schematic diagram of interrelations represented in the problems of distribution (1 - production unit, 2,3,4 - utilization units)

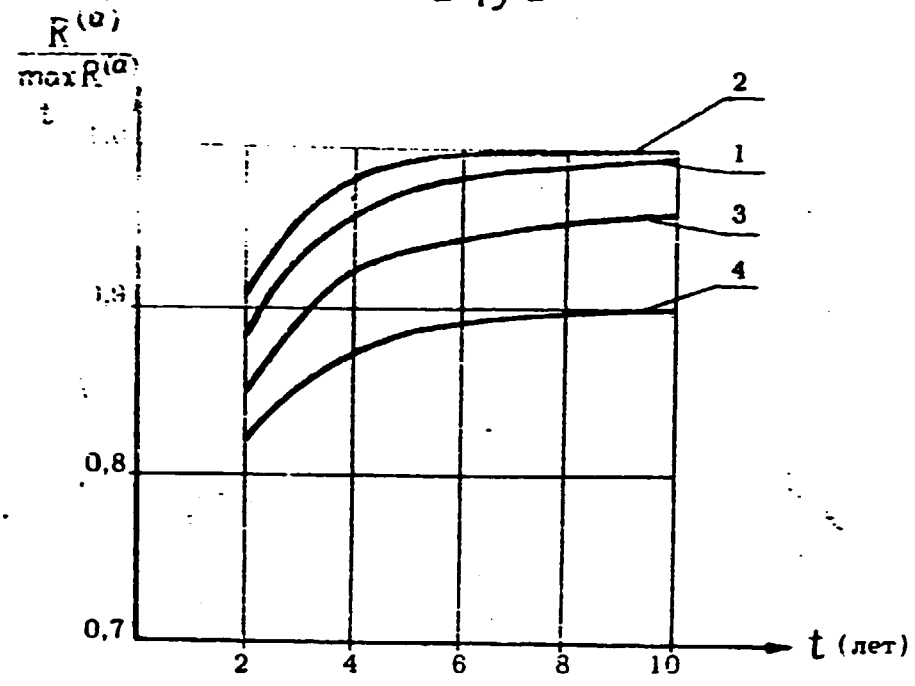

Fig.2. Dynamics of air pollution under comparable conditions

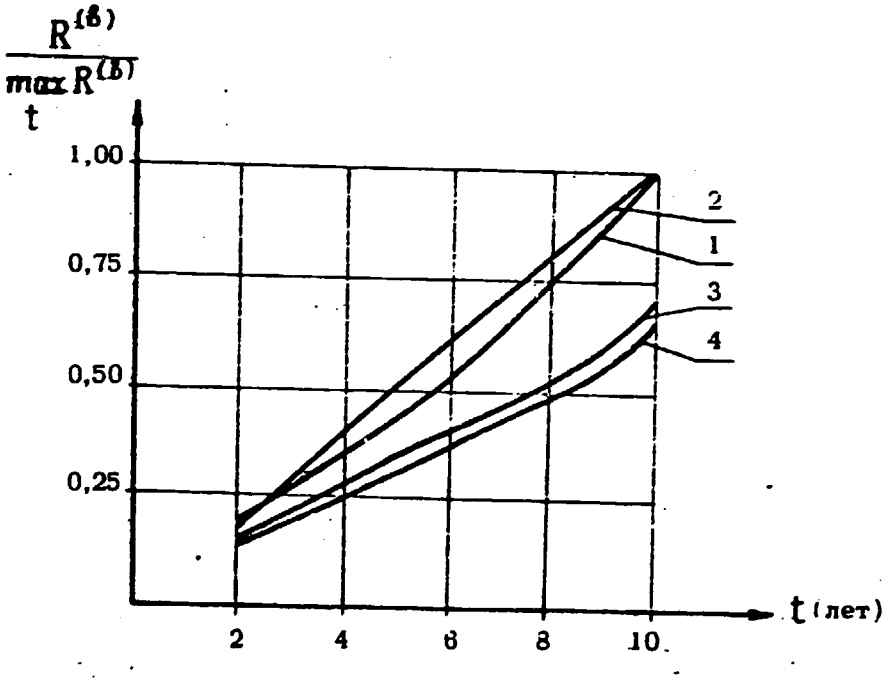

Fig.3. Dynamics of water pollution under comparable conditions

1 - operating technology, emission of solid particles; 2 - operating technology, emission of sulphide compounds; 3 - the new technology, emission of solid particles; 4 - the new technology, emission of sulphide compounds.

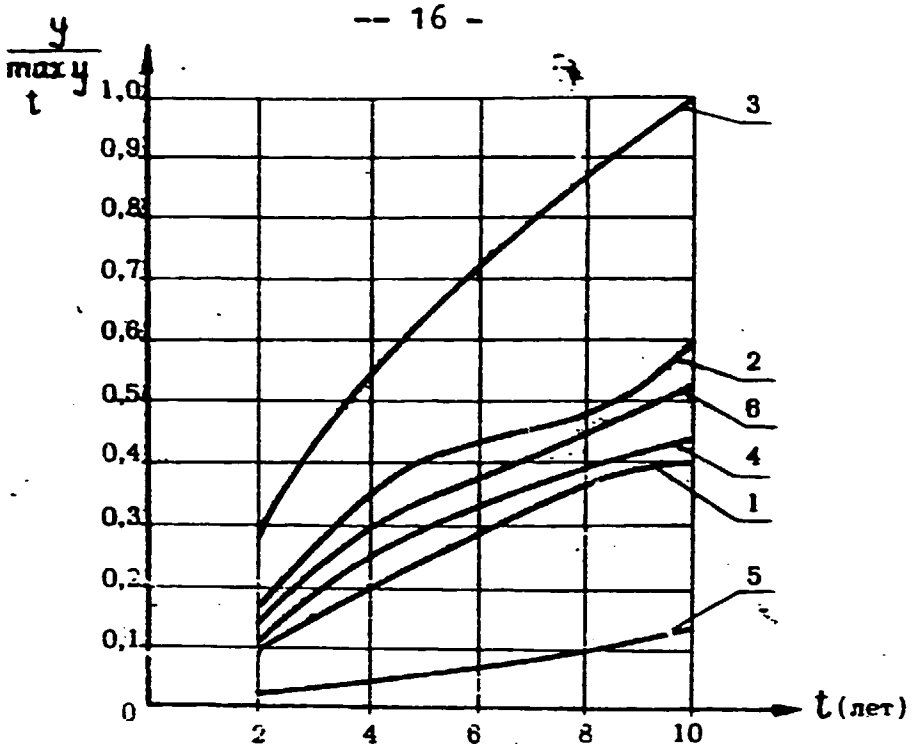

Fig.4. The damage incurred to the biophysical environment in the result of the use of technologies under comparable conditions (1,2,3 - the operating technology: the damage incurred, respectively, to air, water and the biophysical environment as a whole; 4,5,6 - the same under the use of the new technology)

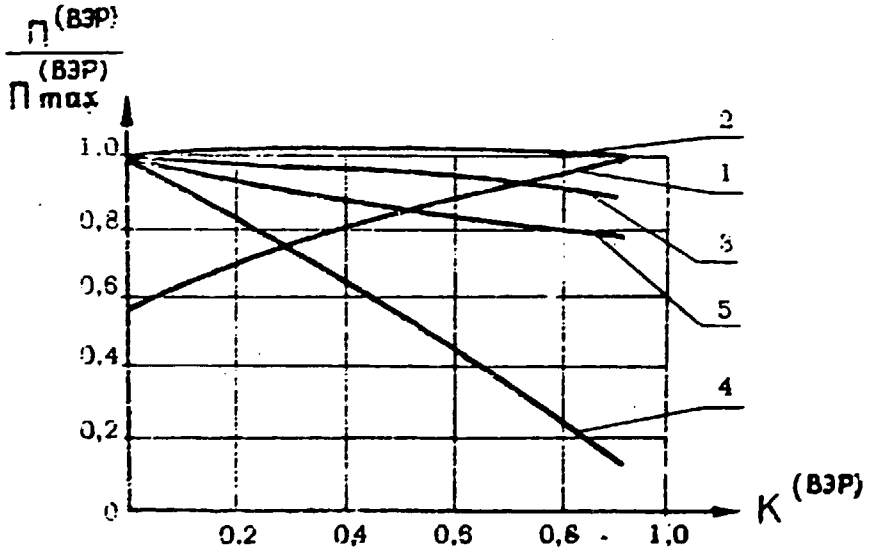

Fig.5. Character of the change of indices of resource consumption and expenditures for siting an industrial plant in dependence of the depth of RPR utilization (1,2,3 - demand for water, land and power resources; 4 - economic damage; 5 - total expenditures for siting)

with the introduction of new continuous coke-free processes of steelmaking, of sponge iron production. As it follows from Figures when the new technology is in use for a long time the water component of the biophysical environment is unloaded most significantly and at the same time the load on the air also reduces.(taking into account the load arising not only from wide-spread pollutants such as solid particles and sulphur compounds but from waste heat). A total antropogenic load on the biophysical environment is reduced by no less than one half (Fig.4); This prevents the damage done to the environment by the use of present technology in the amount of no less than 1,8 rouble per ton of slag.

Thus, the substitution of the operating technology by the new one at metallurgical works when it is sited in the developed region provides the ecological result (effect) which is commensurable with purely production result. Ecological-economic return on introduction of the technology of dry-stream granulation of blast-furnace slag amounts, on the average, to 4 roubles per ton of slag (under conditions of the existing antropogenic load on the biophysical environment in the developed region). At the present state of the art in production of blast-furnace slag in our country (about 60 millions of tons) and on retention of blast-furnace process up to the end of 20th century, the use of the technology of water-stream granulation of slag at metallurgical works will result in serious losses in the national economy, taking into account a complicated ecological situation in the areas of concentration of ferrous metallurgy works.

The active policy of power saving conducted in the Republic is no less important for reducing energenic load on the biophysical environment. Efficient use of recycled power resources (RPR) is one

of its directions. The problem of production and utilization of heat RPR when studying energenic effects at a local territorial level in the process of solving tactical problems of industrial siting assumes particular importance because of a comparatively small radius of transportability of industial waste heat and the necessity for its use on the limited territory. Due to the insufficient level of utilization of RPR in industry (as a result of many causes one of which consists in not making enough allowance for the factor of rational indistrial siting when solving problems of utilization of non-transportable waste a considerable part of which is uncontrolled in the environment) the national economy suffer heavy losses. At the same time the ecological benefits of RPR utilization (which are not "felt" by industrial enterprises) in the regions with a high energenic load are very essential.

While the production effect in the result of utilization of high-temperature heat RPR can be estimated sufficiently exactly (mainly on the basis of the amount of saved organic fuel), the complex ecological-economic estimation of the efficiency of RPR utilization at an industrial plant requires to take into account a number of factors which have different (opposite) influence on this complex estimate.

Curves given in Fig.5 show the character of the influence of principal factors on ecological-economic efficiency of RPR utilization (a machine-building plant is given as an example). With the intensification of utilization of heat RPR at the plant its demand for land resources increases due to the need for expansion of workshop floor space to install utilization equipment, irrevocable

water losses, expenditures for engineering development of the territory for industrial engineering, expenditures for organization of industrial water supply, etc. also increase.

At the same time, expenditures of the plant for power consumption are reduced due to power saving, the economic damage done to the biophysical environment mainly by waste heat is also considerably reduced. All these factors, in the final analysis, bring about the reduction of summarized expenditures for siting and operation of an industrial plant with the growth of the use of high-temperature heat RPR (curve 5 shows this tendency in the Figure). However there may be no such tendency towards reduction of summarized expenditures mainly due to production results of RPR utilization when solving the problems of using low-potential waste heat. As it is seen from Fig.5, in this case such positive factor as prevention of damage done to the biophysical environment by waste heat must play a leading role. In other words, such normative estimates of economic damage (represented in taxes) done to the environment by waste heat should be established which can be "counterposed" to additional expenditures related to utilization of low-potential waste heat.

Increase of the level of utilization of heat RPR (as other non-transportable industrial waste) to a considerable extent is related to the growth of concentration of capacities on the limited territory. The concentration of capacities in conditions of group siting of industrial enterprises may result in considerable saving of expenditures at the stage of joint operation of industrial enterprises, i.e. there is obtained some agglomeration effect which as a rule increases with the growth of concentration of capacities at the reserve territory. Various departments urge to obtain maximum value of this effect by siting their enterprises on territories

provided with skilled man-power and having powerful building machinery and erection bases. However, as results of simulation experiments have shown, the orientation towards obtaining maximum production and agglomeration effects under conditions of concentration of capacities and complex siting of industrial enterprises in an old-developed region can lead to completely opposite, negative ecological-economic results (where there is no sufficient reserve for further growth of technogenic load on the biophysical environment). To this end, first, when solving problems of co-operation of enterprises under conditions of territorial concentration of capacities in the old-developed region we should rely not on the obtained estimates of the agglomeration effect but upon the estimates of ecological-economic efficiency of the decisions made. Second, there are no industrial enterprises with the level of concentration of capacities equally acceptable for different regions of the country and for different terriotories in the limits of one region. Third, there is no some "optimal" capacity of the industrial plant (from the viewpoint of possibilities for its siting in an old-developed region) equally acceptable for different stages of economic development of the region. Industrial-technological progress, introduction of waste-free technologies change the idea of "optimal" capacity of an industrial enterprise in coordination with regional possibilities for its territorial localization at individual time stages of development and distribution of productive forces.

Thus, the necessity for accelerated rates of ecologization of production is determined by a considerable load on the environment. A high concentration of population, of production assets imposes heavy demands on the level of ecological efficiency of new

machinery and brings about the realization of various measures to limit injurious influence of earlier introduced technologies. Even to-day the undertaken efforts resulted, to a considerable extent, in easing tense relations between an economic complex and the environment in large-scale production centers in east regions of the Republic where a greater part of the environmental pollution is due to power economic processes. Industrial waste (dumps of heat power stations, mines) became the object of problems on the improvement of quality of the environment. Owing to the undertaken efforts, gas and dust loading in a number of industrial centers in the east regions of the Republic became 10 times less. Thousands of plants for efficient treatment have been constructed. Metallurgical works, coal dressing plant works, coke by-product works are transferred to turn-round water supply. More than 95% of consumed water is used in turn-round cycles. Annualy about 1.5 million square meters of mine waters are used for irrigation of more than 5000 hectares, tens of waste heaps are extinguished. Along with limitation of the further development of water-intensive productions, introduction of closed-loop technologies, rational use of local resources, struggle with qualitative exhaustion of water resources is conducted by way of large-scale measures for protection of river basins of the Republic such as Dnepr, Desna, Severnyj Donec, etc. A principal way of reducing the load on the environment at many industrial centers of the Ukr.SSR consists in every kind of reduction of mineral raw material waste and utilization of accompanying products which appear at stages of mining and dressing of minerals. Utilization of dressing waste for load production yields a great economic return. Other components as well as overburden

rock find a wide application in the national economy.

In southern regions of the Republic the problems of interaction between economy and nature are peculiar to regions with intensive forms of agricultural production and a high density of rural population. Intensive development of agricultural land resulted in intensification of processes of water and wind erosion, deterioration of soil and vegetation, harmful influence upon reservoirs and air. In this connection a complex of measures for protection of agricultural resources is performed including a set of countererosion measures. Concrete measures are undertaken and study of a number of problems related to water supply of southern regions of the Republic, to coasts of the Black sea and the sea of Azov. is continued.

Not dwelling on the characteristic of all problems in the field of environmental protection in the Republic and methods of their solution we would like to note that at present stage of the development of our society the ecological programs must be realized on a principally new economic basis because of the radical reconstruction of the economy management, the switch-over to the economic mechanism of enterprise activity and the optimal combination of sectoral and territorial planning and management. Under conditions of reconstruction the economic methods of the influence upon industrial enterprises, ministries and departments in the field of careful use of natural resources and environmental protection acquire more and more importance. Rational combination of administrative, economic and social measures for restoration and protection of the quality of biophysical environment and their consistent realization in practice by government, local and social bodies of power will contribute to the optimization of interrelationship

between society and nature with regard for succeeding generations of our country.

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NEW COMPUTER-BASED ECOLOGICAL ASSESSMENT AND RISK MANAGEMENT TECHNOLOGIES

V. Litvin, S. Cheremnykh

(Moscow, USSR)

The primary aim of the study is to introduce the new technologies in the field of the atmosphere protection using minimal data and capable of application by the modern generation of microcomputers

The program package is rather simple and very effective tool for unskilled users for ecological ASSESSMENT and decision support So it could be considered as an expert system for decision maker, as a bridge between ecologist and authorities.

The package includes some kinds of mathematical models : models of transfer, pollutants concentrations under unfavorable conditions economical and ecological damage and others.

he air pollution ASSESSMENT is based on the five main figures: total pollutants emission in region, pollutants concentrations near the surface, pollutants depositions, economical and ecological index.

The main results of the study is the establishing of close relationship between damage reduction and air protection measures expressed by the volume of investments.

Ecological risk management is based on the assumption that every pollution source can be eliminate with a set of the atmosphere protection measures. Each of the measures has its own efficacy which can be calculated, and a full set of them gives us a full set of the efficacy parameters. It is very convenient for us to consider them as the components of special criteria vector. Thus we have a multicriteria task, which creates a lot of risk management technologies.

The program package is developed in the form of two kind of versions using mini and microcomputers. The report deals with the PC version and introduces the results concerning Estonia republic and its capital (the city of Tallin).

Estonia map is depicted in the Fig.1.1. Fig.1.2 - 1.5 displays dust, SO , NO , CO emissions. Fig.1.6 - 1.8 shows the distribution of economical damage, sulfur deposition and danger of pollution for Estonia pine forest.

The best strategies of SO , NO , CO emissions reductions and economical damage protection are depicted in the Fig. 2.1 - 2.2. Fig. 2.3 - 2.4 shows the best reduction strategies, concerning sulfur deposition reduction, pine forest damage reduction. The best SO , NO , CO emissions reduction strategies (Fig. 2.5-2.6) dust concentration reduction strategies (Fig.2.7 - 2.8) are shown Fig. 3.1 - 3.9 displays the same pictures for Tallin.

The tables at the end of the report give us the input and output data examples concerning the program package.

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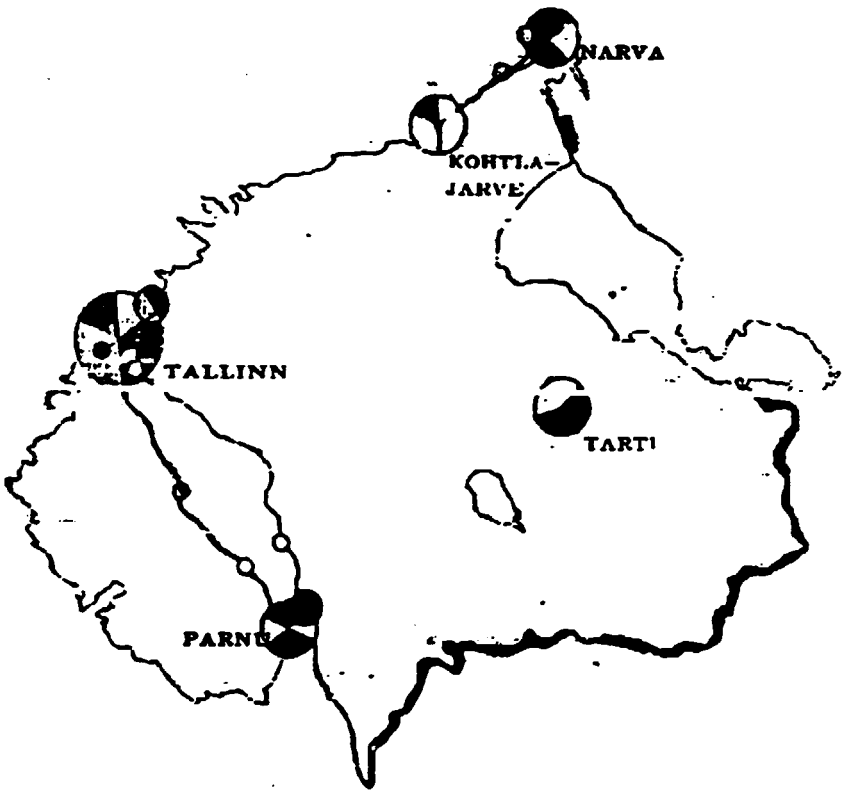


FIG 1.1

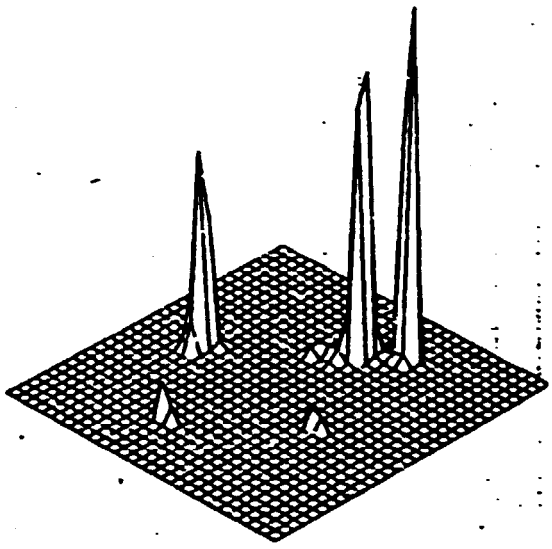
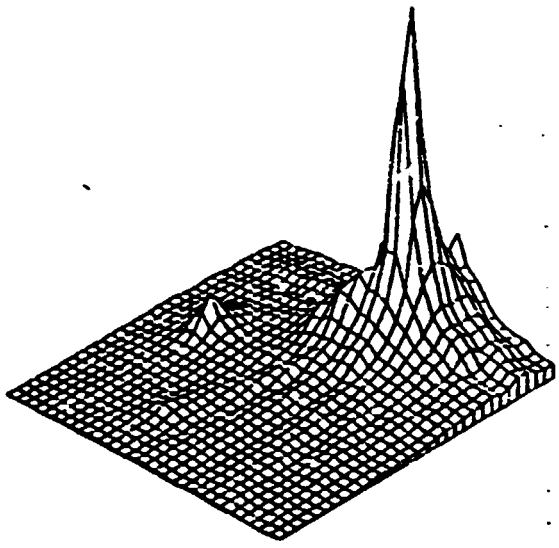


FIG. 1.6



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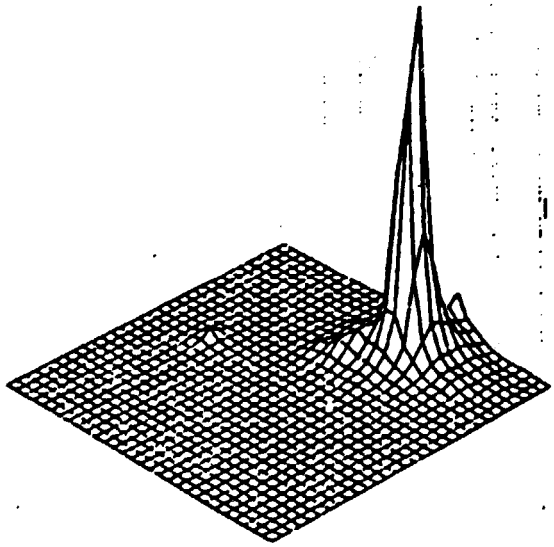
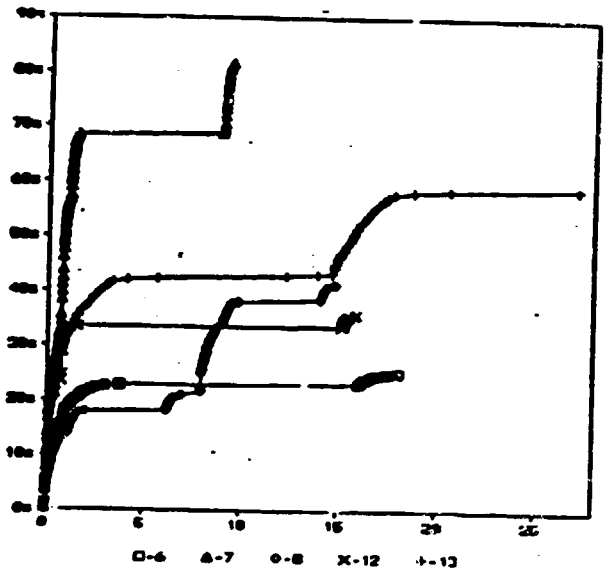


FIG. 1.8



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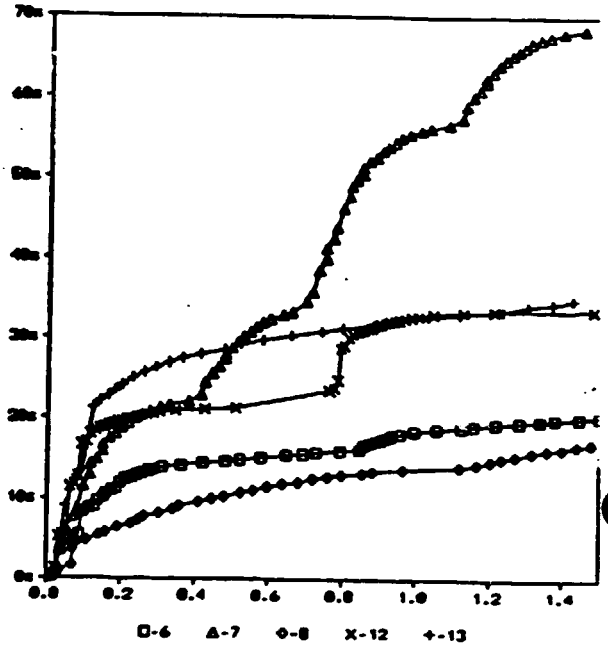

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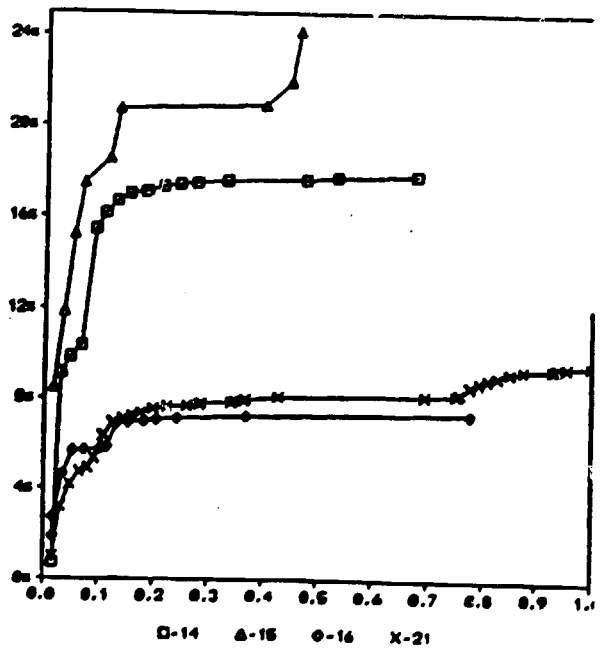

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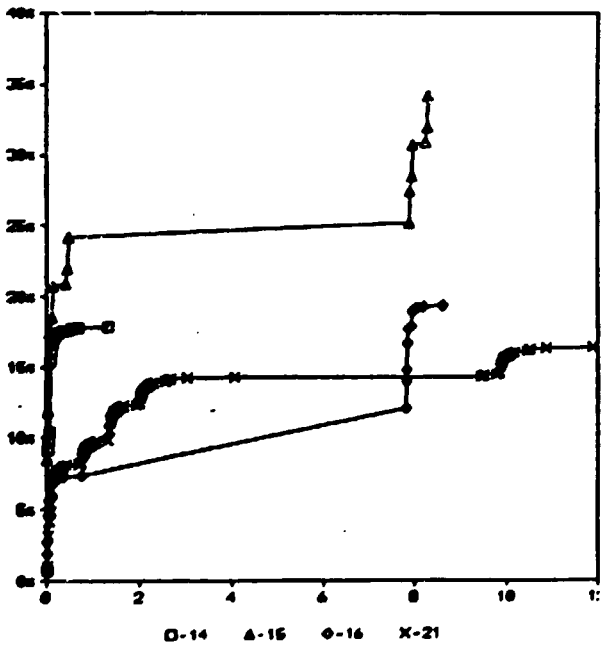

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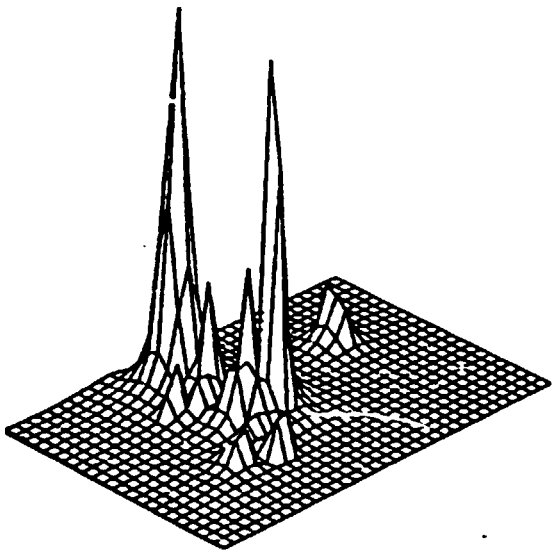
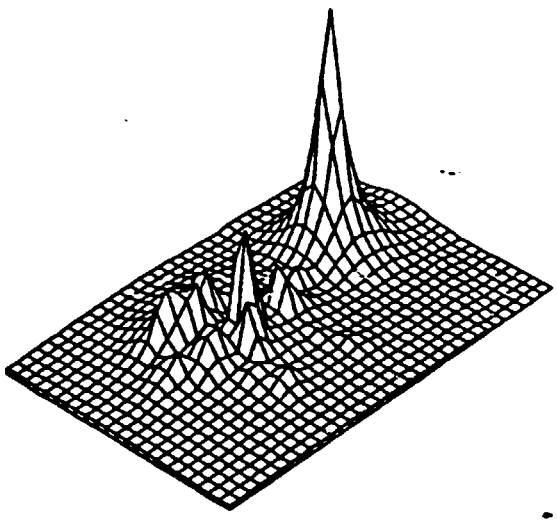


FIG. 3.5



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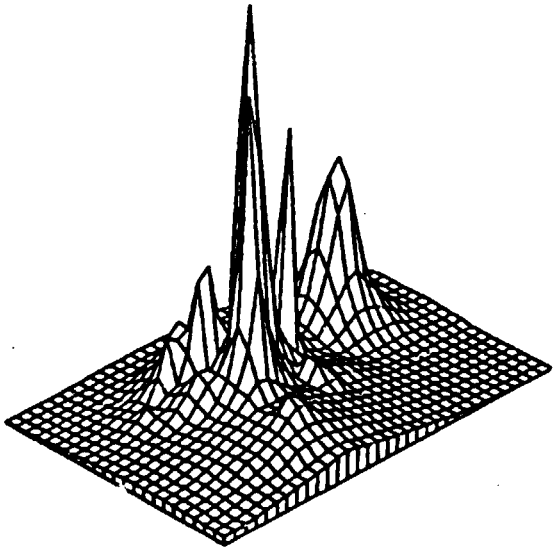


FIG. 3.7

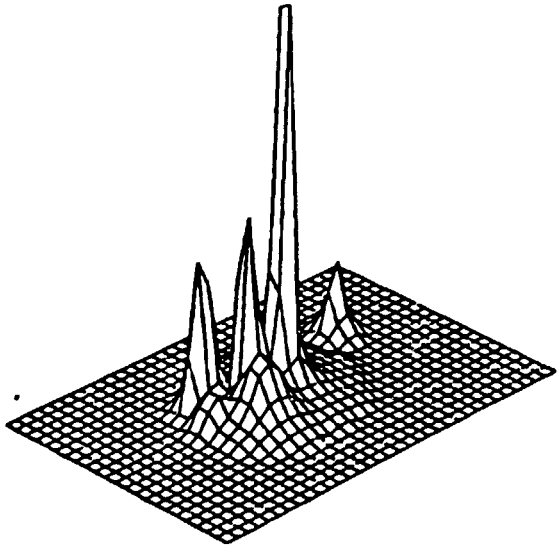


FIG. 3.8

Data about the region

TEST REGION

Number of sources: 7

Wind directions	South	S-West	West	N-West	Nord	N-East	East	S-East
Reiteration	0.400	0.100	0.100	0.050	0.050	0.050	0.050	0.200

Wind directions	Dir. 1	Dir. 2	Dir. 3	Dir. 4	Dir. 5	Dir. 6	Dir. 7	Dir. 8	Dir. 9	Dir.10	Dir.11	Dir.12
Reiteration	0.200	0.200	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.100	0.100

Mean annual speed of the wind near the surface (m/s):	5.1000
Mean annual temperature of the air (C):	5.0000
Mean annual height of the layer permeation (m):	680.0000
Mean annual pecipitation (mm/year):	700.0000
Mean annual atm. stratification parameter:	0.0500
Mean ann. vertic. diffusion coeff. in layer permition (m**2/s):	6.9000
Mean ann. goriz. diffusion coeff. in layer permition (m**2/s):	8.2000
SO2 time span relative to its transformation into SO4(hour):	67.0000
SO2 time span relative to its dry deposition (hour):	13.0000
SO4 time span relative to its dry deposition (hour):	300.0000
SO2 wash-out coefficient (1/mm):	0.3600
SO4 wash-out coefficient (1/mm):	0.3600
SO2 dry deposition speed (m/s):	0.0100
SO4 dry deposition speed (m/s):	0.0020
Time interval (min):	10.0000

Regular grid parameters for the region:

The quantity of cells from the West to the East (X-axes):	6
The quantity of cells from the South to the Nord(Y-axes):	5
Grid step (km):	10.0
Accuracy of the "SIGMA" calculation:	10

Pollutant numbers upon which the data has been entered: 1 2 3 4 6

Agressive pollutants coefficients:

1.Dust	45.0
2.SO2	16.5
3.NOx	41.1
4.NH3	4.6
5.CH	1.3
6.HF	980.0
7.CO	1.0

Data about the city

test (gorod)

Number of sources: 12

Wind directions	South	S-West	West	N-West	Nord	N-East	East	S-East
Reiteration	0.150	0.170	0.130	0.100	0.100	0.100	0.110	0.140
Speeds (m/s):	5.9	6.4	5.9	5.6	4.8	5.1	4.6	5.3

Mean annual speed of the wind near the surface (m/s): 5.5300
Mean annual temperature of the air (C): 5.0000
Temperature in July/January at 13 hours (grad.C): 19.0

Regular grid parameters for the city :
The quantity of cells from the West to the East (X-axes): 9
quantity of cells from the South to the Nord(Y-axes): 6
Grid step (km): 1.0
Accuracy of the "SIGMA" calculation: 4

Pollutant numbers upon which
the data has been entered: 1 2 3 4 6 7
Agressive pollutants coefficients:

1.Dust	45.0
2.SO2	16.5
3.NOx	41.1
4.NH3	4.6
5.CH	1.3
6.HF	980.0
7.CO	1.0

"SIGMA matrix"
test (gorod)

6	1.60	2.40	2.70	0.80	3.40	3.90	3.10	5.20	5.90
5	4.00	4.00	4.00	6.20	7.00	6.30	4.60	4.20	3.40
4	2.30	2.60	2.90	3.60	2.80	1.30	1.40	1.40	2.30
3	1.60	0.50	0.80	3.10	3.60	2.30	2.70	2.80	4.30
2	4.00	4.00	1.50	1.90	5.20	5.10	5.20	6.30	7.00
1	4.00	3.60	1.30	1.80	4.20	4.60	5.00	4.10	3.20
	1	2	3	4	5	6	7	8	9

Information about the sources

test (gorod) listing 1

Number	H	Diam	Temp.	Volume	Coeff: Sigma	% Dust sep.	Total emission of pollutants ktons/year							Source Coordinat., km	
							Dust	SO 2	NO X	NH 3	CH	HF	CO	X	Y
	m	m	grad.C	m3/s											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	200.0	0.1	130.0	225.9	3.49	0.0	0.500	25.600	1.150	0.000	0.000	0.000	1.344	2.25	3.50
2.	83.0	7.4	220.0	383.8	3.98	0.0	0.210	9.700	0.540	0.000	0.000	0.000	0.000	7.50	4.90
3.	183.0	4.8	200.0	81.7	3.49	0.0	0.054	1.200	0.100	0.000	0.000	0.000	0.000	5.70	2.10
4.	20.0	0.6	210.0	0.3	4.66	0.0	0.000	0.130	0.020	0.000	0.000	0.000	0.000	4.49	4.92
5.	20.0	0.3	200.0	0.5	2.00	0.0	0.070	0.090	0.010	0.000	0.000	0.000	0.016	2.67	1.83
6.	18.0	0.6	160.0	0.1	3.52	0.0	0.050	0.040	0.000	0.000	0.000	0.000	0.000	8.22	2.43
7.	15.0	0.5	45.0	0.0	2.71	0.0	0.060	0.060	0.000	0.000	0.000	0.000	0.014	6.46	3.81
8.	24.0	0.8	100.0	0.5	4.10	0.0	0.010	0.140	0.010	0.000	0.000	0.000	0.002	3.57	3.30
9.	102.0	2.0	45.0	19.4	3.15	0.0	0.000	9.700	4.300	0.000	0.000	0.000	0.000	1.50	5.16
10.	33.0	0.8	20.0	1.6	4.14	81.1	1.100	0.000	0.000	0.000	0.000	0.220	0.000	4.31	1.66
11.	30.0	0.4	20.0	1.5	4.49	0.0	3.200	0.000	0.000	0.000	0.000	0.000	0.000	5.12	3.87
12.	23.0	0.6	37.0	2.6	2.00	0.0	0.020	0.000	0.000	1.583	0.000	0.000	0.000	1.91	1.72
Total emission of pollutants in city							5.3	46.7	6.1	1.5	0.0	0.2	1.4		

Maximum emissions data

test (gorod) listing 1

Number Source	Max emission of pollutants g/s						
	Dust	SO 2	NO X	NH 3	CH	HF	CO
1	17	18	19	20	21	22	23
1.	48.30	990.00	312.00	0.00	0.00	0.00	107.53
2.	48.60	960.10	72.60	0.00	0.00	0.00	0.00
3.	10.10	560.30	10.40	0.00	0.00	0.00	0.0
4.	0.00	0.00	0.70	0.00	0.00	0.00	0.00
5.	3.70	4.90	0.40	0.00	0.00	0.00	0.76
6.	2.70	2.70	0.00	0.00	0.00	0.00	0.48
7.	3.90	3.60	0.00	0.00	0.00	0.00	0.90
8.	1.00	12.00	1.10	0.00	0.00	0.00	0.20
9.	0.00	384.60	132.40	0.00	0.00	0.00	0.00
10.	7.40	0.00	0.00	0.00	0.00	6.90	0.00
11.	62.20	0.00	0.00	0.00	0.00	0.00	0.00
12.	3.50	0.00	0.00	45.97	0.00	0.26	0.00

test (gornd)

Initial measures database for emission decrease in the sources ("+"increase, "-"decrease)

Number meas.	Number Sour.	Invest. K rb/year	Full expend. K rb/year	Pollutantsemission variations, Ktons/year Dust	SO 2	NO X	NH 3	CH	HF	CO	Variation: damage K rub/year
2	3	4	5	6	7	8	9	10	11	12	13
1.	4.	16.8	9.1	0.000	-0.130	-0.014	0.000	0.000	0.000	0.000	-10.7
2.	4.	10.8	-6.6	0.000	-0.020	-0.020	0.000	0.000	0.000	0.000	-227.4
3.	5.	6.8	-7.4	-0.059	0.070	0.020	0.000	0.000	0.000	-0.016	-221.1
4.	6.	6.8	-4.6	-0.049	0.030	0.000	0.000	0.000	0.000	-0.000	-224.4
5.	7.	9.8	-6.2	-0.059	0.040	0.000	0.000	0.000	0.000	-0.014	-223.1

Number of groups	Number of meas.	Number of src.	Index variations Dust	SO 2	NO X	NH 3	CH	HF	CO	Total index
1	2	3	14	15	16	17	18	19	20	21
2.	1.	4.	0.00	-1.08	-0.25	0.00	0.00	0.00	0.00	-1.32
2.	2.	4.	0.00	-1.08	-0.35	0.00	0.00	0.00	0.00	-1.43
2.	3.	5.	0.00	0.00	-0.11	0.00	0.00	0.00	0.00	-0.11
2.	4.	6.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.	5.	7.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The table of the incompatible measures

group 2

	1	2	3	4	5
1	*	*			
2	*	*			
3			*		
4				*	
5					*

TEST REGION

Initial measures database for emission decrease in the sources ("+"increase, "-"decrease)

group 1

Number meas.	Number Sour.	Invest. K rb/year	Full expend. K rb/year	Pollutant emission variations, Ktons/year: Dust	SO 2	NO X	NH 3	CH	HF	CO	Variation: damage K rub/year
2	3	4	5	6	7	8	9	10	11	12	13
1.	1.	360.0:	170.0:	-0.618:	-1.000:	0.000:	0.000:	0.000:	0.000:	0.000:	-51.9:
2.	1.	370.0:	90.0:	-0.654:	0.000:	0.000:	0.000:	0.000:	0.000:	0.000:	-34.5:
3.	1.	1060.0:	520.0:	0.000:	-1.000:	-0.400:	0.000:	0.200:	0.000:	0.000:	-38.6:
4.	1.	3000.0:	700.0:	0.000:	-3.000:	0.000:	0.000:	3.000:	0.000:	0.000:	-57.9:
5.	2.	4000.0:	500.0:	0.000:	-4.500:	-1.000:	0.000:	9.000:	0.000:	0.000:	-114.7:
6.	2.	190.0:	50.0:	-0.470:	-1.500:	0.000:	0.000:	0.000:	0.000:	0.000:	-205.9:
7.	2.	5000.0:	600.0:	0.000:	-9.000:	0.000:	0.000:	0.000:	0.000:	0.000:	-147.7:
8.	2.	3500.0:	400.0:	0.000:	-3.750:	0.000:	0.000:	0.000:	0.000:	0.000:	-61.5:

Number meas.	Number sour.	Variation: total deposit. Ktons/yer	Variation Sulphur transfer out of region, Ktons/year: total	sector1	sector2	sector3	sector4	sector5	sector6	sector7	sector8	Variation: index danger conifer
2	3	14	15	16	17	18	19	20	21	22	23	24
1.	1.	-0.04 :	-0.46 :	-0.129:	-0.095:	-0.059:	-0.034:	-0.033:	-0.033:	-0.033:	-0.043:	-0.06 :
2.	1.	0.00 :	0.00 :	0.000:	0.000:	0.000:	0.000:	0.000:	0.000:	0.000:	0.000:	0.00 :
3.	1.	-0.04 :	-0.46 :	-0.129:	-0.095:	-0.059:	-0.034:	-0.033:	-0.033:	-0.033:	-0.043:	-0.06 :
4.	1.	-0.12 :	-1.38 :	-0.388:	-0.284:	-0.178:	-0.102:	-0.099:	-0.099:	-0.099:	-0.129:	-0.16 :
5.	2.	-0.18 :	-2.07 :	-0.599:	-0.415:	-0.257:	-0.145:	-0.145:	-0.154:	-0.155:	-0.201:	-0.34 :
6.	2.	-0.06 :	-0.69 :	-0.200:	-0.138:	-0.086:	-0.048:	-0.048:	-0.051:	-0.052:	-0.067:	-0.13 :
7.	2.	-0.36 :	-4.14 :	-1.199:	-0.829:	-0.515:	-0.291:	-0.291:	-0.308:	-0.311:	-0.401:	-0.56 :
8.	2.	-0.15 :	-1.73 :	-0.499:	-0.346:	-0.215:	-0.121:	-0.121:	-0.128:	-0.129:	-0.167:	-0.29 :

The table of the incompatible measures

group 1

	1	2	3	4	5	6	7	8
1	*	*						
2	*	*						
3			*					
4				*				
5					*			*
6						*		
7							*	
8					*			*

"SIGMA matrix"

TEST REGION

5	2.30	2.80	3.20	3.80	4.60	4.50
4	2.10	2.70	3.80	3.90	5.10	4.00
3	1.80	3.20	3.60	4.40	4.70	4.50
2	1.60	2.70	2.40	3.90	4.90	5.20
1	2.20	2.60	3.70	3.20	3.80	3.00
	1	2	3	4	5	6

Information about the sources

TEST REGION listing 1

Number	H m	Diam. m	Temp. grad.C	Volume m3/s	Coeff: SIGMA	% Dust sep.	Total emission of pollutants ktons/year: Dust	SO 2	NO X	NH 3	CH	HF	CO	Source Coordinat., km: X	Y
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	[illegible]0.0	2.0	220.0	97.0	3.62	90.0	0.000	10.00	2.000	0.000	0.000	0.000	0.000	31.60	35.00
2.	150.0	3.0	230.0	160.0	4.42	70.0	0.500	15.00	2.000	0.000	0.000	0.000	0.000	42.40	28.30
3.	250.0	4.0	200.0	800.0	3.39	92.0	13.000	55.00	9.000	0.000	0.000	0.000	0.000	24.90	20.20
4.	80.0	0.0	200.0	103.0	3.15	94.0	1.200	12.00	4.000	0.000	0.000	0.000	0.000	25.10	49.00
5.	100.0	1.0	150.0	47.0	3.93	0.0	1.000	0.00	0.000	0.000	0.000	0.000	0.000	34.70	28.70
6.	50.0	0.4	50.0	7.0	5.10	0.0	0.900	0.00	0.000	1.000	0.000	0.100	0.000	41.00	29.30
7.	80.0	0.6	40.0	4.6	4.41	0.0	1.700	0.00	0.000	2.500	0.000	0.200	0.000	41.20	43.00
Total emission of pollutants in region							19.1	100.0	17.0	3.5	0.0	0.4	0.0		

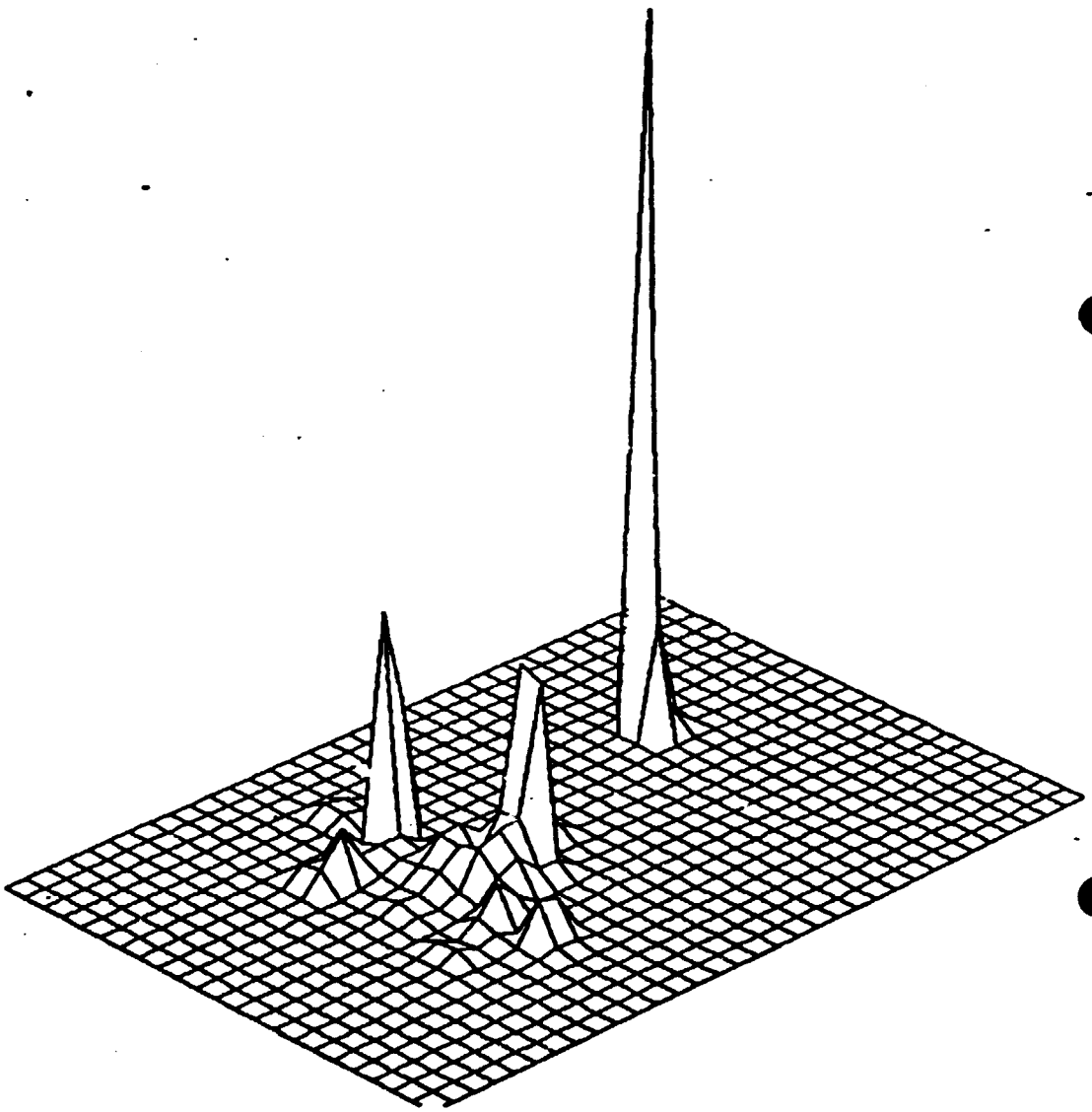


FIG. 3.9

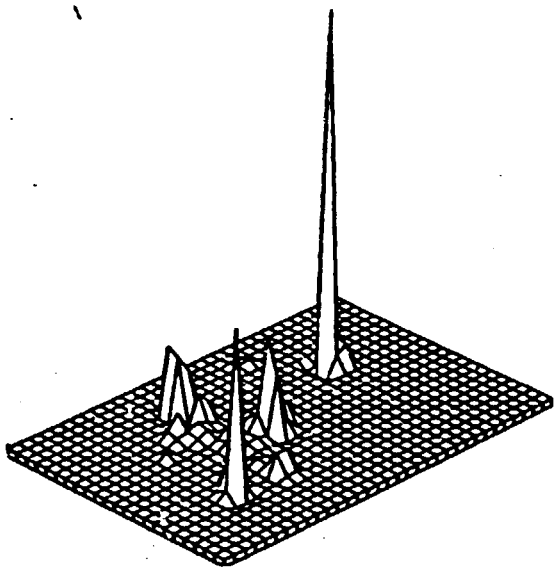


FIG. 3.1

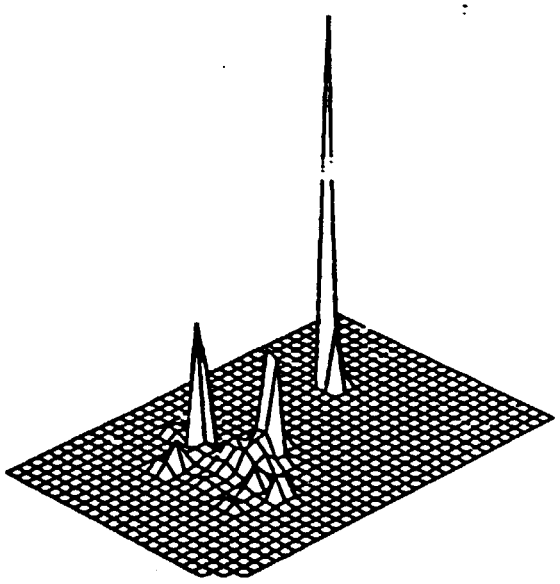


FIG. 3.9

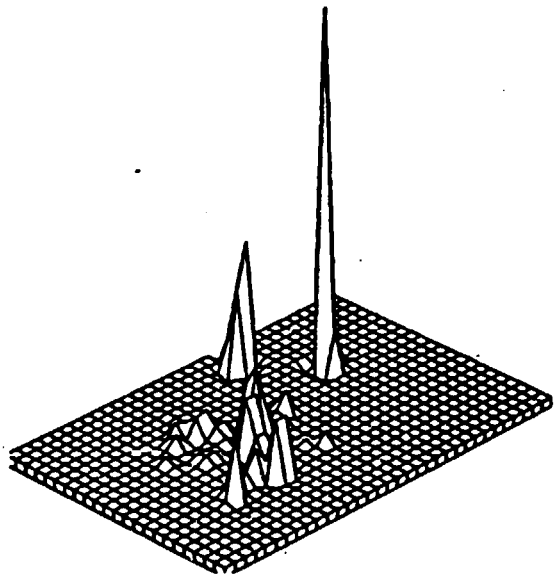


FIG. 3.3

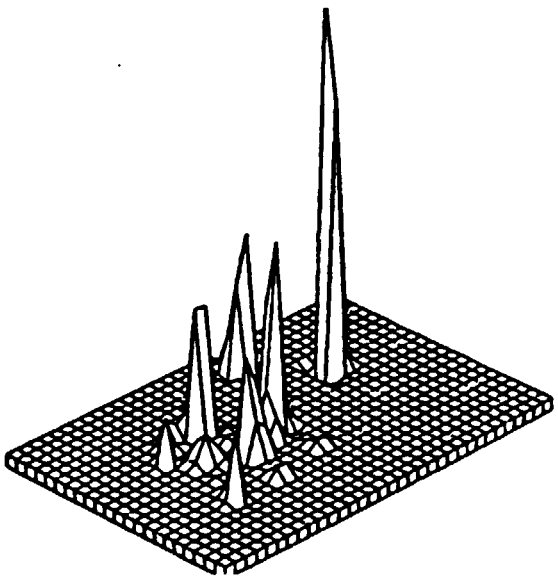


FIG. 3.4

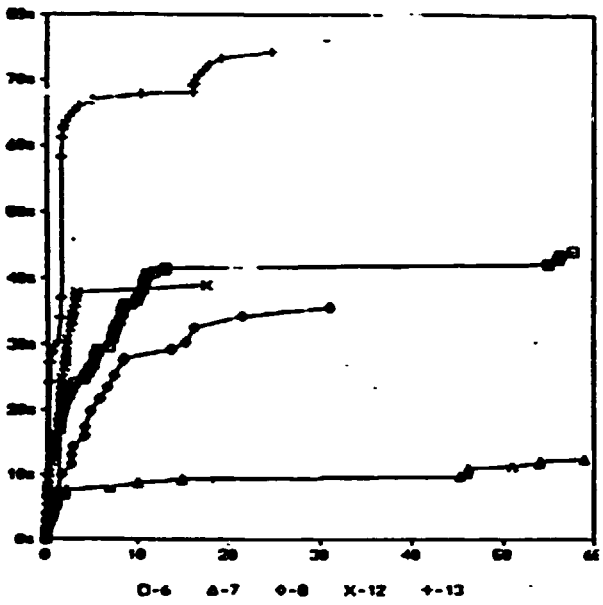


FIG. 2.1

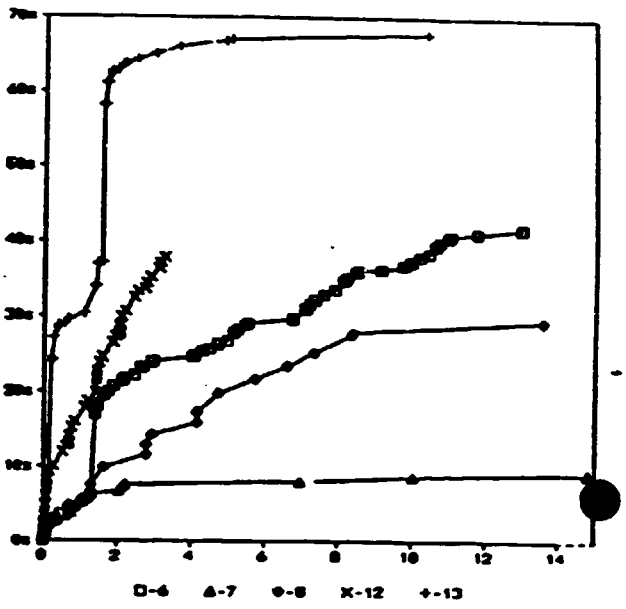


FIG. 2.2

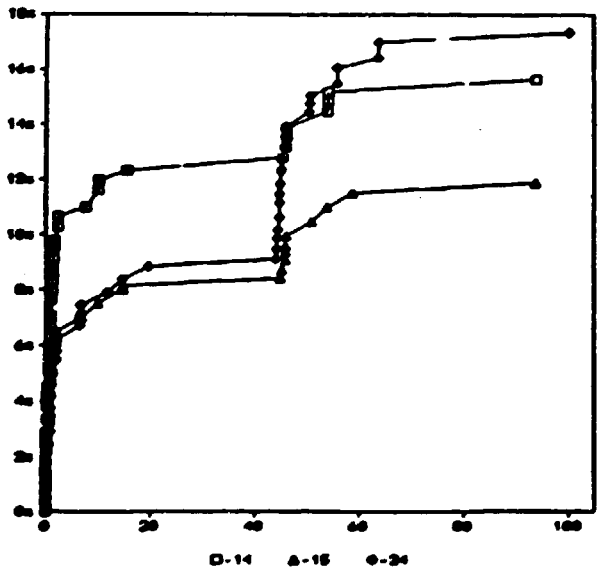


FIG. 2.3

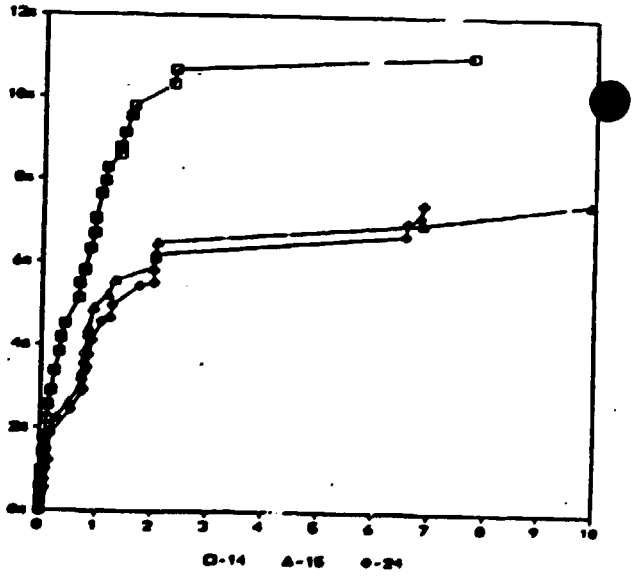


FIG. 2.4

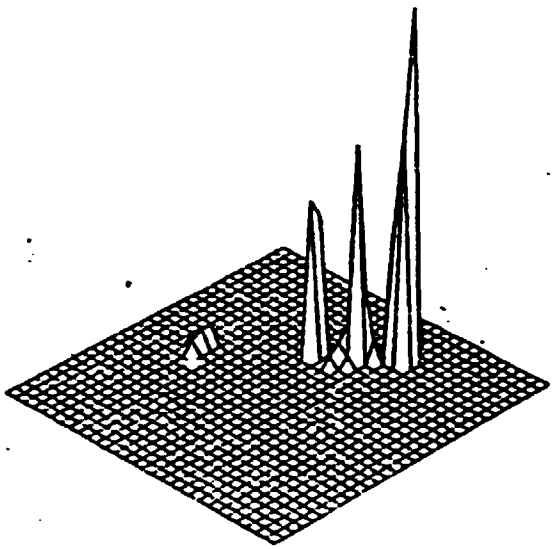


FIG. 1.2

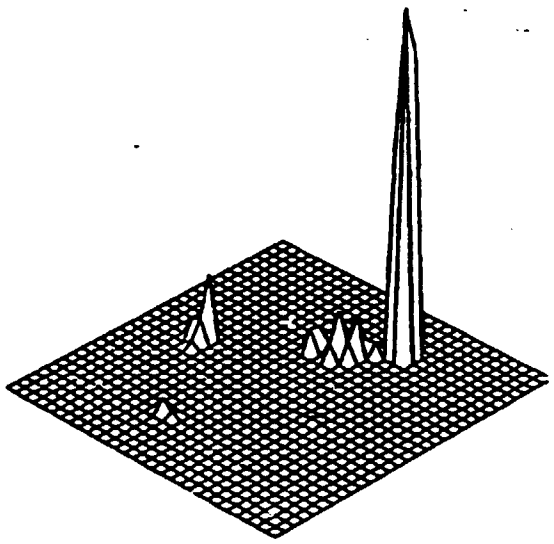
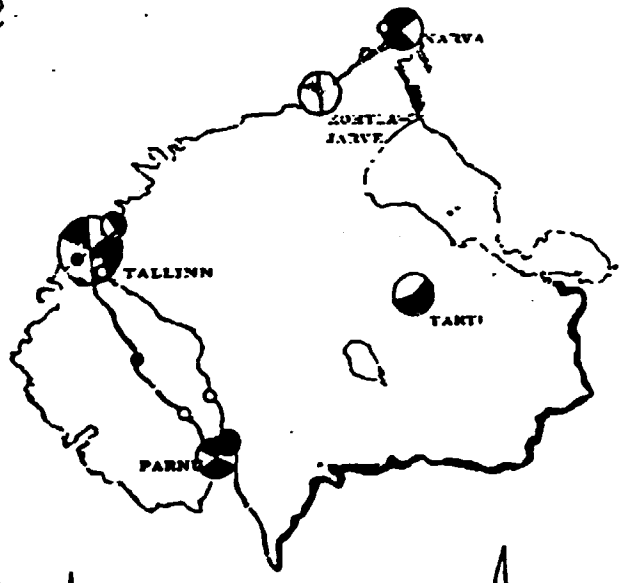


FIG. 1.3

ESTONIA



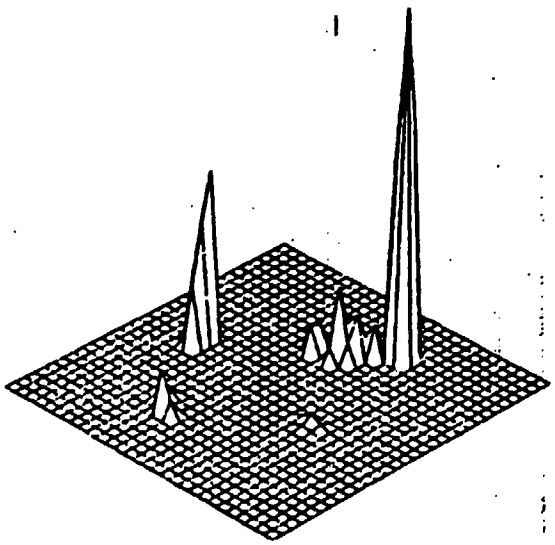


FIG. 1.4

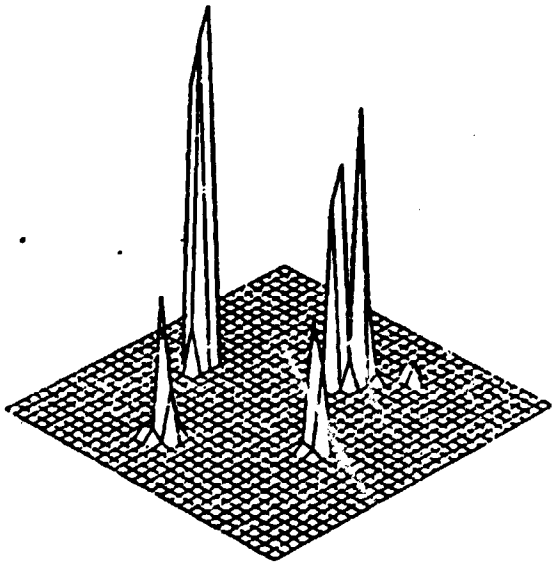


FIG. 1.5

Basic trends of optimization of environmental management and environmental protection in the Ukrainian SSR

P.Lapetchuk, Head of the Main Directorate of Economics, Scientific and Technical Progress, Public Environmental Awareness and International Relations, The Ukrainian SSR State Committee for Environment Protection

It is no wonder that among major burning issues of our everyday restless life people are increasingly turning to their surrounding environmental protection and the relationships of man, society and nature are among the priority issues to deal with. In addition to it these problems are not only of high social importance but they also acquire mor. political significance.

Environmental problems have become of vital concern for the Ukrainian SSR. The Republic's territory covers only 2.7% out of the whole territory of the Soviet Union but here concentrates one quater of the total country's industrial and agrarian potential. Energetics, mining, coal, ferrous metal and chemical industries have been developed in full scale. It is these branches of national economy which require major use of natural resources and have an adverse impact on the environment.

It is worth to note that over 10 billion tons of industrial wastes have been accumulated in dumps, which occupy about 200 000 hectares of land. 2.6 billion cubic meters of sewages are discharged

into open basins. About 20 million tons of harmful substances are discharged into the atmosphere by the enterprises and automobiles. Furthermore, mismanagement of utilization of mineral fertilizers and pesticides aggravate the state of the environment.

Certainly, some useful work has been done in the Republic to improve the environmental situation. Suffice it to say that 4.8 billion roubles have been allocated for the environmental protection over the last 3 years (1986-88). State capital investments consist of 1.3 billion roubles out of the total sum.

At present thanks to the purification installations and close-circuit water systems which have been put into operation 98% of sewages are supplied for purification and 82.5% of clean water is saved. While the steady growth of industrial production continues the water intake from surface sources reduces owing to the cutting limits of water use, introduction of close-curcuit systems of water supply, low-and wasteless technologies. The issues of recultivation of disturbed lands, planting of trees inside city and town territories and so on are being successfully solved.

Still unfavourable state of the environment shows that undertaken environmental actions are not enough.

As figures show due to the enthropogenic and technical load the further increase in capacities of energetics, ferrous metal, chemical and oil industries is not permissible. Hence, when the Republic's scientists and experts developed the Draft Concepts of economic and social development of the USSR till 2000 year they suggested to change proportions between the extractive and manufacturing one. The Draft envisages the speedy development of the engineering industry and industries providing sustainable development and a persueing of a resource-saving policy.

A great obstacle in the proper natural resources management is the underestimation of economic incentives. Due to the absence of effective economic incentives the enterprises and organizations are not interested in integrated management and proper use of natural resources and abatement of environmental pollution.

What are the priority measures in this field? In the first turn while developing the drafts of state plans and long-term programmes of national economy major directions in environmental management with incorporation of planned large-scale development of productive forces and the introduction of the achievements of scientific and technical progress into the national economy will obligatory be taken into account.

Secondly, beginning from 1991 there will be a charge for the utilization of natural resources and the charge for the pollution of the environment. The norms of these charges will be delivered to the enterprises and organizations as part of long-term economic norms. It goes without saying that economic norms of charges for the utilization of natural resources will promote rational and proper utilization of lands, waters, forests, minerals and other resources. At the same time the economic norms of payment for the dihcarges of polluted substances into the environment will promote the timely fulfilment of measures to combat pollution taking into account the features of various natural complexes.

At present the above-mentioned norms are under development. Moreover economic norms of charges for the use of natural resources include the availability of natural resources, their capacity to reproduction, integrative capacity, location and other factors which stipulate the expenses concerning the use of these resources.

The peculiarities of natural complexes, the composition and characteristics of discharges as well as expenditures for combating the pollution are taken into account in the terms the economic norms of payment for the discharges of polluted substances into the natural environment. The above-mentioned norms are set up for the 5-year period (for each year seperately) with the account of yearly reduction of discharges (into the water or atmosphere) of polluted substances. According to this norm the source of payment will be the enterprises and organizations income

It must be noted however that many enterprises often exceed the fixed limits of polluted discharges. Therefore the enterprises will be charged the higher payments (multiple as related to economic norm) for the exceeding limits and accidental pollution, self-financing system being the source of the payment.

It must be mentioned that this payment goes together with the payment for demages resulted from accidental pollution.

Much importance is given in the Republic to the expert examination of project materials, to the sound justification of siting of new objects of national economy, their construction and functioning as well as to the reconstruction of enterprises currently in operation which most affect the environment. There are quite a number of unsettled issues. Most often the project institutes do not incorporate the environmental requirements into their projects or they observe them partially. That is why the Ukrainian SSR State Committee for the Environment Protection returns back the environmentally-unsound projects for their further elaboration or rejects them completely. And this is the case with nearly every third project.

In particular we did not agree to approve the plan of development of energetics in the Ukraine including the atomic energy since

issues of environmental security had not been properly observed and the environmental situation, the availability of natural resources mainly water and the public opinion had not been taken into account.

Naturally no progress can be made without scientists. Quite a lot of work is being done by scientific institutions mainly those of the Ukrainian SSR Academy of Sciences. Environmentally-based researches are done in the framework of the plan of scientific and research and experimental work. As a result about 300 resource and energy-saving works have been proposed to introduction into the national economy.

Nowdays everyone in the Republic wants to Know what Kind of water he drinks, what air he breathes, what food he eats, that is he wants to Know every piece of information. This is every citizen's constitutional right. Therefore the Ukrainian SSR State Committee for the Environment Protection, The Ukrainian Republic Department on Hydrometeorology and the Republican Health Ministry have developed joing measures on close cooperation of providing the public at large with full information. Operational data about current environmental situation in the Republic and regions will be published.

Certainle the system of collection, processing and storing of environmental situation, banks of data on the state of the environmental are needed. Now the Institute of Cybernetics of the Ukrainian SSR Academy of Sciences named after Glushkov is developing a scientific and organizational basis of a creation of a state informational and expert system called "Nature".

Materials of various nature history surveys and observations, cadastres of natural resources, state and departmental statistical data reports, the results of environmental monitoring, distance

zoning, national and foreign scientific and technical projects, indexes of state plans and programms are the source of the "Nature" system.

The system is intended to solve the following main tasks:

- systematization, storing and giving out of the needed information and the analysis of the information;
- estimation of natural and man-made complexes, environmental conditions and natural resources with simultaneous recommendation of their proper management, reproduction, permissible loads;
- estimation of the state of the environment with the purpose of determination of priorities as to its improvement, further social and ecological development of regions;
- environmental and economic estimation of project and planned and project materials, environmental justification of projected and reconstructing enterprises;
- estimation of environmental justification, possibility of economic activities, utilization of natural resources, permissible levels of enthropogenic impacts (for the giving of permissions to use natural resources, limits of discharges and so on);
- calculation of norms of payment for the use of natural resources, for damage to the environment and other ecological and economic indexes;
- the estimation of efficiency of compensational measures carrying out with the purpose of conserving and rehabilitation of a favourable environmental situation;
- environmental justification of developing norms and rules of proper environmental management.

The system is supposed to be able to give information in the form of text, map, diagram and to transform the information to other informational systems.

All this would allow to make decisions at more optimal level on environmental rehabilitation and inform regularly and truthfully the public about the state of the environment.

ANALYSIS OF MODERN ECOECONOMIC SYSTEMS AND NEW COMPUTER BASED TECHNOLOGIES FOR MAKING DECISIONS

A.A.Morosov, N.D.Chepurnoy

The task of comprhensive analysis of the ecology-economic systems now is one of more urgent problems of fundamental and applied sciences.

Traditionally, during the realisation of the analysis of the ecoeconomic systems are marked out an ecological block and a block of human activity.

The ecological block includes such components as biota and geochemistrycal cycles (substance circulation in the nature).

The human activity forms are subdivided into two system groups.

The first group includes such forms (subsystems) that have an universal nature and don't depend on the society organization social peculiarities.

These are the industrial production, agricultural producti●, forestry, power industry, resources, scientific and technical progress and demography.

The second group of the activity forms includes the social mechanisms which reflect individual social nature of the society. These are the financial distribution, investment, price formation, tax policy, etc. Also some general notions typical for modern ecoeconomic systems.

Part 1 Amplification, intensification and expansion of internal, horizontal and vertical relations.

Civilization development leas to the reinforcement of internal interactions of the ecoeconomic system components of

any level. In this case the horizontal relations among different ecoeconomic systems of one level and the vertical relations among ecoeconomic systems of local, regional and global levels are expanded and intensificated.

So, an accident at modern industrial works with high risk of influence over environment (local ecoeconomic system) may significantly influence over a regional ecoeconomic system.

A series of such accidents during some time interval may provoke noticeable changes in global ecoeconomic systems.

An example of such accidents may be one at Chernobil Nuclear Power Plant, which resulted in alienating areas about 3000 km^2 of fertil lands from farming usage and in polluting a significant part of the USSR European territory with radionuclide of technogenetic origin.

Unfavourable location of Chernobil Nuclear Power Plant in the Upper Dnieper with large watercatchment area has resulted in expansion of radioactive pollution areal.

The spring flood, summer and autumn rains provoke a wash-out of a radionuclides from the territory contaminated to the Dnieper and then they are transferred to lower water storages.

Now is required special control of the quality of Dnieper's water which is used for irrigation in a zone of intensive farming in the South of the Ukraine.

Part 2. Sharp aggraviation of ecological problems on local, regional and global levels.

As a result of intensive and not always motivated influence of human activity over the ecological block now there are many disputed ecological problems which are difficult to solve.

Some biological species are disappering, new substances with technogenetic origin, which are alien to the nature, are

involving in geochemistrical cycles. Also, is becoming worse sharply the medium of existence of the man as a biological specie.

Special preocupation is provoked by the problems associated with a pollution of the medium as a result of extensive economic activities.

Among these problems on a local level there are: soil erosion, air pollution of industrial centers, contamination of farm products, surface and soil waters with mineral fertilizers, pesticides, heavy metals, radionuclides, etc.

In addition to the direct negative influence over the organs of the man, a contamination of air, soil, water, food leads also to some influences over chromosomic organs, which can provoke pathological genetic alterations.

Among these problems at a regional level there are a quali tative exhaustion of water, terrestrial and forest resources, a disappearense of biological species, a degradation of natural landscapes.

On a national and international levels these are an atmospheric transfrontier transfer of industrial waste, contamination of large international rivers.

On a global level these are an alteration of climate, a violation of a heat balance of the planet, an alteration of physical and chemical properties of the atmosphere, a destruction of ozone layer, an accumulation of long lived radioisotopes in the geosphere.

Inspite of enormous internal reserves of the ecological systems in relation to a self-recovery, many of them are already exhausted their potential reserves as a result of irrational usage of the nature.

In the nearest future the ecological problems will be aggravated by a heterogeneity and a polarization in relation to the geodemography as well by urbanisation and future growth of the population.

Part 3. In the human activity block are absent the systems of qualitative informational service y of qualitative making decisions, which secure valid decisions making from the point of view of guaranteed stable long-term rational development of the ecoeconomic systems with local, regional and global levels.

We consider as a system of qualitative informational service [2]:

a) precision (точность); b) opportuneness of service; c) completeness of presentation; d) importance (relevantness) for a question to consider; e) expressiveness (activity of perception); f) accessibility and comfortabability (high service); h) economy.

The informative servicing of high quality is necesary but is insufficient condition for improving the quality of the decisions to make as a final product of the activity of any decisions making system.

A process of making decisions is founded on taking into account the factors, on analysis of their relations, on prognosis of situation development, on forming of neighbouring and distant goals, on planning and distribution of the resources.

Es natural that the general requirement of improving the quality of service must extend also to the processes of making decisions in ecoeconomical systems in following directions:

- improving the precision, the opportunity and the comple teness of the decisions which are making, owning to usage of modern mathematical methods and computing equipment;

- increasing the number of factors to consider;

- intensification of analysis of their influence including the results of fundamental and applied researches;

- rational determinating of the aims;

- optimal planning with a consideration of multiple criteria and conflicts of interaction between the multilevel ecoeconomic systems.

The fundamental principles of the informational service and making decisions systems first were formulated and then developed in more detail as applied to the first group of human activity forms, with the exeption of the ecological block.

From the beginning of sevebties untill the present time in all the world are developing intensively different informationretrieval systems (IRS), automatic-control systems and automatic-design systems are developing new mathematical models and methods aimed principally at the resolution of complex economical, scientific and technical problems.

The created systems are aimed first at an increasing the economic efficiency of the industrial plants and power plants, at the intensification of land tenure and forest tenure, at further acceleration of scientific and technical progress.

The tendencies, which take place, to unilateral development of these systems, aimed principally at achievement maximum economic efficiency, and that leave out of account the ecological component, not only don't favour the solution of ecological conflicts, but on the contrary, aggraviate them.

Theoretically the situation may change, if in the near future it will be possible to guarantee a priority development of ecological and ecoeconomic information systems and decision support systems on all the levels.

Below we shall describe one of possible approaches to the creation of ecoeconomic decision support systems (DSS), which is developing in the Special Design Bureau of mathematical machines and systems of the Glushkov Institute of Cybernetics of the Academy of Sciences of the Ukraine.

Let us descuss the DSS from the point of view of ensuring the guaranteed stable long term development of the ecological systems with a national, regional and local levels. We suppose that DSS ensures the guaranteed stable long term development of an ecoeconomic system if simultaneously are achived economical and ecological criteria.

As an economic criterion let's consider compulsory satisfaction of constantly increasing demand for consuming goods, and as an ecological criterion, we'll choose ecological system yearning to preserving homeostasis of which limits may be set, having introduced the whole complex of examples of environment quality.

Structure and Main Tasks of National Level DSS

National level DSS has the most adequately to take into account the influences of the whole national economy structure on environment, influences taking place in the world economic structure.

Any pollution is the economic activity undesirable product and it has quite definite connection with some work process.

For description of producing desirable and undesirable products one can apply the same structural coefficients used for describing structure of making and using branches.

For the first time the idea of national economy structure

influence analysis of different branches of industry on environment was offered in work [3].

In the presence of the expenses reliable coefficients of different branches of industry, given approach allows to consider producing and eliminating the whole variety of wastes as an economic process organic part.

Let's consider the dynamic model "expenses-output" with the inclusion of the activity connected with polluting environment.

Indexes:

Let $1,2,3,\ldots,i,\ldots,j,\ldots,m$ be the indices of useful products;

$m+1,m+2,\ldots,g,\ldots,k,\ldots,n$ be those of polluting substances, (undesirable products).

Technological Coefficients:

$a_{ij}(t)$ are the product expenses i for producing a product unit j at moment t;

$a_{ig}(t)$ are the product expenses i for annihilating wastes using g at moment t;

$g_i(t)$ is wastes letting g for a product unit i at moment t;

$g_k(t)$ is wastes letting g per a annihilated wastes unit k at moment t;

Variables:

$x_i(t)$ is gross cutput of product i at moment t;

$z_g(t)$ is the total volume of annihilated wastes g at moment t;

$y_i(t)$ is the final deliveries for consuming product i at moment t;

$y_g(t)$ final deliveries of wastes g at moment t.

Matrixes and Vectors

$A_{11}(t)=[a_{ij}(t)]$, $i,j=I,\ldots,m$ is the matrix of coefficients of different branches of industry at moment t;

$A_{21}(t)=[a_{gi}(t)]$, $i=I,\ldots,m$ is the matrix of wastes $g=m+I,\ldots,n$ direct letting coefficients at moment t;

$A_{12}(t)=[a_{ig}(t)]$ is the matrix of branches expenditures coefficients on pollution control at moment t;

$A_{22}(t)=[a_{gk}(t)]$ - $g,k=m+I,m+2,\ldots,n$ is the matrix of coefficients of letting wastes by these branches at moment t.

$X_1(t)=(x_1(t),\ldots,xm(t))$ is the vector of useful products gross output at moment t;

$X_2(t)=(xm+1(t),\ldots,xn(t))$ is the vector of annihilated wastes at moment t;

$Y_1(t)=(y_1(t),\ldots,ym(t))$ is the vector of useful products final deliveries at moment t;

$Y_2(t)=(ym+1(t),\ldots,yn(t))$ is the vector of wastes final deliveries at moment t.

Then natural intersectoral balance may be described in the following form:

$$X_1(t)-A_{11}(t)X_1(t)-A_{12}(t)X_2(t)=Y_1(t),$$
$$X_{21}(t)X_1(t)-X_2(t)+A_{22}(t)X_2(t)=Y(t).$$

Let $Y^{e}_{1e}(t)$ be a final product export into the country e at moment t;

$Y^{m}_{1e}(t)$ be a final product import from the country e at moment t.

Let $\overline{Y}_1(t)$ be required final consumption level guaranteeing satisfaction of the demands in the given country;

$\overline{X}_1(t)$ be maximum possible level of producing goods at moment t taking into account shared resourses limitedness.

The economic criterion for the given national ecology-economic system is reached per t-moment on condition that the following relations hold true,

$$Y(t)-\sum_{e} Y'_{1e}(t)+\sum_{e} Y''_{1e}(t) \geq \overline{Y}_1(t),$$

where

$$Y_1(t)=X_1(t)-A_{11}(t)X_1(t)+A_{12}(t)X_2(t)$$

and

$$X_1(t) \leq \overline{X}_1(t)$$

Let $Y'_{2e}(t)$ be the transfrontier waste transport to a country e per t-moment;

$Y''_{2e}(t)$ the transfrontier waste transport from a country e per t-moment;

Let $\overline{Y}_2(t)$ be the maximum possible level of waste accession per t-moment securing homeostasis of the given national ecological system.

Then the ecological criterion is reached per t-moment on condition that the relations are correct,

$$Y_2(t)-\sum_{e} Y'_{2e}(t)+\sum_{e} Y''_{2e}(t) \leq \overline{Y}_2(t),$$

where

$$Y_2(t)=A_{21}(t)X_1(t)-X_2(t)+A_{22}(t)X_2(t)$$

and

$$X_1(t) \leq \overline{X}_1(t)$$

Thus a national ecological system has stable development guaranteed for a long time on condition that the following relations hold true for any moment of t=0,1,2,

$$Y_1(t)-\sum_{e} Y'_{1e}(t)+\sum_{e} Y''_{1e}(t) \geq \overline{Y}_1(t) \qquad (I)$$

$$Y_2(t)-\sum_{e} Y'_{2e}(t)+\sum_{e} Y''_{2e}(t) \leq \overline{Y}_2(t) \qquad (2)$$

where

$$Y_1(t)=X_1(t)-A_{11}(t)X_1(t)+A_{12}(t)X_2(t) \qquad (3)$$

$$Y_2(t) = A_{21}(t) X_1(t) - X_2(t) + A_{22}(t) X_2(t) \quad (4)$$

$$X_1(t) \le \overline{X}_1(t) \quad (5)$$

For realization of the mathematical model (I)-(5) it is necessary,

- to organize source data collection for reliable determination of the $A_{11}(t)$, $A_{12}(t)$, $A_{21}(t)$, $A_{22}(t)$ technological matrix factors;

- to design a system of long-term prediction of the $A_{11}(t)$, $A_{12}(t)$, $A_{21}(t)$, $A_{22}(t)$ technological matrix factors modification dynamics;

- to create a data bank of up-to-date and long-term manufacturing processes with due regard for their environmental action;

- to create a national resources data-base and a prediction system of their amendments;

- to design a national socio-demographic model, the external and domestic market models;

- to realize a program of fundamental and applied complex scientific investigations for determination homeostasis borders of the national ecological system;

- to design and verify mathematical models of the transfrontier atmospheric industrial waste transport and as a result big international rivers pollution;

- to organize the environmental national monitoring;

- to create the national geoecology information system.

We have enumerated the national level principal subsystems of decision support system (DSS), the functioning stages of which can be described as followings.

The First Stage. To determine the vectors

$$\bar{Y}_1(t), \bar{Y}_2(t), Y'_{1e}(t), Y''_{1e}(t), Y'_{2e}(t), Y''_{2e}(t), \bar{X}_1(t)$$

and the technological matrix factors

$$A_{11}(t), A_{12}(t), A_{21}(t), A_{22}(t), \quad t=0,1,2,....$$

The $\bar{Y}_1(t), Y'_{1e}(t), Y''_{1e}(t)$ vectors are determined by the national socio-demographic model, the external and domestic market models, as the basis.

The $Y_2(t), Y'_{2e}(t), Y''_{2e}(t)$ vectors are determined by the fulfilled scientific investigations, the environmental monitoring, the mathematical models of transfrontier atmospheric waste transfer and as a result big international rivers pollution, the geoecology information system data, as the basis.

The $\bar{X}_1(t)$ vector is determined by the scientific economic researches and the existing national resources data with regard for their modification dynamics, the geoecology information system data.

The $A_{11}(t)$, $A_{12}(t)$, $A_{21}(t)$, $A_{22}(t)$ technological matrix factors are determined by the active source data collection system and the long-term prediction of technological matrix factors modification dynamics.

The Second Stage. To verify the satisfiability of the (1)-(5) relations.

It should be proceeded to the First Stage with the purpose of looking for the optimal development trajectories or interrupted the functioning, it the (1)-(5) system is compatible.

It should be proceeded to the Third Stage, if the (1)-(5) system is incompatible.

The Third Stage. To study the alternative decision versions directed to achieving (1),(2) and (5) criteria, to choose the optimal one and proceed to the First Stage.

As alternative decision versions it might be studied followings:

- to change the technological matrix factors including to economics structure, for instance, new economically more effective or ecologically more purified manufacturing processes;

- to decrease production, to reduce export and to increase import of goods manufacturing of which is connected with the high-level environmental pollution;

- to increase the share of annihilated waste;

- to reduce the transfrontier waste transport through interstate agreements about cancellation of atmospheric and big international rivers effluents;

- to increase an import of limiting resources etc.

Proposed above the structure and the main aims of the national level DSS allow the further development and the generalization of various directions.

The national DSS may be the base for the creation of the international and the global decision making support systems necessary for the supply of the guaranteed stable long-term development of the continental and the global ecology-economic systems being greally conductive to acceptance of the most well-founded decisions connected with regulation of the global ecological and social problems.

Now let us study some approaches to the creation of region--level DSS.

The Structure and the Main Aims of Regional DSS.

Let us study a regional ecology-economic system. Suppose, the guaranteed long-term stable development of the regional ecology-economic system are provided on condition that simultaneously the economic and ecological criteria for each of the regions, including to the given national ecology-economic system, are reached.

Let introduce the following symbols,

r - region index (r=1,2,...,R);

$X_{1r}(t)$ - the total volume of goods production in r-region per t-moment;

$X_{2r}(t)$ - the total volume of the annihilated waste in r-region per t-moment;

$Y_{1r}(t)$ - the ultimate deliveries of the useful products manufacturing by r-region per t-moment;

$Y_{2r}(t)$ - the ultimate environmental waste deliveries by r-region per t-moment;

$A^r_{11}(t)$, $A^r_{12}(t)$, $A^r_{21}(t)$, $A^r_{22}(t)$ the technological matrix factors repelling regional economics structure per t-moment;

$\bar{X}_{1r}(t)$ - the goods manufacture maximum possible level per t-moment in r-region taking into consideration insufficiency of resources in use;

$\bar{Y}_{2r}(t)$ - the waste effluents maximum possible level for r-region securing homeostasis of the given regional ecology-economic system;

$Y'_{2rp}(t)$ - the interregional waste transport from r-region to p-region per t-moment;

$Y''_{2pr}(t)$ - the interregional waste transport from p-region to r-region per t-moment;

$T'_r(t)$ – the transfrontier waste removal from r-region;

$T''_r(t)$ – the waste ingress in r-region as a result of the transfrontier transport.

The economic criterion is reached on condition that for each moment t=0,1,2,... and any region r=1,2,... the following relations hold true,

$$\sum_z Y_{1z}(t) \geq Y_1(t), \tag{6}$$

$$\sum_z X_{1z}(t) \geq X_1(t), \tag{7}$$

$$X_{1z}(t) \leq \overline{X}_{1z}(t) \tag{8}$$

Let us take that the ecological criterion is achieved on condition that for each moment t=0,1,2,... and any region r=1,2,... the relations hold true,

$$Y_{zz}(t) - \sum_\rho Y'_{zz\rho}(t) + \sum_\rho Y''_{z\rho z}(t) - T'_z(t) + T''_z(t) \leq \overline{Y}_{zz}(t), \tag{9}$$

where

$$\sum_z Y_{zz}(t) \leq Y_z(t) \tag{10}$$

For realization of the regional DSS on base of (6)-(10) models it is necessary,

- to design the regional socio-demographic model;
- to realize the fundamental and applied complex scientific investigation program for determination homeostasis borders of the regional ecological system;
- to design and verify mathematical models of interregional pollution substances transport;
- to organize the regional environmental monitoring;
- to create the regional geoecology information system;

- to design the mathematical model of the optimal enterprises placement.

The main stages of regional DSS functioning are similar to the stages presented for national decision making support system.

Let us separate just a number of alternative versions specified for the regional level,

- to change the regional economics structure through the technological factor modifications, inclusion of new manufacturing processes and exclusion of the obsolete ones;

- to redistribute goods production connected with the high-level environmental pollution through the different regions;

- to increase the waste share annihilating in the region;

- to reduce the interregional industrial waste transport;

- to provide the industrial enterprises optimal placement.

The geoinformation systems (GIS) play an important part in regional DSS.

The GIS organization for modeling of the anthropogenic load consequences on the region environment was suggested in [4].

GIS is the system for gathering, holding, conversion and representation of the geographic data. The GIS principal distinguishing features of ecological and other natural databases consist of their pronounced regional direction which is achieved by using the cartographic matter as the source data and the object of formalized processing. Using GIS is very effective when promptitude, precision, completeness, expressiveness, accessibility and comfortness in data representation play an important part in the environmental monitoring, remote sounding data processing, solving the problems of industrial enterprises optimal placement.

The GIS includes the following structure components:

I. Information block (data bank of the modeling region).

The block content is defined by the concrete trend of the GIS and may contain topographic, geological, soil, economical, landscape and other maps of the different scales, data of the economic use of the territory and technogenic factors, etc.

2. Block of the conceptual and mathematical models.

This is the main algorithmic and mental part of GIS. It provides stored and encomming data processing operations currently. According to the putting tasks and special purposes it includes the set of models intended for cartographic and ordinary data processing.

3. Scenario block for support decision system and registration of the recomendation.

It includes the dialog simulating and diagnostic research phenomena and processes subsystem, the development of the alternative variants on recomended measures and the choice of the optimal one.

The important section of this block is operative cartography mapping system, meeting the quality information service requirements.

4. Computer block.

This is the main technical support block, whithout which the operation of GIS and DSS is impossible.

The modern graphic station, providing input, processing, store, output and hard copy of the cartography information is the computer block nucleus.

Completing the discussion of the structure and regional tasks, it should be underlined that all the decision making

process must be permanent information exchange process between national DSS and regional DSS, from one hand, and between different regional DSS, from other hand.

From this the quite definite requirements follow to the organization of the distributed net, which connects the regional and national DSS centres.

Structure and the Main Tasks of the Local DSS.

Let us examine the ecology-economic system. We shall account, that garanted long-term steady local ecology-economic system development is provided, when local economic, ecology and sanitary-hygiene criteria are achived simultaneously.

Under the economic criterion we shall understand the useful products manufacture, envisaged by the regional DSS for given local economic system.

Under the ecology criterion we shall understand the aspiration for homeostasis conservation, the limits of which may be set by introducing the permissible levels of the environment.

Under the sanitary hygiene criterion we understand such characteristics of the human environment, which garanted absence of genetic consequences and create available gigienic work and rest conditions.

For controlling simultaneous achievement of the named criteria, the local DSS must include the following subsystems:

- local monitoring of the environment;
- local geoinformation system;
- mathematical models of the local level for simulation of the pollution transportation in atmosphere, surface waters, aeration zone, soil waters, food and trophic chains;

- mathematical model for estimating of the genetic consequences of the pollution of the human environment.

In the case of the ecological and sanitary-gigienic criteria unkeeping, as a set of analyzed alternative variants may be proposed the following actions:

- to agree with regional DSS the less volume of the goods production;

- to increase the volume of wastes;

- to impose penalties for the environmental pollution;

- to agree directly or through the regional DSS the reduction of the wastes by another local ecologyeconomic systems;

- to do the nature preserving measures: to increase the area of the forestry, to expand the recreation zone, to make medical-prophylactic measures and so on.

Such a way, every local DSS must contain the adapted mathematical model of the pollutant transporation, filled data bank about environmental pollution, the acting geoinformation system.

In many modern local and regional ecologyeconomic systems the many hundreds of the technogenic substances are involved in geochemic cycles.

In the current time the mathematical model of radionuclide transportation is the most performed one. The great work on the development and adaptation of the mathematical models, which allows to consider all the forms and processes variety of the other pollutant transportation is in prospect.

For operative and reliable filling of the environmental pollution data banks, the automatic collecting and store information system must be developed. It requires the high-precision analytical instruments design, new ideas and new methodic

searching, new distant communication channels, the wider implementation of distant probe methods for economic purposes.

The many problems arise during the information block GIS filling. In the existing GIS the nature information is introduced from branch component map series: hydrography, soil, vegetation and so on.

In this case the problems of the cartographic data intercorrelations appear, which is often based on the different principles and approaches. Sometimes it requires hard work on coordinating of the content and skeleton parts of inputting map complect.

Completing the discussion about the structure and the main tasks of the local DSS, it should be underlined that the most actual becomes the sanitary-gigienic block, which must provide stable and comphortable human existence as a byological specie.

The given block must contain:

- medical-social monitoring
- genetic monitoring
- sanitary-gigienic monitoring.

During the creation of the given block one of the main problems may become the absence of the suitable information streams.

In conclusion, admit, that in this work only the most actual economic, ecologic scientific, social, technical and technologic subjects are broached, which appear during the constructing of the quality service and decision support systems, aimed at providing the garanted stable long-term development of the ecologic local, regional and national level systems.

The marked stages and subsystems should be considered not

separately, but as a composed parts of one of the same information technological and organization process, in which the most important role belongs to computer technologies of the information service decision support.

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PROBLEMS OF POWER ENGINEERING DEVELOPMENT AND ENVIRONMENTAL PROTECTION IN THE UKRAINIAN SSR

V.E. Tonkal, Corresponding Member of Ac.Sci.Ukr.SSR
M.I. Minc, Doctor of Economic Sciences
Institute of Problems of Energy Saving,
Academy of Sciences of the Ukrainian SSR,
252070, Kiev, USSR

Present-day power engineering is a large-scale highly developed industry. Its impact upon the environment manifests itself at all stages of power production and has a specific character for each power industry and a power plant. The influence of power engineering upon the environment manifests itself, first, in quantitative influence, i.e., in consumption of natural resources (oxigen, land, water), second, in qualitative influence, i.e., in the influence of waste of power production in the form of: detrimental effluents, buried waste, side effects (radioactive, electromagnetic, acoustic radiation), disturbance of landscape, effect on climate, etc.

Power engineering as a system comprises five relatively independent stages: recovery of natural fuel and power resources (FPR); transport of FPR; enrichment, refinement and concentration of FPR; production of converted forms of energy and their transport, end use of the energy. Each stage is characterized by its type and peculiarities of quantitative and qualitative impacts of power plants on the biophysical environment. When estimating the influence of power plants on the environment, among five stages of power production and consumption of significant interest are electric power stations, proceeding from the intensity of their dynamic influence upon the natural resources and from the distinguishing features of ecological situat . after the accident at Chernobyl nuclear power station .

By the beginning of 1988 the installed electric power of electric power stations of the USSR amounted to 320 mill[illegible]kW, and the generation of electric energy - 1599 mlrd kW hr. In the USSR, the electric

power stations are combined into 93 power systems which, in their turn, enter into 11 interconnected power systems (IPS) which form the power grid of the country.

Power systems of the Ukrainian SSR form in common with the power system of Moldavian SSR the interconnected power system of the South, the largest power complex of the country, which generates about 20% of All-Union production of electric energy. The distinguishing feature of this complex is its location at the junction of power grid of the USSR and Interconnected power system of CMEA member-states. Such location of the complex imposes additional requirements upon the modes of operation of power stations and intersystem connections.

The installed power of electric power stations in the Ukraine comes to about 53 millions of kWt at present. Organic fuel electric power stations generate the main part of power (60% by power, and 70% by output), the share of nuclear power stations is above 20%. The maximum voltage is 750 kV ; at this voltage, electric power deliveries to CMEA member-states, power output of nuclear power stations, relations with cooperating associations are carried out.

In future, the Ukrainian SSR will also play an important role in the development of the national economy in our country. High rates of the economic development in the Republic motivate the necessity for enlargement of the capacities of electric power stations in Interconnected power system of the South (for a term up to 2005) despite structural shifts in the direction of accelerated development of non-power-intensive industries and the conducted policy of power and electric supply.

The nearest stage of the development of electric power engineering of the Ukraine (1990-2005) is considered at present as transitional one. The Chernobyl accident and its consequences generated a need for revision and profound study of the earlier adopted long-term concept about paying off long-range loads in the International power system of the South by priority introduction of nuclear power capacities into power

systems of the Republic. The following problems became the most important ones: siting of nuclear power stations (with different types of reactors) in densely-populated areas with a high concentration of industrial and agricultural production; safety and reliability of nuclear power stations ; concentration of power capacities over one area ; ecological, power, social-economic consequences of using nuclear power stations under normal conditions and in emergency ; the similar studies on estimation of effects and consequences of distribution of other power technologies and systems, and so on.

As a result of studies conducted since 1976 in the Republic, various scenarios of the long-term development of power engineering in the Ukraine have been elaborated. Two of them are regarded to be the most probable. One of them provides for the moratorium on siting of nuclear power stations with modified reactors WPR-1000 (the question is about moratorium on siting of nuclear power stations at transition stage) with orientation towards the development of nuclear power engineering beyond 2000 on the basis of a new generation of reactors with inherent safety. By this scenario the growth of basic power to pay off the long-range load in the Interconnected power station of the South will be provided through construction of thermal power stations oriented towards the use of local fuel (coal) and delivered resources (natural gas).

The second scenario differs from the first one by a higher level of development of nuclear power engineering in the Republic by the end of the transition stage (as compared to the existing level) through priority introduction of new blocks (on the basis of WPR-1000 reactors) on sites of operating nuclear power stations and those in the process of construction. The second scenario of the long-range development of electric power engineering of the Republic is more preferable at the given stage due to the possibility of a more intensive growth of electric loads in power systems than it is provided by the first variant ,

the possibility of creation in the given case, of a reliable reserve of generating capacities in power systems and due to uncertain situation in the matter of supplying thermal power stations with centralized resources of natural gas produced in the eastern regions of the country.

Problems of development of thermal power engineering on organic fuel which must be solved in our Republic (in case of the moratorium on the development of nuclear power engineering) are very complicated due to the necessity of solving a number of technical and organizational problems related to the re-equipment of power stations and manufacturing of the proper equipment as well as due to the existing environmental pollution by conventional pollutants produced in the process of organic fuel combustion.

Problems of the development of nuclear power engineering in the Republic are also complex if we take into account the consequences of the accident at Chernobyl nuclear power station, limited possibilities of the Ukraine as to the allotment of the new lands and theuse of water resources for the development of nuclear power engineering, factors of public opinion, etc.

Today thermal power stations (TPS) emit on the territory of the Ukrainian SSR into the air: 76% of sulphur oxides, 53% of nitrogen oxides and 20% of solid particles of the total emission from stationing plants in spite of drastic increase of expenditures for achievement of the national ecological standards. To a considerable extent this is caused by deterioration of quality characteristics of fuel and by using low-quality energy carriers for combustion. For example, the ash of Donetsk coals which comprise mainly compounds of silicon and calcium, has also trace impurities of vanadium (120-170 mg/kg), lead (170-210 mg/kg), arsenic (170-210 mg/kg), chromium (110-150 mg/kg), zinc (70-400 mg/kg). In the recent years the ash content of coals in the Republic has increased from 15-20% to 25-40%.

Relations given in Figs. 1-3 show what profound effect has the deterioration of qualitative characteristics of fuel (or the change of composition of energy carrier) on generation of air pollutants. For example, the increase of ash-content of coal from 32.2 to 34.2% results in one-and-a-half increase of the number of solid particles contained in the flue gases which must be purified beforeemission into the atmosphere. Deterioration of the fuel quality resulted in the severe increase of expenditures caused by the necessity of obeying maximally admissible norms of emissions and effluents in places of TPS location. Expenditures for diminishing of emissions of gaseous ingredients into the atmosphere increased considerably. The specific investments for reduction of sulphur or nitric oxides emissions into the atmosphere are approximately 20 (and more) times in excess of the similar expenses on reduction of ash emission (with the use of domestic gas cleaning equipment). Application of the specialized units operating by magnesite, limestone, ammonia-cyclic and other methods of TPS gas cleaning from sulphur oxides results in the raised costs for installed capacity of power station by 30% in average, and the growth of the prime costs of production of 1 kW·hr of electric power by 10%.

Moreover, each next percent of reduction of harmful substances emission into the environment requires more and more money. This statement is illustrated by curvature of Fig.4 reflecting the dependence of the specific expenditure for ash emission reduction on the value of inde of the "depth" of emission reduction in the atmosphere. The dependencies of Fig.4 are obviously nonlinear and slope of the curves increases over the last sections, i.e., for high efficiency of dust and gas cleaning equipment. The specific investments in the equipment for utilization technologies of the environmental protection purpose grow in a number of cases in geometric progression with the increased depth of cleaning the technological gases (for example, expenses on electric filters in-

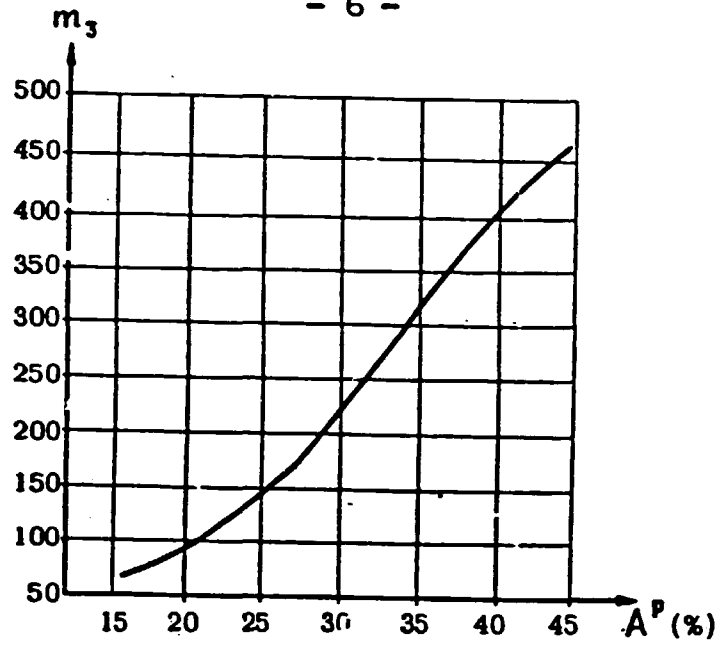

Fig. 1 Dependence of the specific indices of solid particles formation from flue gases on the ash contents of a fuel

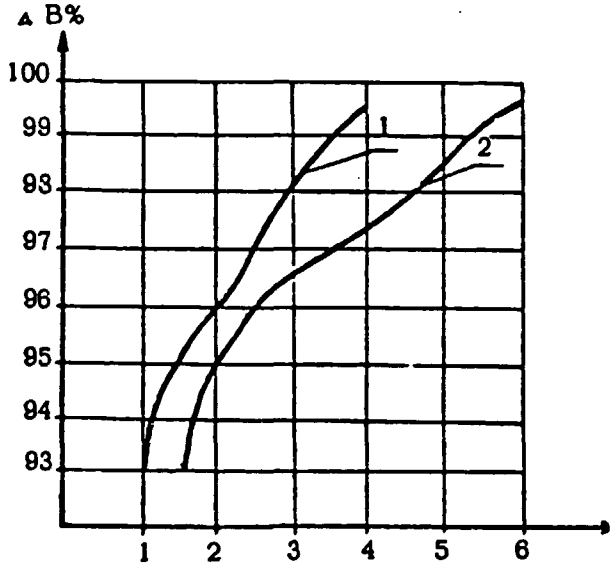

Fig.4 Character of variation of the cumulative costs for reduction of ash emission into atmosphere by TPS as a function of the depth of emissions utilization (1 - operating expenses; 2 - cumulative costs)

stallation with the efficiency 90, 99 and 99.9% are correlated as 1:2:4). Of similar character are the dependencies concerned with emission of other (gaseous) ingredients and discharge of harmful substances present in TPS effluents into water sources. The investigations conducted with the use of ecological economic simulation models of estimation of the entire spectrum of quantitative and qualitative impacts of power plants exerted over biophysical environment with the further development and distribution in the Republic of powerful thermal and nuclear power stations(in accordance with the rates of power engineering development envisaged by a long-term scenario) permitted to draw a number of fundamental conclusions concerning the interactions among energetic, economic and natural (typical for the republic) processes and phenomena. And here, in simulation experiments, the estimation of the intensity with which the dynamic technogenic load of power plants over a region's natural environment manifests itself is realized on the basis of qualitative indices of convolution of the obtained number of quantitative and qualitative influences (social-economic aspects of power plants siting inclusive) into the value form. When organizing the normal base of economic estimates of technogenic impacts on the environment, different methods were used (expert estimates of thermal emissions and discharges, air resource estimate inclusive): the methods of estimation of the Ukraine's natural resources with account of differential rental income returned by the unit of each type of the considered resources at the expense of better natural conditions as compared with the same type of resource with maximally admissible for the national economy level of expenditure; combination of methods and approaches to attainment of equivalence with the normative method in determination of economic estimates of damages caused by contaminants to biophysical environment; the methods of extrapolation of economic estimates of damages, for which the respective normals of maximally admissible concentrations (MAC) in various media were

established; the methods "doze-effect", "doze-response" when radionuclides are emitted into the environment, etc. The carried out experiments showed that the further development of heat power industry in the Ukrainian SSR (with orientation to coals of Donetsk coal fields) is associated with the huge compensation expenditure that must be invested into the branch to reduce the technogenic load on biophysical environment. Thus, with the further siting of TPS on the territory of the Ukrainian SSR the cumulative costs reflecting not only direct but also indirect expenses (loss) stipulated by TPS construction and operation in the regions of high anthropogenic load have the following (averaged over the territory) structure: in the total economic estimates, an expenditure on construction and functioning of utilization technologies capacities attains 11% ; the loss as a result of qualitative TPS impacts on biophysical environment - 8.0% ; the loss as a consequence of quantitative TPS effect on the natural resources (estrangement of agricultural lands, unrequited water consumption, utilization of atmospheric oxygen from the air for fuel combustion) - 5.5% ; expenses on construction and expansion of the projects of production and social infrastructure - 1-2% ; fuel expenses - about 48%.

Thus, when siting a TPS in the old developed economic regions, the important role in the structure of expenses of a power plant stationing and operation is attached to the compensation costs and losses in the national economy stipulated by additional technogenic load on the biophysical environment, by estrangement of valuable lands from agricultural rotation, by the use of expensive and deficient water resources, etc. If the compensatory costs and losses are taken into account, then the real expenses of electric power generation at new heat-and-power stations (located in the Republic) are 1.8 times greater than the shadow costs of the basic electric power fixed for the central and South regions of the Soviet Union.

Construction of nuclear power stations and, what is of crucial importance, a favourable fuel balance in the recent decades owing to an increase in a relative share of natural gas burned in heat-and-power stations postponed the need for a mass implementation of expensive plants for removal of sulphur in the USSR. It should be kept in mind that the majority of heat-and-power stations and hydroelectric power stations burn the natural gas from 6 to 9 months a year in the Ukrainian SSR and in other regions in the European part of the USSR, therefore the plants for removal of sulphur would be in operation at this stations less than half of the time of exploitation of the basic power equipment. At the same time the stringent air-emissions standards of the last years, increase in power capacities, the International Convention on Transborder Transfer (that provides for the decrease in SO_2 emission by 30 per cent by 1993 compared to 1980) necessitate us to master methods of removal of sulphur and nitrogen oxides and to fit the power plants with the appropriate environment control equipment.

The high-sulphur coals burned in the heat-and-power stations in the European part of the country (including coals mined in the Lvov and Volyn basin) are responsible for approximately 40 per cent of the total of SO_2 emissions in the USSR. The sulphur content in coals of the Donetsk basin is 3.5 to 4 per cent and in the fuel oil from 2.3 to 3.5 per cent.

Fig.5 shows the general dependencies representing the nature of change in technical-and-economic indices and in the indices of environment conditions related to the distribution of heat-and-power stations burning coals as a function of a depth of recovery of sulphur oxides from flue gases by various recovery methods (each of which affording some depth of recovery of sulphur oxides from flue gases by various recovery methods). As follows from Fig.5, an increase in recovery of SO_2 from the flue gases leads to a pro-

nounced improvement in the condition of atmospheric air in the area where the heat-and-power station is sited (curve 1), to a decrease in a damage inflicted on the environment by qualitative impact of TPS in nearly 2.5 with the recovery coefficient $K^{(SO_2)} = 0.9$ (curve 2). There is observed a reduction in the total expenditures on the siting and exploitation of a coal TPS (flat curve 4) in an old developed region as a result of a high "cost" of technogenic impact of SO_2 emission and a possibility to sale the by-product (sulphuric acid), even though the total expenses of recovery technology development grow almost exponentially (curve 3).

The implementation of recovery technologies at TPS enables decreasing the emission of sulphur oxides into the environment but entails a change in power supply reliability and a drop in the available power (curve 5) due to an increase in power expenditures charged to the station itself. As Fig.5 illustrates, the recovery technology consumes approximately 10% of power generated by the installed power equipment when coefficients of SO_2 recovery are high. Its development requires accumulation of energy generated by TPS and redundant capacities in case of failure of the equipment for sulphur oxides recovery from flue gases. However, from the standpoint of ecology and economy the expediency of SO_2 recovery at TPS that burn high-sulphur coals is beyond a doubt even at the modern level of technogenic load on the biophysical environment, no matter what additional expenses associated with the power factors of the system nature are.

Deterioration of quality parameters of fuel burned in boiler installations, for instance, the ash content from $A^p = 15.2$ per cent to $A^p = 34.2$ per cent of working mass, enhances the qualitative effect of heat-and-power station on the biophysical environment in the vicinity of this station, as shown in Fig,6. Economical damage

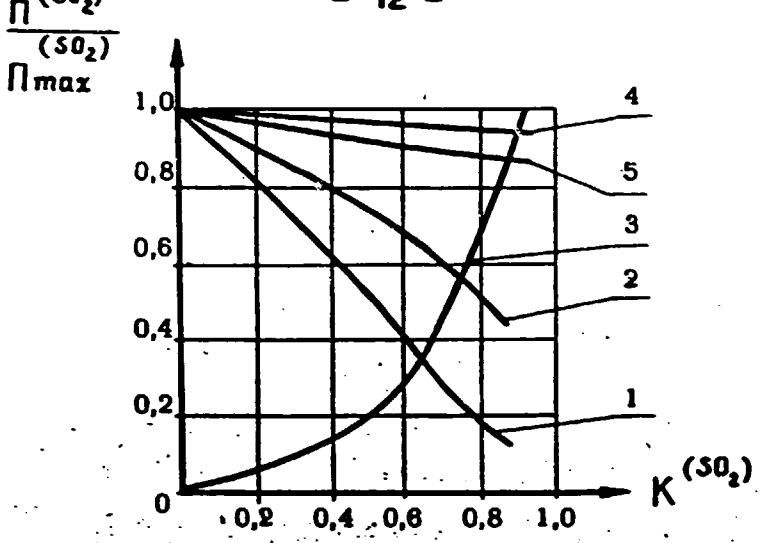

Fig.5 Nature of a change in technical-and-economic indices of a coal heat-and-power station and in the environment conditions in the area where it is sited as a function of a depth of recovery of sulphur oxide from flue gases (1 is a state of atmosphere; 2 is a damage to th environment; 3 is costs of SO_2 recovery; 4 is total expenses; 5 is an available power of the heat-and-power station)

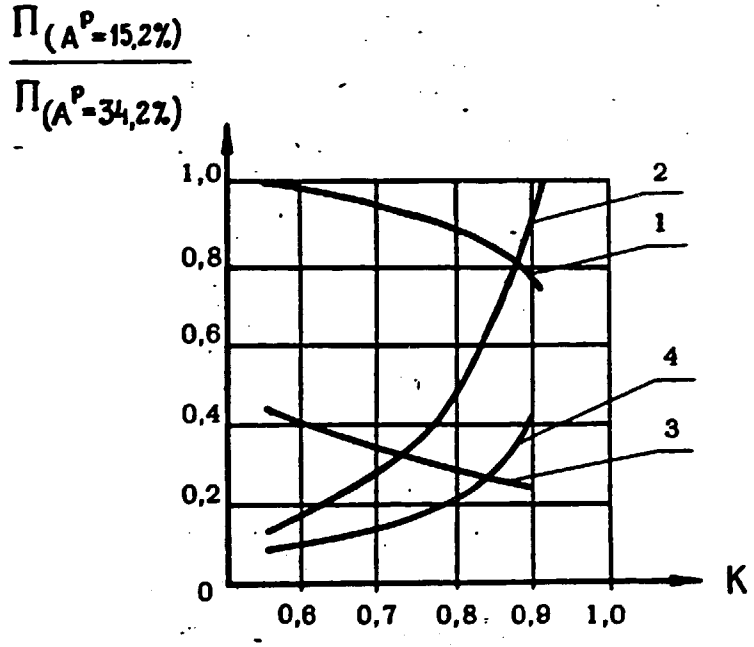

Fig.6 Change in qualitative effect of the heat-and-power station on the biophysical environment when the quality of fuel deteriorates (1 and 3 show the economic damage inflicted on the environment when a fuel of a lower or a higher quality is burned; 2 and 4 are expenses of the development of recovery technologies when burning a fuel of a lower or a higher quality)

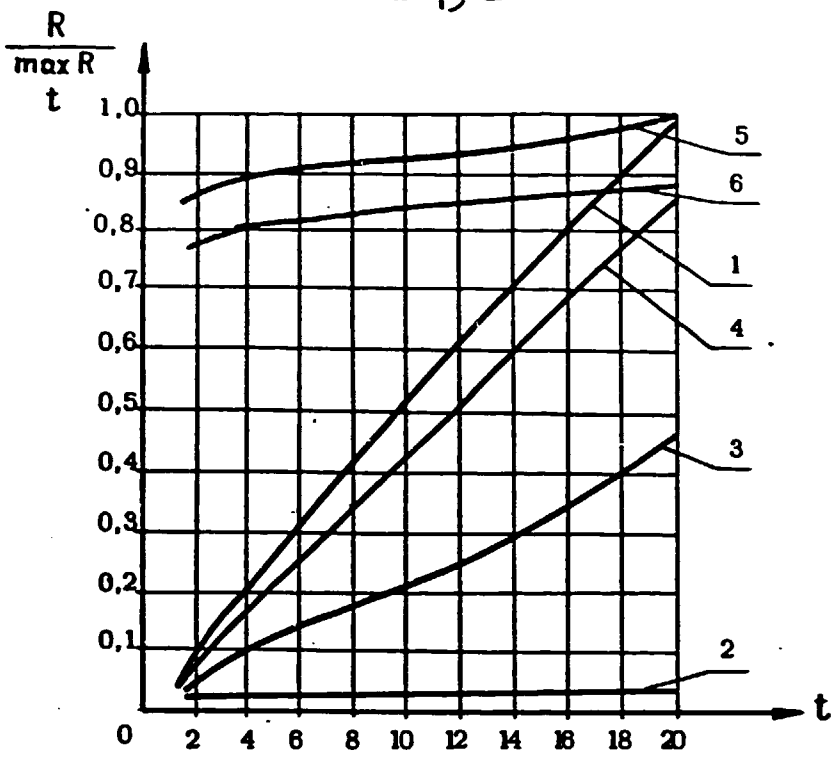

Fig.7 Dynamics of the effect exerted on components of the biophysical environment by a nuclear power station with the RBMK reactors and water power reactors operating under comparable conditions (1 and 2 depict the radiation effect on the atmosphere by RBMK and water power reactors, respectively; 3 and 4 depict the non-radiative effect of water power reactors and RBMK, respectively)

inflicted on the environment by polluting wastes of a power generating plant (in comparable conditions) under the above stated change in the content of ash in the burned fuel increases by a factor 2.5 to 2.8 (curves 1 and 3 in Fig.5), even though expenditures on the develpment of recovery technologies "moderating" ruinous effects of ash discharges on the biophysical environment components (curves 2 and 4 in Fig,6) also increase. In the second case with the increase in the ash content in the fuel the rates of increase in expenditures are higher than those in the case with the fuel for which A^P = 15.2 per cent. However the growth of expenditures on the development of recovery technologies highly efficient in trapping solid particles in fuel combustion gases is unable to prevent the "additional" economic loss that the biophysical environment suffers when qualitative characteristics of solid fuel degrade. It seems that the standard conditions of the environment in the vicinity of power station cannot be ensured only by an active development of recovery technologies at the heat-and-power station due to the trend towards deterioration of fuel quality and the methods of fuel combustion. Therefore, when siting the coal heat-and-power station in an old developed region, it is necessary, firstly, to develop processes of enrichment and treatment (gasifying, liquefying) of the solid fuel for improving (or at least stabilizing) its qualitative characteristics and, secondly, to extensively implement new technologies based on efficient methods of solid fuel combustion. These measures that help to lighten the technogenic load when the heat-and-power station burns coal must not be opposed but rather supplement one another.

So the two scenario of long-term development of power industry in our Republic allow for the technical re-equipment of the heat-and-

power stations now in operation and the introduction of new heat-and-power stations based on fundamentally new processes of solid fuel combustion. The main problem therewith consists in the advent of economic and less polluting technologies to burn coal and suitable small equipment for 200 and 300 Mw blocks (fluidized-bed furnaces, air-gush modules, that is the prefurnaces with a preliminary semicocking of solid fuel, methods of coal combustion in fusion), technological from the standpoint of power. Implementation of such technologies at the heat-and-power stations enables the emission of nitrogen oxides and sulphur oxides to be reduced by 40 and 30 per cent, respectively, as against the chamber fuel combustion and the fuel to be burned whose dirt content is up to 90 per cent and heat of combustion is from 1000 to 3500 Kcal/kg.

For the years from 1991 to 1995 we already plan to construct sulphur removal systems at 19 operating heat-and-power stations to be reconstructed in our country. The systems will cost from 1.5 to 2.2 milliard roubles. Precautions are taken at all heat-and-power stations now under construction to reduce the production of nitrogen oxides by recirculation of gases, the use of burners of two-stage combustion in systems of ammonical catalytic reduction of nitrogen oxides, etc.

Considerable investments are channeled to boost the efficiency of dust collection systems which is as high as 97 to 98.5 per cent at the modern power stations. The technology of vanadium recovery is refined (and that of nickel recovery is being developed) by washing and separation of ash deposits on heating surfaces of boilers. The problem of use of ash and slag produced by the heat-and-power stations in the amount of 20 millions of tons per year is being tackled. Up to now, the economy of our Republic uses about 15 per cent of available

resources of ash and slag. By 2000 no less than threefold increase in the use of ash and slag wastes of heat-and-power stations is planned with the putting into operation of concrete mixing sets, plants, shops producing ash keramsit, aggloporous gravel, and other building materials.

Analysis of the effects of nuclear power stations on the biophysical environment in different regions of the Republic made it possible to come to the following main conclusions which play a significant part in the elaboration of a long-term strategy of the development of power industry and in the siting of nuclear power stations on the territory of the Ukrainian SSR.

Computer experiments on simulation models of nuclear power stations conducted with the account of conditions characteristic of the Ukrainian SSR have shown that these plants produce quantitative effect on the territorial natural resources (by the corresponding cadastral estimates of natural resources) from 1.3 to 1.4 time greater than that of heat-and-power stations of similar capacity (regardless of the heavy consumption of atmospheric oxigen in organic fuel combustion).

However, under natural radioactive background, the technogenic load on the biophysical environment caused by qualitative effect of the power nuclear station is from 40 to 50 times less than the load resulting from the qualitative effect of the coal heat-and-power station of the same capacity. The nature of distribution of technogenic load of the nuclear power station on the biophysical environment components depends to a large measure on the type of reactor systems applied at the station. Fig.7 presents results of the simulation experiments conducted to compare the impact of nuclear power

stations on the biophysical environment when employing RBMK reactors and water power reactors during 20 years of operation at nuclear power stations. As indicated in the Figure, a nuclear power station operating under normal conditions in the course of 20 years increases its qualitative effect on the natural resources due to the escape of radionuclides into the environment (i.e., even though the emission is small, the process of gradual accumulation of radioactive materials in components of the biosphere is in progress). Comparison of the reactors used presently at the nuclear stations shows that the radiation effect on the air produced by the nuclear power station with the RBMK reactors is an order of magnitude heavier than that of the nuclear power station with water power reactors (while the difference in the radiation effect on the hydrosphere is much lower and a non-radiation effect is almost equivalent).

The key points in the long-term strategy picked for the advancement of power industry in the USSR are the reliability and safety of operation of the nuclear power stations in spite of the fact that the development of nuclear power stations with reactors affecting minimally the biophysical environment is a must. After the Chernobyl accident steps are taken in the USSR to boost safety of the nuclear power stations which may be divided into several stages. The first stage of activities had been realized on the basis of initial data before the thorough scientific and engineering analysis of the accident, had encompassed the operating nuclear power stations with the RBMK reactors, and had covered urgent measures for the prevention of modes registered just before the accident.

The second dtage includes measures that are put into effect on the basis of results and conclusions of the scientific and engineering

analysis of the course of accident at the fourth block of the Chernobyl nuclear power station and are directed at the enhancement of safety of all types of nuclear power stations. These measures are based on recent advances in science and technology, on a wide experience in the operation of nuclear power stations, on vast possibilities of the metal condition diagnosis made for pipelines and equipment, as well as control devices.

The development of new types of reactors showing inherent safety and the development of new safety systems for the existing reactor designs may be considered as a new stage in the boost of safety of the nuclear power stations.

Efforts directed to ensure the safety of nuclear power stations had a strong impact on investments in their construction. In view of the scale of action of the nuclear power station on the biophysical environment in conditions of the Ukrainian SSR the versions with electrical supply of consumers from the heat-and-power stations or the nuclear power stations can be classified as equally economic. What is more, actual investments in the distribution and operation of the nuclear power stations in the Republic (under admissible localization versions) can vary over a wide range, from 35 to 40 per cent, as a result of factors of local territorial nature. For the available territories an acceptable concentration of capacities of the nuclear power stations oriented towards the existing types of reactor systems was estimated after a comprehensive research into the hydrogeological characteristics of the sites, the radiological conditions after the Chernobyl accident, the outstripping rates of nonlinear growth of the technogenic load on the biophysical environment as compared to the rate of built-up of nuclear power station capacities, and other

factors it has been found advantageous to limit the total capacities of the nuclear power stations for the most of sites.

Consequently, the strategy of development of the Ukrainian power industry at the transition stage is oriented towards the balanced use of different sources of energy that in the period to come allow for achieving a comparatively meak action on natural resources and meeting the standards adopted for the qualitative characteristics of the biophysical environment. Concurrent with the heat- and nuclear power industry, this strategy attaches particular importance to accelerated development of non-conventional and renewable power sources, i.e., to the development of non-waste technologies of power generation. It is founded on the active policy of the power saving. The active power saving policy in the republic to-day is a possibility of checking the growth of power resources needs, a possibility of reliable power supply and of economic independence of the region, protection of the environment through the decrease in technogenic load on the biosphere on the part of industrial plants saving energy as well as plants generating it. The most important factor in saving the energy resources is a reorganization of the inter-branch and intra-branch production structure that (along with the introduction of energy saving technologies) will accelerate near three times the reduction in power-intensity of the gross national product of the Republic as against the rates typical of the last decade.

Nowadays under the new conditions of economic management in our country the strategy of improvement of the power saving management consists in rendering the economy highly sensitive to the advances in the scientific and technological progress in power saving by way of switch-over to economic methods of management and stimulation of the power saving through the true cost accounting, self-repayment,

and self-financing of all activities promoting the scientific and technological progress.

Only the economic measures and levers can ensure significant changes in intensification of the power saving process, in the turn of the state economy to the scientific and technological progress in the development and implementation of economic and ecologically clean methods of power production and consumption, that is, to achieve, as a matter of fact, a fundamental reorganization of the social production.

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