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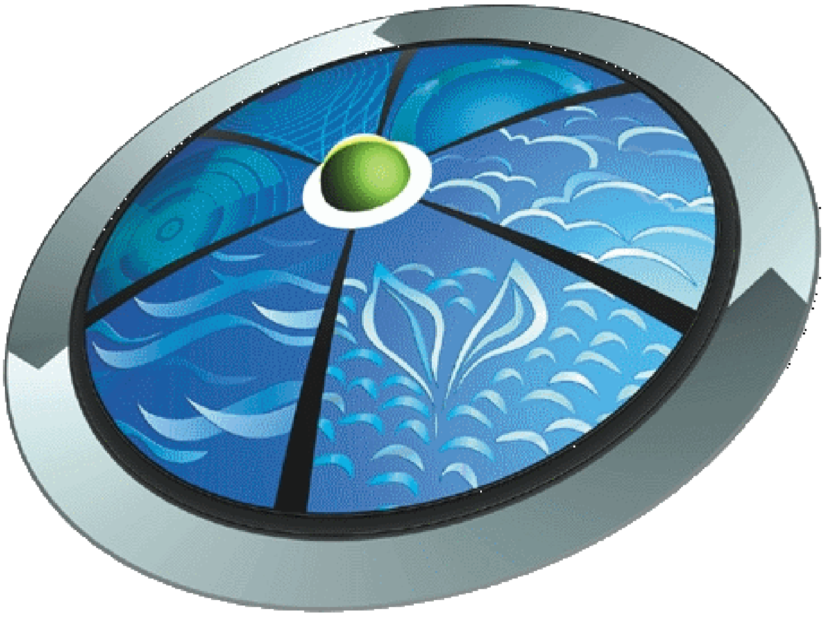
Environmental engineering knowladgebase

Series editor: Dr. Endre Domokos



23. volume

Environmental Informatics II

Editor: Dr. István Gyulai

University of Pannonia – Institute of environmental engineering

Nemzeti Fejlesztési Ügynökség
www.ujszechenyiterv.gov.hu
06 40 638 638
MAGYARORSZÁG MEGÚJUL
A projekt az Európai Unió támogatásával, az Európai Szociális Alap társfinanszírozásával valósul meg.

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ÚJ SZÉCHENYI TERV

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Series editor: Dr. Endre Domokos

23. volume

Environmental informatics II.

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2012
Veszprém

University of Pannonia – Institute of environmental engineering

Environmental engineering knowladgebase

published volumes

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1. Table of contents:

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4. Nature of environmental data, data sources, green authorities in Hungary

Written by: Istvan Gyulai, PhD, Széchenyi István University, Győr

4.1. The environmental data in Hungary Scoping data in the space

Environmental dictionary (Környezet- és természetvédelmi lexikon, Budapest, 2002) defines concept of the milieu or environment as the physical, chemical, biological circumstances in the surrounding of living organisms.
The biosphere, where the organisms occur, is located above and under sea level approx. 2x10-kilometer zone.
This 20-km track is the scene of the most important data. Compared to the Earth's radius (R = 6780 km) it is small, 0.3% (one percent or even below 1 % of R), so descriptive name for this sphere is the earth's surface. Károly Kogutowicz (1930) geographer defines the earth’s surface or with other words: geographical environment or geosphere a part of space imbued with life where lithosphere (solid crust), hydrosphere (water) and atmosphere (air) meet. Strong sense of the data gathered in this sphere.
The most important part of the solid crust is around 1.5 m thick weathered upper layer of mulch (pedosphere), on which agriculture is based, the medium of food production.
The atmosphere is the lowest, approx. 12 km thick layer of the troposphere, where weather phenomena play role. Although this is the most important medium for us surrounding living creatures, it is noted that at the higher altitude, the stratosphere or the Sun itself has an effect on the living creatures (UV radiation, ozone layer), but stratosphere research is more global, then local (country) activity.

The timely release of data

The data collected in our environment, some more than a hundred years of history, for example: water management, agriculture and other data, usually a few decades. These data served / serve for certain sectors (e.g. energy, transport, industry, agriculture, commerce), management’s objectives. We can speak systematic and continuous collection of environmental data only since the formation of environmental inspectorates (1 of December 1990.)

The environmental data for the sake of clarity are grouped according to their nature and source.

According to their nature may environmental data include:

a) measuring stations, monitoring data (direct measurements)
b) model calculation data (indirect)
c) statistical data (in total)
d) covering the whole earth (global) data.

a) Measuring and monitoring stations collect data regularly. The developed data acquisition is the safest form - usually the most expensive in terms of cost - a method. E.g. Danube monitoring, automatic on-line measuring air pollution, manual immission (RIV) meter station, meteorological stations, groundwater wells, ad-hoc measures, etc.
Some example for directly measured parameters:
- The concentration of pollution in the air (immission): CO [μ g/m^3], SO_2, NO_x , particulate matter PM10 etc.

- emissions of nitrogen oxide, soot, toluene, xylene, ethyl acetate [kg / h], wind speed [m / s], precipitation [mm]
- Surface water temperature, pH, total carbon, etc.

In this group are the public utility data related to drinking water, sewer, gas, electricity, communal services, etc. E.g. drinking water's physical and chemical properties, quality and quantity of sewage into waterways allowed, cared green areas (in m^2), waste disposed per year (in tons).

b) A model for calculating the data are not directly measurable, the estimated environmental loading (e.g., diffuse sources) allow for the calculation. E.g. air pressure of traffic (number of vehicles and vehicle emissions) can be calculated due to models, or soil pressure derived from overdosed fertilizer at agricultural area.

c) The statistical data is based on the notification. The Central Statistical Office (KSH) collects, processes and publicities the data in the form of yearbooks, or other issues, or open databases. There may be regional (national, county and city) and sector (industry, agriculture, trade, services, etc.) summarized data.

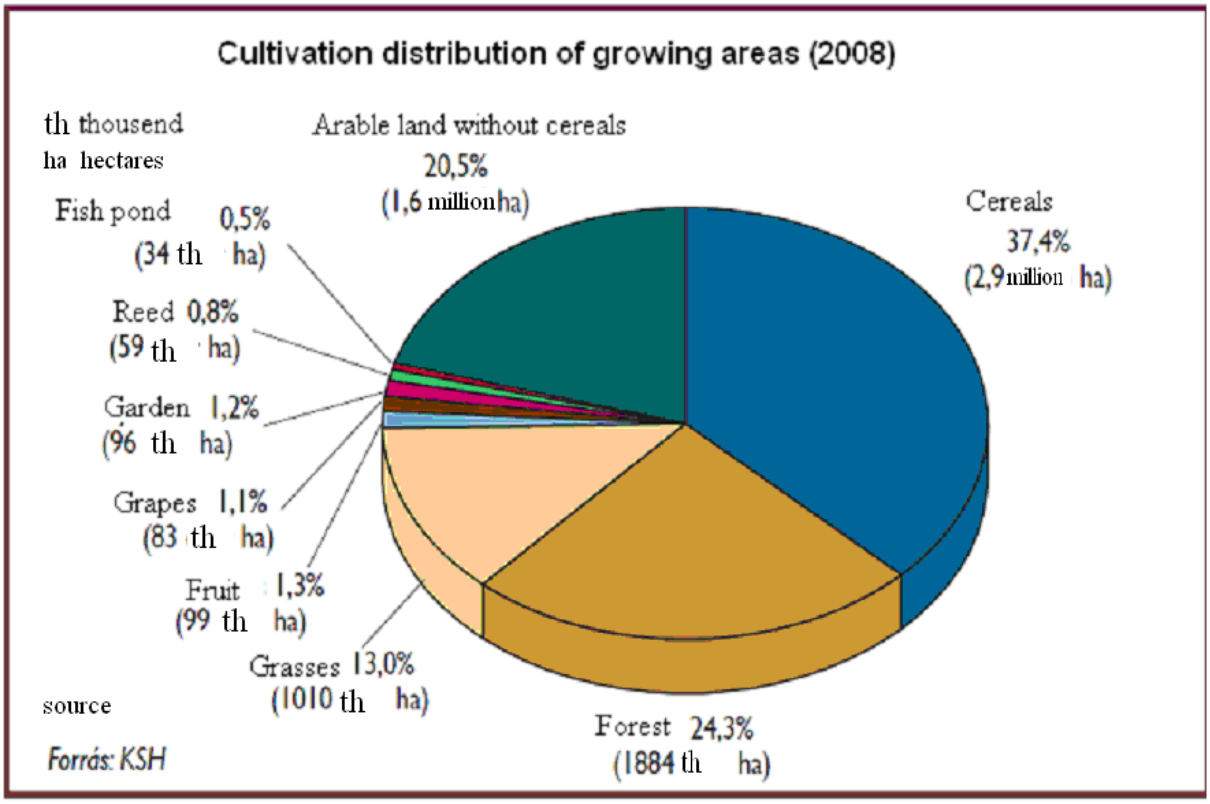


Figure 4.1. KSH data source: agricultural area in Hungary in 2008

Environmental inspectorates also aggregate the data. One of them is published. The upcoming six-year National Environment Programme (NEP), a summary of these data, the initial situation and the objectives to be implemented and financial resources. Publications are published biennially about domestic environment, taking into account the state of realization of the program.
Characterizations of the environmental conditions include the following:

- Condition: air, soil, surface water and groundwater, wildlife, landscape, urban noise, waste, human health, environmental safety.
- Environmental issues (air, water, soil acidification, noise, radiation)
- Goals (SO_2, NOx, VOC, greenhouse gas reduction, water purification, thermal back feed, regulated waste disposal, nature conservation and geological values, health promotion - Interventions and their financial background.
- Other sectors (e.g. health). Common development, international cooperation (climate change, biodiversity), regional function (e.g. Tisza River Basin)

d) The global systems cover the whole world with data:

- satellites images
- UN-organized collection of data (GEMS, GRID).

The data sources include two groups:

A) data related to activities of environment use
B) descriptive data of environment
A) The environmental data for use (e.g., mining, water use, waste disposal, agricultural and forestry land use) are generated in this course. Authorization requirement for activities involving the launch and operation of the user data and requires assessment. E.g. a poultry farm (85 000 or more chickens) needs permission for activity and environmental impact assessment.
These types of data mainly are statistical ones: notes, reports, assessments, permissions. They are at database of the authorities.
B) The data describing the diverse environment.

Agencies, authorities, research institutes, service providers, farmers, businesses collect and use various environment-related data. The environmental components (systems) that are taken into account.
E.g. earth related data: cadastre, real estate records, habitat soil, and geological repository.
Built environment related data: historic, infrastructure, housing, utilities, etc.
Data related water management: the quantity of water in the rivers and lakes, water demand of agriculture-industry-population.

4.2. Green authorities

History
Although environmental protection in the modern sense emerged in the sixties, has always been an asset worth protecting our country.
The national forest management has a few milestones:
1426. King Sigismund’ (German-Roman Emperor, Hungarian King) decree about correct use of forests
1769. Maria Theresa issued an order for protection of woods1791. The first feudal forest law in our country.
1879. The first modern civil forest law
1947. The Hunting Act was included in the protection of Great Bustard.
1973. The Hortobágyi National Park creation.
1976. The protection of the human environment (the first environmental law in our country)
1987. Environment protection was gained to ministerial rank
1990. The establishment of inspectorates
1995. LIII. General rules of law to protect the environment.

One important element is in achieving the environmental protection the statutory framework and institutional arrangements.
The legislation also has hierarchy on environmental protection:
Act, adopted by parliament, in Hungary in 1976 and in 1995 appeared environmental protection act,
Decree, order: the Government, the Ministry issued, standard: Hungarian Standards Board (Council) adopted by, technical specification, code of practice, regulations.

The institutional hierarchy of the Minister for the Environment is at the top.
The Minister and the Ministry has had variable names:
Ministry of Environment and Water Resources (1987)
Environment and Regional Development (1994)
Ministry of the Environment (1997)
Ministry of Environment and Water (MEW, 2002)
Ministry of Rural Development, State Secretary for environmental matters (2010)

Note: the name of regional institutions, restructuring the organization, of government, etc. Result is also unchanged, but the structure can be considered stable structure is outlined below.

341/2004 decree regulated environment, conservation organizations and water management functions.

The tasks are carried out by the following land organizations:
a) National Inspectorate for Environment, Nature and Water
b) National Directorate for Environment, Nature and Water
c) the territorial bodies: environmental inspectorates, water management directorates, National Parks.

a) The National Inspectorate for Environment, Nature and Water (follow-up activities), the supervisory authority of the ministry.
This institute is the central fiscal authority under the direction of the Secretary of State; its competence covers the country's entire territory.
The follow-up activities provide the first instance, the legislation specified in the environmental, ecological and water authority, authority powers. It checks the official work of the inspectorates. It coordinates trans boundary environmental impacts related to official duties. It participates in the EU integration due to its roles and responsibilities of their activities.

The environmental inspectorates are the real authority, the water directorates have the tasks of water management. National parks have the nature conservation tasks.

c) The 12 inspectorates (having local center office) and directorates are situated approximately the same catchment area and cover the whole country.

1. North-Transdanubian Inspectorate for Environment, Nature and Water, Győr
2. Central-Transdanubian Inspectorate for Environment, Nature and Water, Székesfehérvár
3. Middle Danube Valley Inspectorate for Environment, Nature and Water, Budapest
4. Middle-Tisza District Inspectorate for Environment, Nature and Water, Szolnok
5. North Hungarian Inspectorate for Environment, Nature and Water, Miskolc
6. Upper-Tisza Region Inspectorate for Environment, Nature and Water, Nyíregyháza
7. Tiszántúli Inspectorate for Environment, Nature and Water, Debrecen

8. Kőrős-Maros Inspectorate for Environment, Nature and Water, Gyula
9. Lower-Tisza Region Inspectorate for Environment, Nature and Water, Szeged
10. Lower Danube Valley Inspectorate for Environment, Nature and Water, Baja
11. South-Transdanubian Inspectorate for Environment, Nature and Water, Pécs
12. Western-Transdanubian Inspectorate for Environment, Nature and Water, Szombathely

Figure 4.2. Location of directorates and inspectorates

A specialized administrative duties of the inspectorate and the official air quality protection, surface and groundwater quality and quantity, protection of geological (soil), the protection of nature and landscape protection, and waste, noise and vibration caused by the harmful effects protection against radiation from radioactive forms.
Beside the general environmental protection there are particular lows to save or regulate use of land, forest, mine, etc. Inspectorates cooperate with municipal bodies, local authorities.
The Inspectorate performs within the jurisdiction of the state of the environment and the use of monitoring, the expected significant changes in anticipation of the environment, as well as providing visibility to these data.
Due the law it collects and records data to the National Environmental Information System and exchanges data with other information systems, like local municipal system.
Assist the local authorities operating within the jurisdiction of the Environment, Nature and Water official duties;
Propose to the country's territory into zones based on the extent of air pollution (agglomerations) the classification;
The capped polluted villages, regions and zones of action program to prepare, publish, manage and implement it.

Environmental and Water Management Directorates (centre):
1. North-Transdanubian Environment and Water Directorate, Győr
2. Central-Transdanubian Environment and Water Directorate, Székesfehérvár
3. Middle Danube Valley Environment and Water Directorate, Budapest

4. Middle-Tisza District Environment and Water Directorate, Szolnok
5. North Hungarian Environment and Water Directorate, Miskolc
6. Upper-Tisza Region Environment and Water Directorate, Nyíregyháza
7. Tiszántúli Environment and Water Directorate, Debrecen
8. Kőrös-Maros Region Environment and Water Directorate, Gyula
9. Lower-Tisza Region Environment and Water Directorate, Szeged
10. Lower Danube Valley Environment and Water Directorate, Baja
11. South-Transdanubian Environment and Water Directorate, Pécs
12. Western-Transdanubian Environment and Water Directorate, Szombathely

A directorate is responsible for coordination of water supply of the settlements, industry, agricultural areas, then sewage, waste water, territorial bath at the catchment/operational area. Further task of directorate is to make medium-and long-term development of regional development concepts and their implementation and coordination.

National park directorates (centers):

Figure 4.3. National Parks Source: *http://www.nemzetipark.gov.hu/*

1. Aggtelek National Park, Jósvafő
2. Balaton Uplands National Park, Veszprém
3. Bükk National Park, Eger
4. Duna-Drava National Park, Pécs
5. Duna-Ipoly National Park, Esztergom
6. Fertő-Hanság National Park, Sarród
7. Hortobágyi National Park, Debrecen
8. Kiskunsági National Park, Kecskemét
9. Kőrös-Maros National Park, Szarvas
10. Őrségi National Park, Őriszentpéter

Environmental inspectorate ensures application of the environmental protection and ecological, hydrological coordination at the own area then statistical data collection and services. It operates the monitoring and control systems. Here we can find gathered data for use of the environment.

Air clean protection

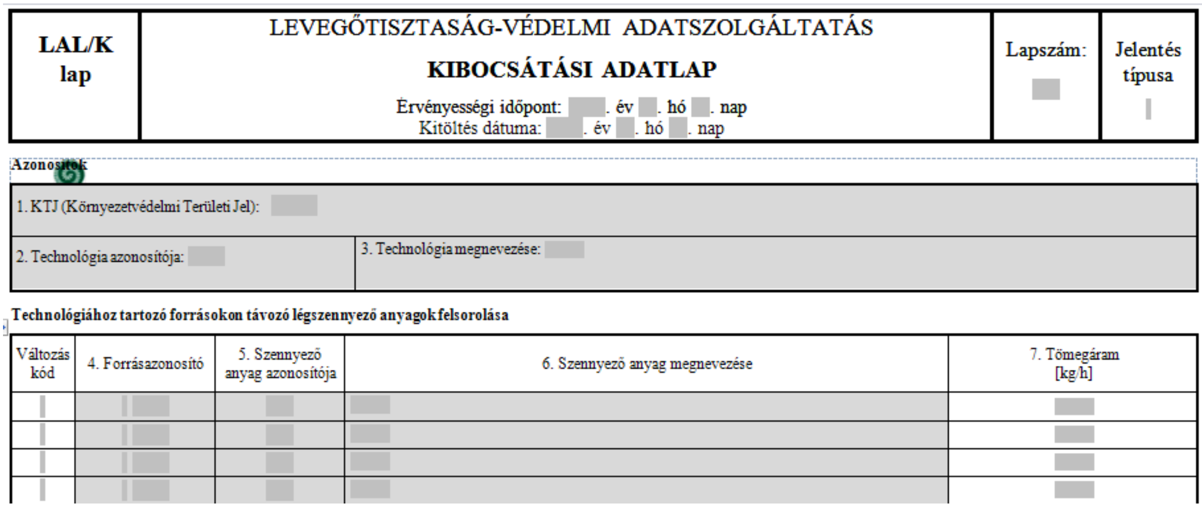
As a consequence of legislation firms must report to the Inspectorate air pollution caused by the air load point source with their begin of operation. For example, the heat input of 140 kW in excess fuel and other equipment issued only flue chimneys.
Pollution of air (mass flow, kg / hr) per year (quarterly) should be reported.
A non-exhaustive list of some air pollutants reported in tons per year:sulfur dioxide, carbon monoxide, nitrogen oxides (as NO_2), solid (non-toxic) dust, lead compounds, soot, acid, xylene, toluene, butyl acetate, ethyl benzene, propyl benzene, iso-butyl alcohol, acetone, alcohol diacetate, ethyl acetate, butyl acetate, butyl glycol acetate, benzene, acrolein, education.
Declared liable for those technologies they use more than 100 kg per year HFC (chlorofluorocarbons). The restriction was to protect the stratospheric ozone layer.
The data shows the following details, see an illustration.

The inspectorate periodically checks the measured emission sources.

Pressures on surface water data
For registration forms (VAL)
-Water: measurement and control, to determine sewage penalty
Purchase a water-regular (e.g., monitoring the Danube),
Groundwater samples, core network,
Ad-hoc announcement of measurements (e.g., cyanide pollution of the Tisza in 2004, Raba foaming).

Waste data
The waste sites have been initially covered only the hazardous waste. 2000th year (XLIII. the Waste Management Act) already applies to other landfills. The specific locations of hazardous waste treatment plant (the VEHUR) recorded in the Registry tab.

Besides the official work of the inspectorate, administration takes a position as other economic activities, such as roads, gravel mines opening, architectural projects, industrial activities (production car) authorization state.



LAL/K lap	LEVEGŐTISZTASÁG-VÉDELMI ADATSZOLGÁLTATÁS KIBOCSÁTÁSI ADATLAP Érvényességi időpont: . év . hó . nap Kitöltés dátuma: . év . hó . nap	Lapszám:	Jelentés típusa

Azonosítók

1. KTJ (Környezetvédelmi Területi Jel):	
2. Technológia azonosítója:	3. Technológia megnevezése:

Technológiához tartozó forrásokon távozó légszennyező anyagok felsorolása

Változás kód	4. Forrásazonosító	5. Szennyező anyag azonosítója	6. Szennyező anyag megnevezése	7. Tömegáram [kg/h]

Figure 4.4. Reporting sheet, emissions

4.2.1. National Environmental Information System (Országos Környezetvédelmi Információs Rendszer, OKIR) *Source: KvVM website, 2010*

The regional environmental bodies feed their own measurements, and relevant collected data to a national geographic information system. The environmental inspectorates are directly connected to the central database server. The system's primary task is to monitor the environment and the use, occupation and exposure data collection, processing and record keeping support, and for the users (including publicity) to provide the necessary information.

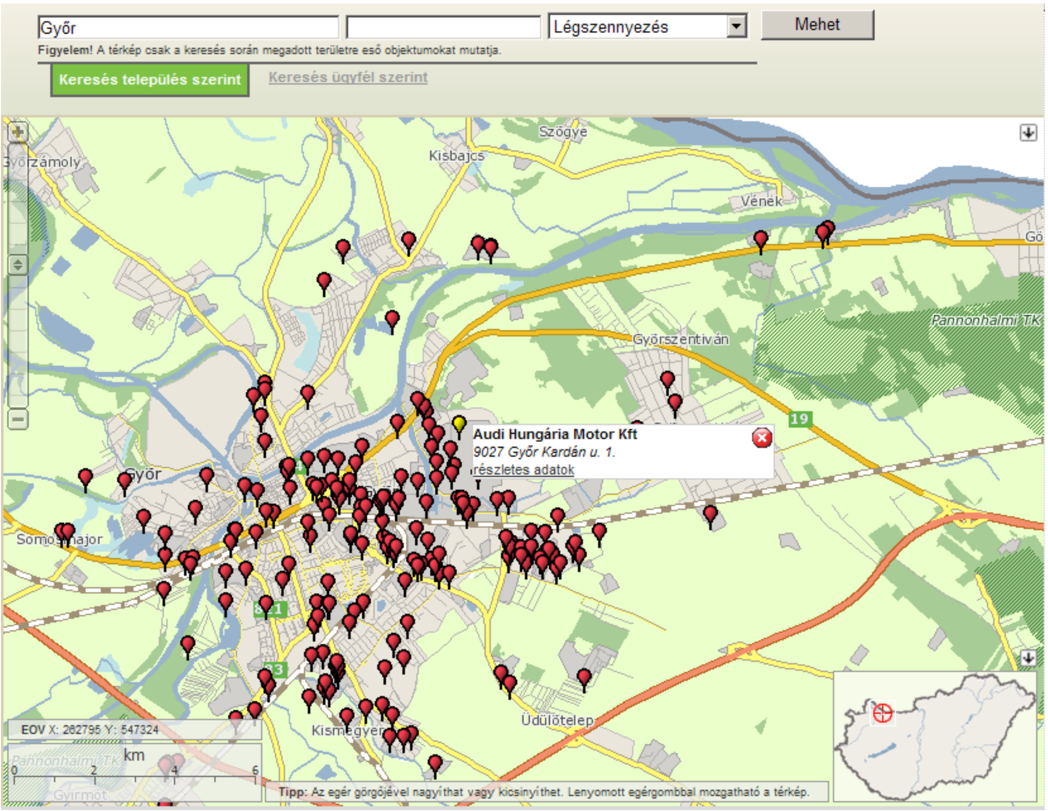


Figure 4.5. OKIR site, point sources, air borne contaminants

Through internet you can query the following areas of environmental data:

1. What is it in my environment?
2. Select a city, for example. Győr and retrieved, which are point sources of air charged environment?

Contained in the database of sites shown on the map. Use your mouse to point out one of the red balloon ", opens to the label: Audi Hungaria Motor Ltd For detailed information, click the table and they get the annual emissions of pollutants.

1	Szennyezőanyag	2002	2003	2004	2005	2006	2007	2008
2	1 - Kén-oxidok (SO2 és SO3) mint SO2	2 300	766	24 626	19 570	0	0	0
3	2 - Szén-monoxid	153 901	88 931	88 880	109 200	74 033	47 761	43 408
4	3 - Nitrogén oxidok (NO és NO2) mint NO2	24 162	18 945	22 717	57 695	49 748	46 800	46 823
5	7 - Szilárd anyag	515	485	1 010	2 442	1 700	1 390	2 498
6	12 - Kénsav-kénsav gőzök (SPECIFIKUS)	20	21	21	21	7	0	0
7	13 - Kén-dioxid (SPECIFIKUS)	0	500	0	0	0	0	0
8	16 - Sósav és egyéb szervetlen gáznemű klór vegyület	7	7	7	7	7	0	0
9	52 - Ólom és szervetlen vegyületei Pb-ként	4	4	4	4	0	0	0
10	80 - Nátrium-szulfát	79	0	0	0	0	0	0
11	100 - METÁN	7 738	6 680	0	0	0	0	0
12	151 - Toluol	35	22	66	80	7	5	5
13	152 - Xilolok	16	9	9	11	3	2	2
14	163 - 1,2,4,-Trimetil-benzol (Pseudokumol)	0	0	0	0	0	0	0
15	164 - Trimetil-benzolok	0	0	0	0	0	0	0
16	301 - Etil-alkohol / etanol /	0	0	0	0	0	0	0
17	302 - Propil-alkolok	35	36	27	36	0	0	0
18	304 - Butil-alkoholok	0	0	0	0	0	0	0
19	308 - Butil-alkohol (primer-butanol) / butanol-1 /	0	0	0	0	0	0	0
20	323 - Butil-acetát / ecetsav-butil-észter /	29	58	17	21	23	16	16
21	331 - Butil-glikol-acetát	0	0	0	0	0	0	0
22	334 - Etilén-glikol-acetát	7	0	7	7	7	0	0
23	459 - Etanol-amin	165	165	133	158	0	0	0
24	500 - Benzin mint C, ásványolajból	0	12 348	2 394	2 394	2 449	2 648	2 244
25	530 - Ásványolaj gőzök	7 452	7 675	11 822	16 971	23 971	20 906	22 167
26	598 - Paraffin-szénhidrogének C9-től	0	0	9 873	15 908	2 769	1 821	1 558
27	729 - Butil-diglikol / dietilén-glikol-monobutiter /	0	0	0	0	0	0	0
28	999 - SZÉN-DIOXID	0	0	0	114 611	6 984 103	3 388 192	3 086 844

Figure 4.6. OKIR website business - air is charged - emissions

Similarly, query data from the factory waste and environmental decisions.

1. Waste data
2. The Waste Management Information System (HIR); retrieve the aggregate data to businesses, waste groups, communities, regions, counties, etc. relevant inspectorates.
3. Air pollutant emissions in the Clean Air Defense Information System (LAIR) can be obtained.

3. Surface water quality test results - the inspectorate investigation laboratory measurements of the '60s are back.
4.
5. Final details of environmental regulatory decisions, which are led by the inspectorates of Official Registration System (HNYR) originate.

6. Non-hazardous and hazardous waste management, allowing them to gain information, including waste collection and transport licenses.

5. Descriptive data of environment

Operating databases, information systems related environment in Hungary will be overviewed in the order of environmental elements (earth, water, air, wildlife, built environment).

5.1. Earth databases

Written by: Istvan Gyulai, PhD, Széchenyi István University, Győr

5.1.1. Land use, land administration

Land Use
The earth has several functions:
- Building material,
- Energy conversion system, the solar radiation is absorbed, converted by the Earth's
- Filter system, it filters and protects groundwater from contamination of the surface,
- Storage (buffer), heat, water, plant nutrient storage ability, able to store hazardous materials and demolished
- Living space of plants, animals and micro-organisms in a habitat,
- Vital medium of food production.

Due to multi-function and operation, the land use is under the influence of the various laws and also affects the lower-level legislation. There is separately forest law, mining low, environmental law, land protection law, etc.

The historical development of land for farming
The present form of arable crops in Hungary are the result of historical development, which includes technical and social aspects. Agriculture as a professional activity dates back to old times, in certain territories to times before the foundation of the Hungarian state. There was a certain regulation in each era and regime in this region to control and help the work of those who lived from agriculture and the usage of the produced crops. *Source:"Mezőgazdasági szakigazgatási hivatal", web2010*
At the end of 10 century an Anglo-generated map of the world (Cottonian library) marks Hungarians who occupied the Carpathian Basin, as descendants of the Huns (hunorum gens). King St. Stephen (1000-1038) of Hungary has strengthened the central power of the western model, developing the landlord-serf system. The serfs lived at the high-middle land parcels, which were in the ownership of landlords. The serfs did the farm works for landlords and catholic bishops. The land parcels, where the serfs lived ranged from 24 to 40 acres. *Source: J. Varga (2006): Land regulation, WEB*
It is interesting to mention that the current cadastral maps can often be found in an array of other vineyard name of parcels "serf parcels" referring to the previous use.

There are two fundamental interests of producing maps: one of the purpose is national defense, the other is the registration and tax assessment purpose. Both the preparation and updating of content is important today as well. The first records for military maps and cadastral maps and census in Hungary were made at the time of (Habsburg) queen Maria Theresa (1740 – 1780).
Nine branches of farming (arable land, fish pond, meadow, garden, field, snow, bush, vines, and forest) were identified.
In 1856 it has started a regular, continuous, detailed cadastral survey in Hungary. The Directorate of Land Surveying and regional surveying inspectorates were founded. The

organization center was in Vienna, later in Budapest (1867), under the Hungarian Ministry of Finance.
Between the years 1959-1962 in the agriculture, constituted the "socialist" restructuring of state farms were formed under a large farm holdings. The tables suitable for large-scale production were planned using 1: 10 000 scale map. Agricultural fields were formed 700 to 1,300 meters in length, usually 40 to 50 hectares, at flat land larger: 80 to 100 hectares, less hilly, 15 - 20 hectares in area designed tables. One hectare equals 10 000 m^2.
In 1967, the issue of land use has been transferred to the agricultural ministry. Management of the land offices (cadastral bureau) was formed.

In 1991 the land compensation process was launched. A compensation for owners of those land parcels which were confiscated by the state in 1946. A considerable amount of compensation for land surveying work of the administrative and technical strengthening could be embarked. Cadastre bureaus were equipped with advanced tools in order to supply digital maps and register 1997 launched a National Cadastral Program, a public company (NKP Ltd.) organized by. 2007th were finished in the entire country the cadastral digitized maps

Note that the accuracy of digital maps has not increased as compared to their previous state, only one of the better manageability. The origin of the map accuracy depends on how the data are edited by new land survey, reconstruction, photogrammetry, digitizing.
The compensation is contrary to the initial estimates the property conditions greatly changed. The competitive advantage of the medium holding disappeared. Individual land holdings average 3.5 hectares (KSH, 2004), economic organizations 487 hectares.

Land administration, land registration authority
The country's entire territory, including urban, agricultural, industrial and non-utilized areas is all in a land register.
The task of land administration under the direct control of the minister performs Land and Geographic Information Department (FTF). FTF supervises the territorial Land Registry (cadastral bureau). The name of department changed several times: State Land and Mapping Agency, National Land Survey and Mapping Office, Land and Cartography Department.

The FTH, the 20-county Land Registry (19 county + capital) and 116 District Land Registry have three tasks:

- Property register
- Surveying, mapping
- Land quality, land protection.

Real estate records, property register
In Hungary there are more than 9 million property owners. Every year, more than 2 million applications are received at Land Registry: copies of cadastral map, copy of title pages.
The title page contains
- The property parcel number, area, branch of cultivation (arable land, meadows, orchards, houses, etc.)
- The owner's name, place and date of birth, addresses, ownership percentage,
- Mortgage (e.g., residential construction loan), entries for right of way (overhead lines, underground cable, the site drainage channel).

The Land Registry supplies title page, certified copy of the map given for official matters, such as bought and sold, and building permit.

Surveying, mapping

The property belongs to the register, the registration map, which is 1:4 000 scale covers the entire country. In general, the villages inside a scale of 1:2 000, 1:1 000 scale cities. The map contains the plot (plot of land), the location, boundaries, lot identification, number of permanent buildings and structures, public land and river, and the slope of the street names, the mapping required for geodetic datum points of the map sheet number, scale.

The technical department of the inventory map, the old maps is maintained; sometimes 10-20 years status quo should be investigated. In addition, former survey, array plans, aerial photography, survey control points, land shares, the transformations.

The framework for the national land survey control points are to get in the county land registers. The satellite positioning control points (OGPSH) we can get at the Institute of Geodesy, Cartography and Remote Sensing (FÖMI). The satellite positioning (Global Navigation Satellite System, GNSS) can get a (paying) service to improve the accuracy at FÖMI.

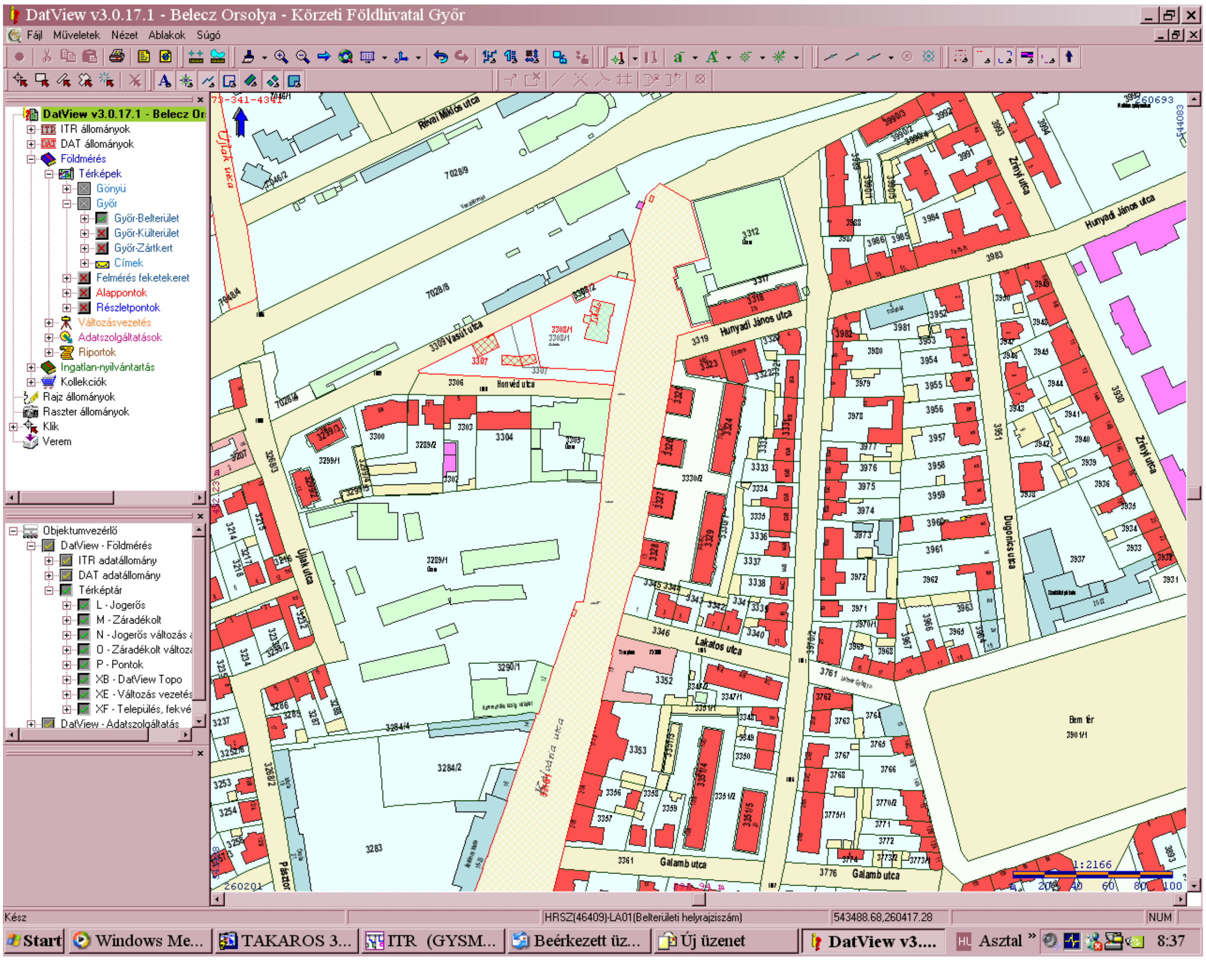


Figure 5.1. digital cadastral map detail, courtesy of Orsolya Belecz, Land Registry, Győr town,


Figure 5.2. 4-order control point (left) and leveling point of reference, Nadap (right)

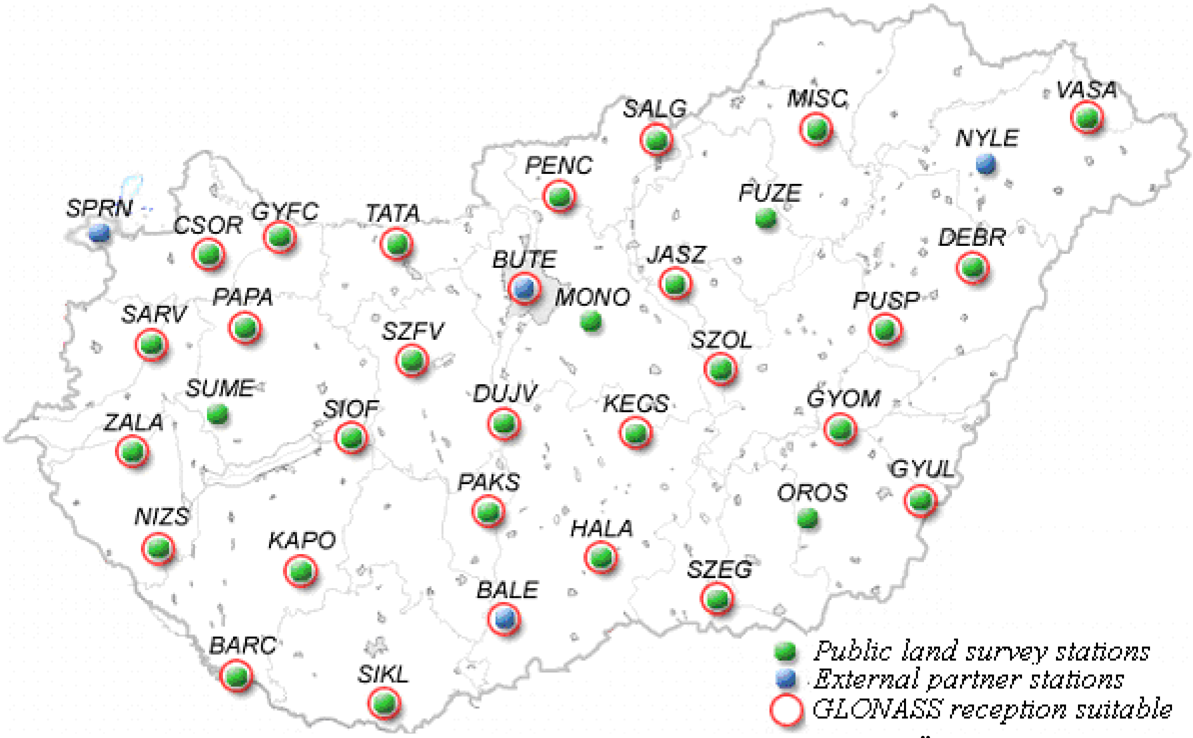


Figure 5.3. Active GNSS (GPS) Network (Source: FÖMI)

Land quality

The land law is quoted in connection with the 105/1999. (XII. 22) FVM decree on the detailed rules for land quality.

"1 § (1) land quality: the process by which the value of the farming class and earth-pointed cadastral net income is established.

(2) Appraisement district: the territorial integrity of a system of land quality, which is approximately similar to the conditions of production. Each appraisement district has its own net income depending on its soil quality and branch of cultivation.

(3) Classification of land: if the appraisement district within the soil not be generalized to the entire territory it is divided into zones. Different quality cadastral net income belongs to each class or zone.

(4) Cadastral net income: the ratio, expressed as the gold crown (AK), which pointed to the same cultivation area expresses the difference between fertility.

(5) Quality class: the class of the countryside and appraisement district within a branch of the cultivation areas to distinguish between different qualities ranging from one to up to eight rating. The lower grade is better, higher quality of land registry records, the higher number and value of the soil shows worse.

The typical depth of soil quality class should be examined in more than one hundred centimeters.”

Land protection

The land registry keeps records of land use as well. These records include the parcel of land property registration number, the area in hectares and m^2 (one hectares = 10 000 m^2), the value in gold crown (AK), the owners/user’s data, in case of fixed-term contracts the duration of use. Who uses a land and its area exceeds one hectare, it shall, within thirty days of notification of the real estate authority. If the user is not the owner, the registration form, the owner of the land user can be signed.

The user is required to protect the soil fertility. To this end, soil conservation cultivation must continue, for example. Insurance coverage to avoid plants grown in soil erosion, nutrient replacement, (fertilization), carried out the chemicals and waste to avoid contamination.

The settlements are subdivided into two parts: downtown (district) and the fields (outskirts). At downtown areas can be built (urban areas) by buildings, institutions, industry, at the fields can be used like agricultural, forestry areas. If road traffic, or other non-agricultural purposes (construction sites, industrial parks, etc) receives a request from its owners (e.g. local governments), the Land Registry declare acceptance or rejection. If adopted, Land Registry defines the extraction fee (extraction from agricultural use) due to land protection contributions. The extraction fee can reach the size of the land parcel price.

E.g. 2008th annual rate is a very good quality arable land area (Northern Great Plains) 800 thousand HUF per hectare. If the area is 20 ha in size, the cost is 16 million HUF.

Note that the price is 388 thousand HUF per hectare (1 ha = 10 000 m^2) on average in Hungary (2008th year) in Austria 1-2 million HUF, in the Netherlands 3-6 million HUF.

If this land is not intended to be used for agricultural purposes, you must pay for land protection contribution. This rule encourages entrepreneurs, not to select the most valuable land for building.

The contribution of land protection in the land value is calculated after gold crown (AK). Depending upon the category from 4000 to 92000 HUF / AK may be a charge. If the above-mentioned high-quality area is I. category (e.g. 30 AK / ha), it means 20 ha*30 AK/ha = 600 AK-value, then the rate should be 92,000 HUF/AK, and the fee is 92,000 HUF/AK * 600AK = 55.2 million HUF. If the same area would be of poor quality grass (e.g. 3 AK / ha), the area is 20ha, the value of this parcel is 20 ha*3AK/ha = 60 AK. The fee is due to the land protection contribution AK 60 * 4000 Ft / R = 240 thousand HUF.

The land law in certain parts of the quote below, linked to our topic.

2007 ". CXXIX. Protection of the law of the land (2) of this Act, land use, the land protection, the land quality and soil protection provisions set out.

§ 2 of this Act

a) land means a parcel of land by the municipality on the outskirts of arable land register, vineyards, orchards, gardens, meadows, pastures (grass), reed, forest, wooded, a fish pond, branch of land use.
b) h) soil: a conditionally renewable natural resource, which is also the agricultural and forestry production is a fundamental means of production, the Earth's solid surface medium of living, which is the most important feature of the fertility; "

5.1.2. Plant and soil protection

In addition of the quantity land protection it is important to preserve the quality, that is fertility of agricultural areas.

Soil Conservation Authority

The tasks of soil protection provide the Rural Development Minister (Secretary of minister) through the central and local authorities. The central authority is the Agricultural Management Office (AMO, Mezőgazdasági Szakigazgatási Hivatal, MgSzH).

The organization and procedure of the AMO *Source: MgSzH homepage,2010*

The AMO is a central office directed by the Minister of Agriculture and Rural Development. Its headquarters is in Budapest. The Office is directed by the President, the work of whom is assisted by four Vice Presidents responsible for the following fields: Institution Management, Food-Chain Safety, Natural and Genetic Resources, and Economy.

The Office holds a centre and 19 regional organizations, including 144 district centers. The heads of the regional organizations (county agricultural administrative offices) are Chief Officers.

In order to fulfill the duties of the central offices operating customer service in the framework of the regional organizations and certain duties of food-chain inspectorate, there are district animal health and food control offices (district offices). The laboratory network operated by the Office implements all the examinations with relevance to agriculture.

In the frames of its basic agricultural managerial duties regulated by a dedicated statute, the CAO’s responsibilities are as follows:

- Plant production, animal breeding and conservation of genetic resources;
- The national approval of plant varieties, and qualification of plant reproductive material;
- Plant health control of vegetative reproductive material and seeds;
- Wine management, wine control and wine qualification;
- Wild game management and fishing;
- Management, forest asset protection, timber production and related services;
- Agricultural product marketing;
- **Agricultural environmental protection, plant protection, soil protection;**
- Quality control of fruit and vegetables and approval of pesticides and regulators;
- Animal health, animal welfare;
- Feed safety, feed hygiene and feed quality;
- Food hygiene, food safety and food quality;
- Veterinary medicinal products;
- Post-slaughter qualification of slaughter animals;
- Water management for agriculture;
- The operational organization and control of the agricultural market rules and regulations.
- Land administration and authority affairs are also carried out, regulated by a dedicated statute.

The Authority shall be assisted by the regional laboratories: Tanakajd, Velence, Kecskemét, Szolnok, Debrecen center.

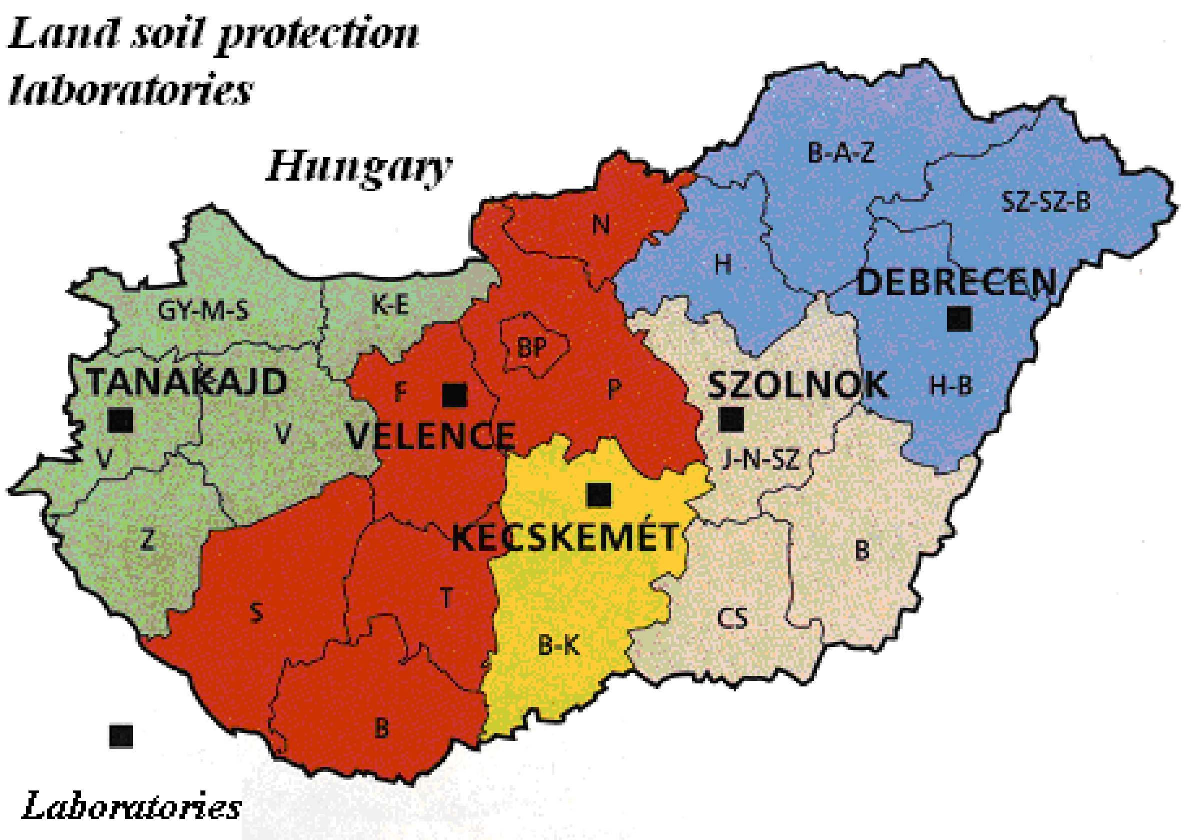


Figure 5.4. Soil Laboratories (Source: Soil, Ministry of Agriculture publication, 2004)

5.1.3. Earth databases

It is mentioned here first the soil then geology, mining.

Soil Information and Monitoring System (Talajvédelmi Információs és Monitoring Rendszer **TIM**) *Source: MTA TAKI study, 2003.*

The TIM data are generated by the Central Service for Plant Protection and Soil Conservation (NTKSZ, Növény- és Talajvédelmi Központi Szolgálat) and regional soil laboratories. To design the TIM database it was used all available information (description, data, maps, models, etc).

These were the most important features:

- The mid-thirties to mid-50s (1955) throughout the country prepared a scale of 1:25.000 Kreybig's soil maps
- The country's agricultural area of 60% completed large scale (M = 1:10000) soil maps,
- Forest areas of the prepared 1:10000 "site-maps",
-- Agricultural Chemistry of the Information and Management System (AIIR, Agrokémiai Információs és Irányítási Rendszer) database provider, is about 5 million hectares of arable land, meadow, pastures, orchards and tables data, three-year cycle for the soil analysis results and parcel of the production plants of all details,
-- On 6000 piece farm tables soil test data called deeper layer
- The national muster land evaluation program revealed several-thousand-soil profile description and test data
- Research Institute for Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences (RISSAC, Magyar Tudományos Akadémia Talajtani és Agrokémiai Kutatóintézet, MTA TAKI) database,

- The various soil maps produced for specific purposes and their database (for example, the Kisköre Barrage and Irrigation area, prepared a scale of 1:25.000, 6 thematic map series includes maps)
- Amelioration, water balance and agricultural technology interventions is based maps, information and advice, etc,
- Various treatises, books, atlases, studies, collections of books, advice, etc. soil material information.

1,236 points above considerations have been identified. From 1992 may carry out a thorough survey.

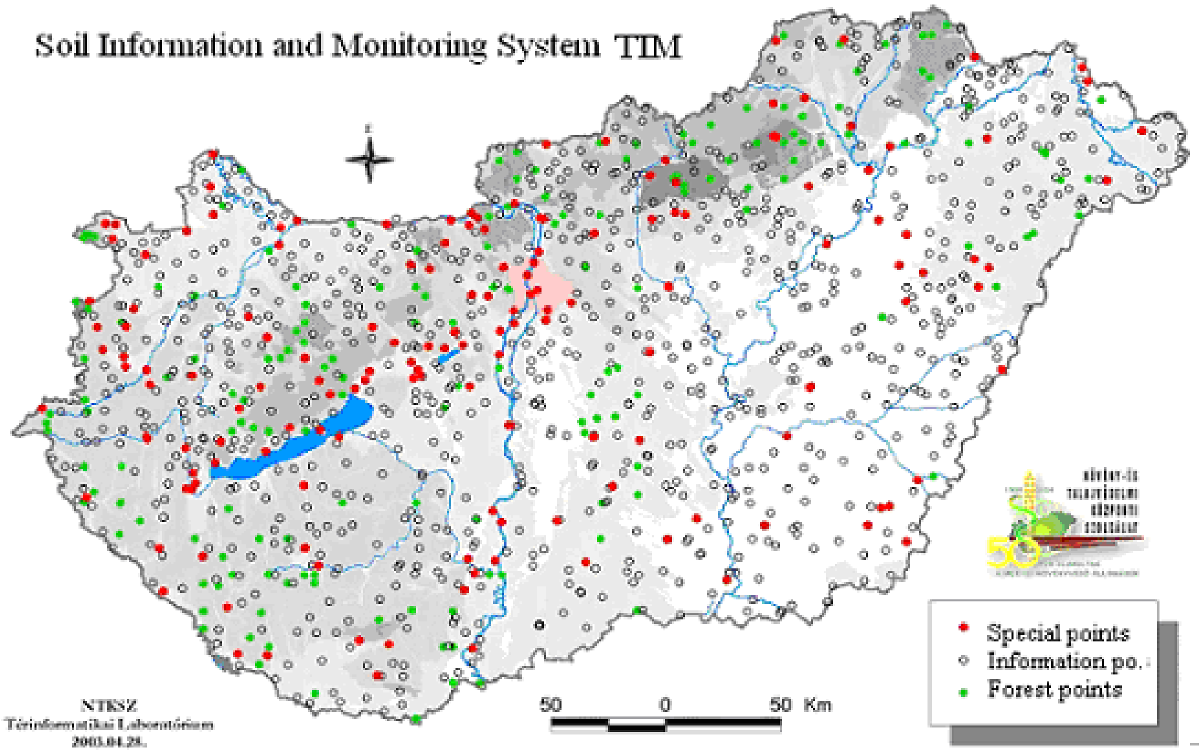


Figure 5.5. TIM points

The soil physical and chemical properties are determined at selected points. The additional task is monitoring changes in the properties.

At TIM points the soil physical, hydraulic characteristics are as follows:
- Arany plasticity number (KA)
- Mechanical composition,
- Humidity-hygroscope (hy) - Bulk density,
- Total water capacity (PFO),
- Field water capacity (PF2, 5),
- dead water content (HV, pF 4.2),
- Usable water resources (DV, PF2 pF4 ,5-2)

Soil chemistry characteristics, nutrient content

- PH / pH (H_2O), pH (KCl) /, all water-soluble salt, phenolphthalein alkalinity, hydrolytic acidity, exchangeable acidity, organic matter content, soda lime content and adsorption capacity (T value), exchangeable cations, a 1:5 water extract , NO_2 + NO_3, total nitrogen in the soil all levels;

- Include nutrients (P, K, Mg, Na, Ca, Cu, Zn, Mn, Fe, B, Mo), only sections of the upper levels, but each year;

- Soluble toxic element content (As, Cd, Co, Cr, Hg, Mo, Ni, Pb, Zn, Cu). Lakanen the soil samples, according to Lakanan-Ervio procedure, to produce an extract solution, which will determine the soil content of soluble toxic element ICP device;

- All the toxic element content (As, Cd, Co, Cr, Hg, Mo, Ni, Pb, Zn, Cu). Digestion with a mixture of nitric acid and hydrogen peroxide at 105 ° C is carried out, the filtrate determined by the above-listed toxic elements ICP device.

From subsoil water determined parameters: pH, EC, Ca^{2+}, Mg^{2+}, Na +, K +, CO_3^{2-}, HCO_3^-, Cl-, SO_4^{2-}, NO_3-, NO_2-, PO_4^{3-}.

The test methods can be found in the relevant Hungarian standards and the testing laboratory accreditation manual.

Soil microbiological tests:

- Moisture content,

- Determination of CO_2 production,

- Cellulose activity, - Determination of dehydrogenate enzyme activity.

The determination of CO_2 production except for the soil microbiological tests can be performed by standard methods.

Erosion monitoring points
The measure changes in the thickness of the soil layer below the surface, placed in parallel with 1 m^2 (1 x 1 m) surface, 10 mm thick aluminum plate incorporation was carried out. The disc positions of GPS measurements were recorded. Using a penetrometer and then backfilled soil thickness was measured directly.

The Hungarian Academy of Agricultural Chemistry and Soil Research Institute (MTA TAKI) database *Source: MTA TAKI homepage, 2009*

The institute was founded in 1949. At the '80s began to organize with the soil data into GIS databases and labor in 1993, then the formation of regional-scale preparation of maps.

Database
The Agro topographical database map (AGROTOPO)
The country's territory 1:100.000 scale, soil, land use and meteorological data is built. The geometric base is created by homogeneous agro-ecological units, which contain the dominant habitat soil characteristics and the main soil parameters.

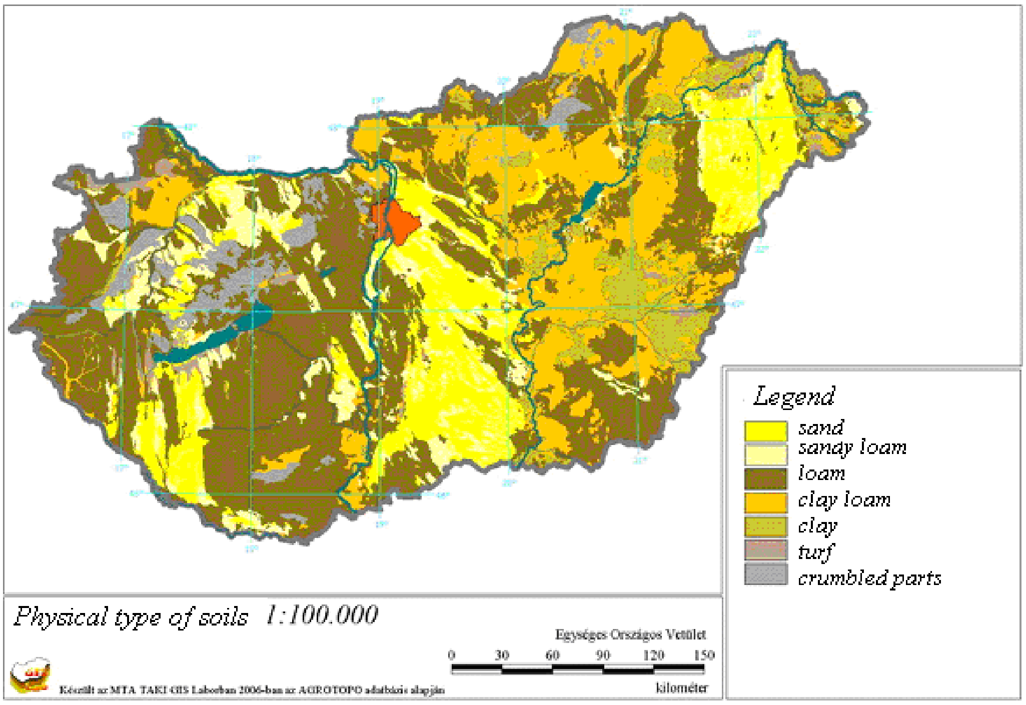


Figure 5.6. one element of agro topographical maps. ***Source: MTA TAKI***

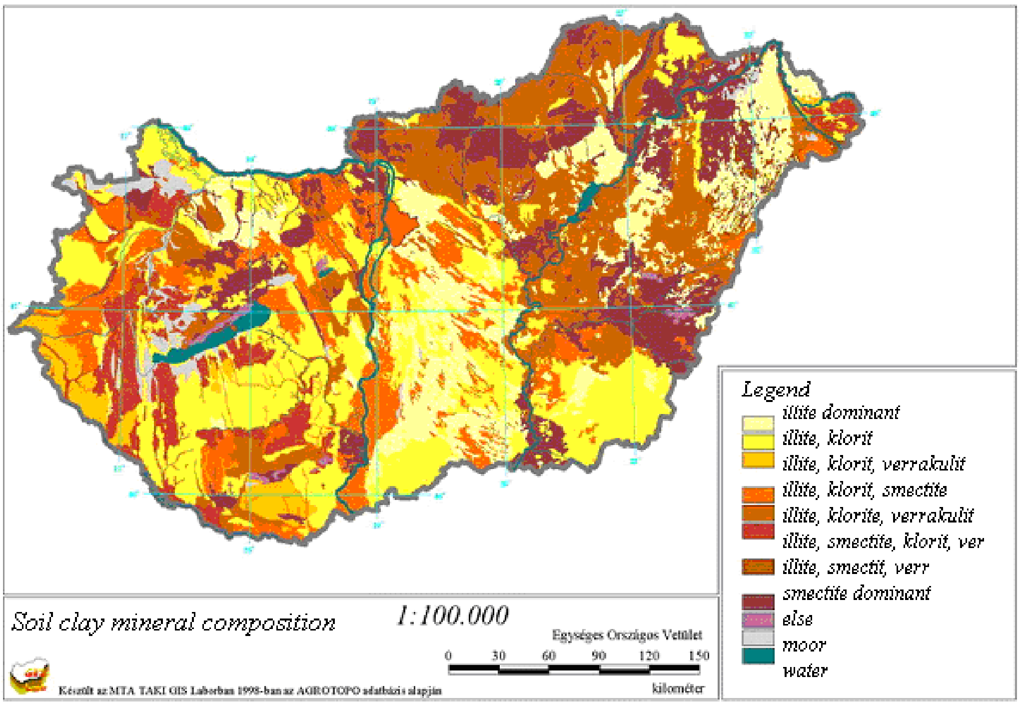


Figure 5.7. another element of Agro topographical maps. ***Source: MTA TAKI***

Large-scale databases

– Pest county service area of genetic soil maps using structured, 1:25.000 scale soil map series and about four thousand a single soil profile data (digital GIS) system management.

– Kreybig soil map, still only one of the map series, covering the whole country in such large-scale map series 1:25 000

– GIS methodological development since 1997, aiming at the table-level data on agriculture (1:10000 plant geneticist and land evaluation, soil survey and other data) to exploit the operational level foundation.

– The former Hungarian soil research: a large amount of cartographic and descriptive data (the most of mapped soil properties' change is not significant.) In the case of rapid changes, this archival data maps can serve as a reference to the measure of change indicating a detailed assessment of environmental impacts by man.

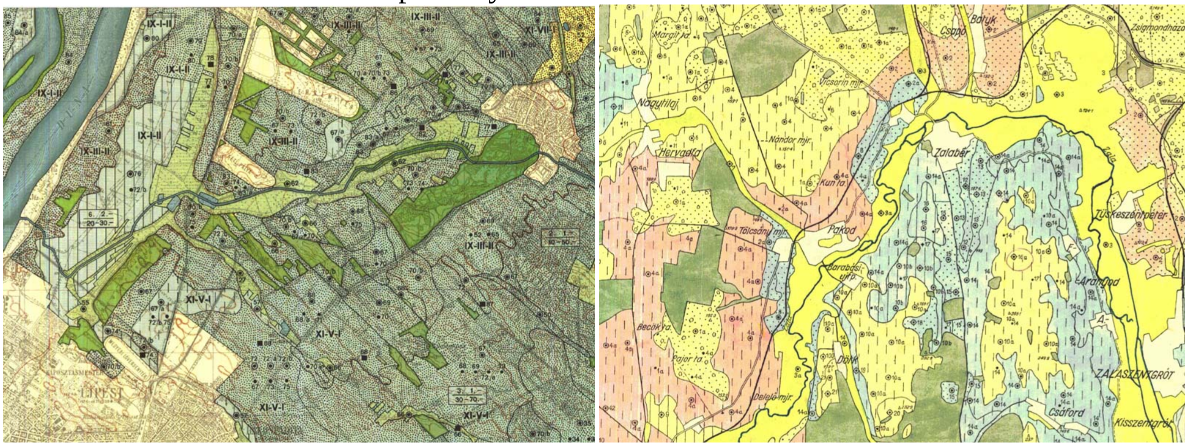


Chart 5.1. Digital Kreybig - types of maps. (Source: MTA TAKI homepage, 2009, Tamás Németh, József Szabó)

Geological mapping, Geological Institute of Hungary's Database

The Geological Institute of Hungary (Magyar Állami Földtani Intézet, MÁFI) Hungary's oldest still-operating scientific research institute was founded in 1869 as the Royal Hungarian Geological Institute. The country's geological exploration and mapping perform in this institute, the new geological maps are made from time to time and it will appear in print and digital form.

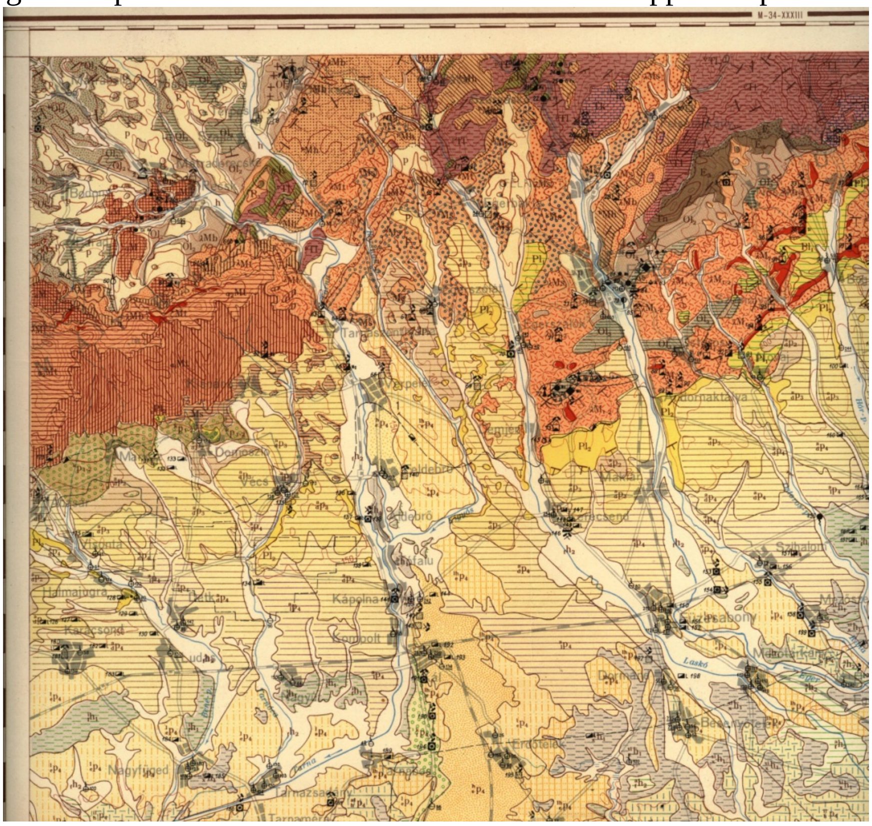


Figure 5.8. Geological map of Hungary, detail, 1:200 000 scale series, economical-geological version (Eger town), details

Mountainous areas usually at 1:10 000 scale are recorded, edited in 1:25 000-scale. Landscape's map sheets are printed generally in scale of 1:50 000. At the lowland the record is in 1:25 000 scale, the edition in 1:50 000, the print in 1:100 000 scale with tabs. Source: Geological Institute homepage, 2010

Mineralogical studies of the institute's laboratory instrumentation (computer-controlled X-ray diffract meter, thermal analysis derivatograph-PC devices and Fourier transform infrared spectrometer), as well as chemical, organic geochemistry, sedimentology, scanning electron microscopy, optical and thermo luminescence tests.
Separate GIS Department creates and maintains the digital maps.

The Environmental Division deals with the various elements of geological conservation, sustainable management of their diverse functions.

The division examines the effects of various human activities on natural state system (fixed and territorial construction, agricultural activities, a variety of waste disposal, transport, water management, mining and industrial activities, etc.) It also looks at the geological natural values and the various conservation areas classified as geology, geological values to be protected.

The Environmental Research (agro geological, environmental geology, environmental geochemistry, engineering, eco geology, park geology, urban geology) covers the surface and subsurface formations (including the soil-bedrock ground water system).
Respecting the European Union's environmental law, the Water Framework Directive (WFD), Hydro geological Department of MÁFI participates in the scoping of groundwater body boundaries, refines their geological, hydro geological, water geochemical characterization, researches on Trans boundary water bodies, building groundwater geological and hydro geological information system.

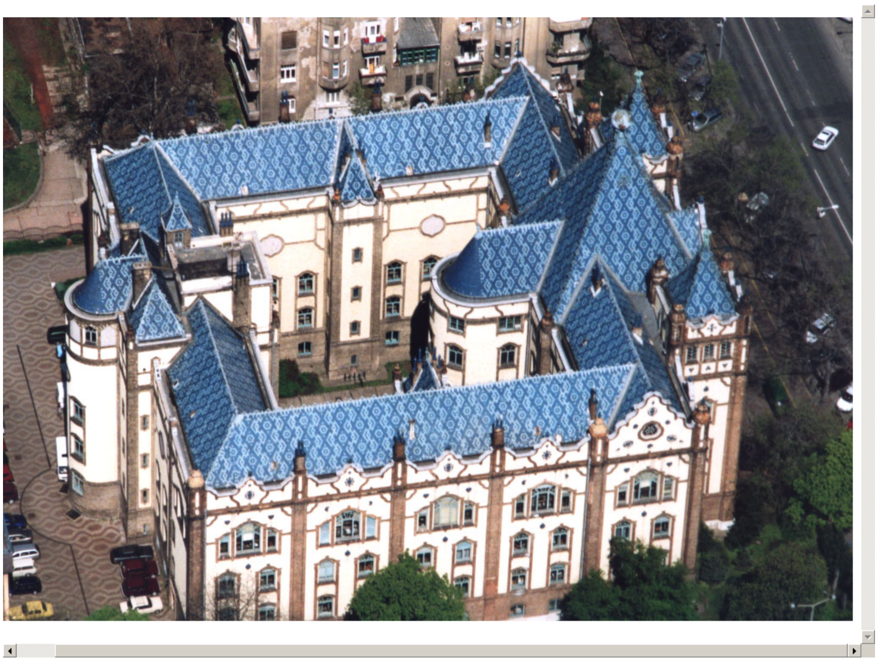


Figure 5.9. MÁFI building in the aerial photograph. ***Source: http://www.mafi.hu. wikipedia.org, 2010***

To the Water Framework Directive it needs the implementation of groundwater (drinking water and thermal), qualitative and quantitative characterization. This requires the detection of water level and survey chemical status of water bodies (drinking water and its natural health components), the effects caused by human activity. Then the preparation of regional vulnerability maps, the examination of water-rock interactions, as well as to develop models which are suitable for the professional development of water management plans.

The Institute regards the continuous detection of nearly 180 pieces of wells, the data recorded in a database, display, evaluate and provide necessary services. The sightings continued to be tracked and assessed by the overproduction and water-level recovery, and calibration data is provided drinking water supplies necessary for testing models of sustainable use of inputs. Network of 83 groundwater monitoring wells covering the whole country operated by the Institute is a part of the land groundwater quantity network required by the WFD.
The simulations provide an opportunity for the country's geothermal energy is used to answer questions as well.
The institute operates a professional library and museum. *Source: Geological Institute homepage,*

The Hungarian Office for Mining and Geology (MBFH) Source: http://www.mbfh.hu

It belongs to this office the Geological Institute of Hungary MÁFI), the Eötvös Loránd Geophysical Institute and the territorial concerning mining.
The tasks include MBFH
- contributions of mining, mineral resources research, mining places licenses to certain special authorities (landscaping, water rights, environmental use, reservoirs, underground storage space)
- Opinions on geology, mining records: coal, bauxite, ores, hydrocarbons, non-metallic materials, geothermal energy topics, building operational database of geotechnical data

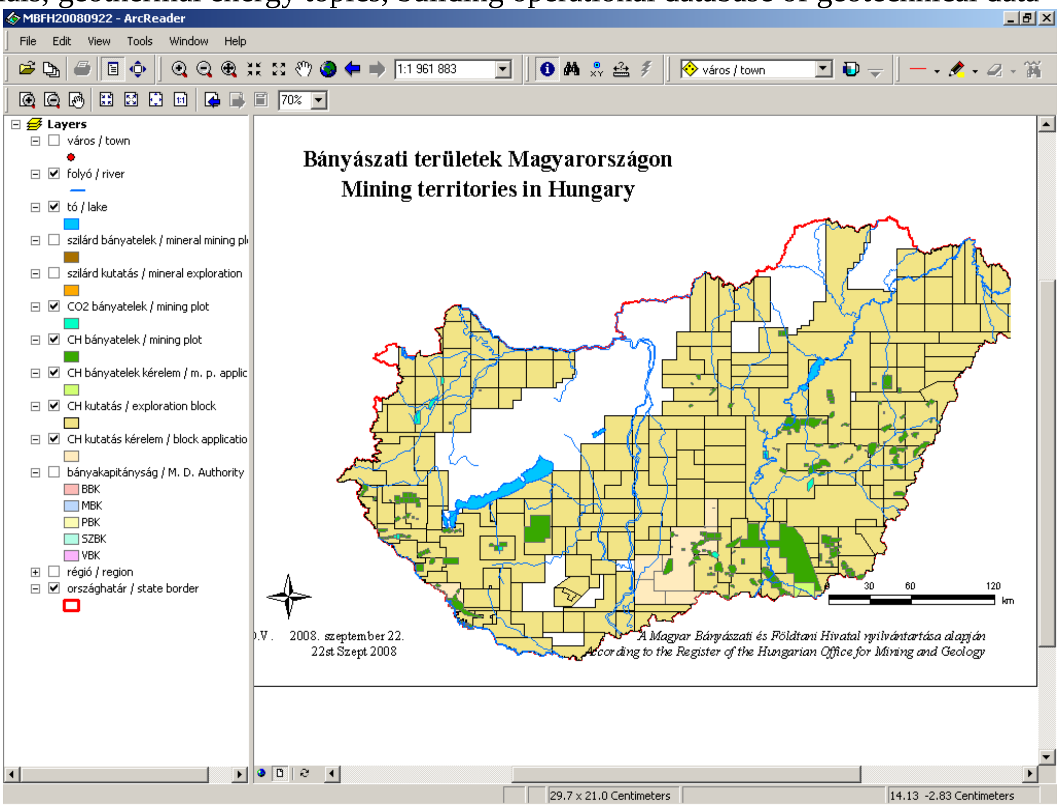


Figure 5.10.: mining areas *Source: http://www.mbfh.hu*

5.1.4. Remote sensing-based systems

Map of land cover (CLC) *Source: FÖMI (Földmérési és Távérzékelési Intézet*

The land cover project name: Corine Land Cover (CORINE - Coordination of Information on the Environment, Land Cover)
In the 80s a project started by the EU with 28 participating countries, including our country too. It was evaluated a total 4.4 million km^2 land cover, which is 47 times larger as area of Hungary. The goal was a basic land use map, quantitative, reliable and comparable information on land cover. This was to ensure a coordinated European environmental policy, which is driven by knowledge of changes in land cover and assisted in the understanding of changes. 44 land cover categories were used in Hungary.
Possible applications of the CLC:
• Modeling of environmental processes,
• regional planning,
• Land management,
• Rural Development,
Specifications:
To create the database in accordance with the standard European methodology.
The result of evaluation is thematic map during satellite images.
The evaluation happened to visual interpretation of satellite images.
The interpretation layers later were digitized. Help from the computer control is made. Detected in the thematic and geometric correction of errors on-screen digitizing took place.
Little that is completed in 1: 100 000 scale maps, the renovation has already begun. During 2000-2002 the content was updated and the scale becomes better: 1: 50,000.

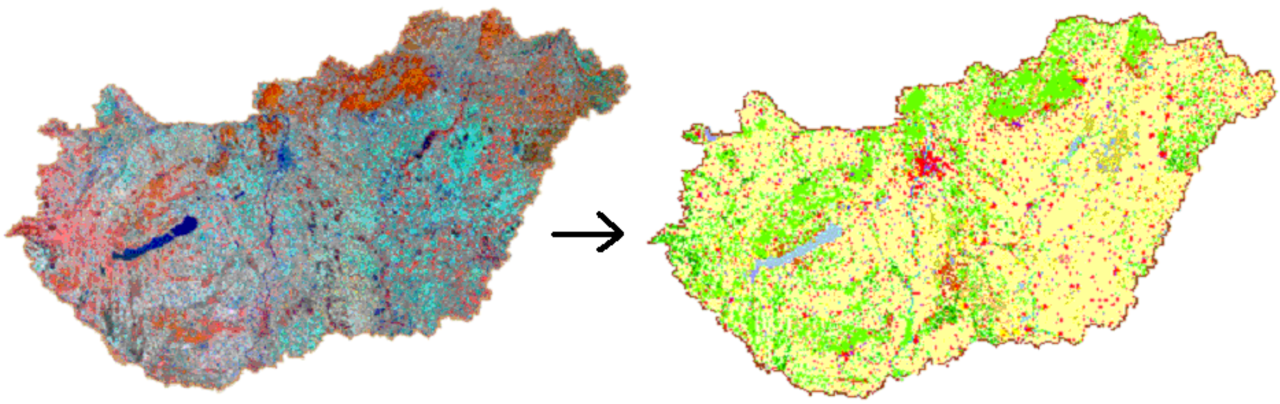


Figure 5.11. From satellite image thematic map has been made. Source: FÖMI

Aerial survey of Hungary

Already it incurred at the end of the nineties, to produce a multi-purpose, air photo series for the whole Hungary. It was mainly to help topographical, geological studies and municipal management. The first complex aerial photography was carried out in 2000 year, with help the Ministry of Agriculture and EU. *Source: Peter Winkler: digital orthophoto program for Hungary, Győr performance, surveying conference, 2003.*

The processing result was orthophoto across the country. The orhophoto is like a map and photo as well. The aerial photo is transformed in that case in order to eliminate the perspective distortion of photo. The transformation needs the elevation circumstances on the field. That is why in FÖMI was produced an elevation grid net for the whole country in a 5 meter x 5 meter grids, utilizing 4,000 pieces of topographic maps' elevation data.
A similar nationwide aerial photography took place in 2005 throughout the country, in 2007 the eastern part of the country, in 2008 the Western, in 2009 the median part of the country.

The Common Agricultural Policy and Land Parcel Identification System (LPIS)

In the fifties, agricultural production in Western Europe - in contrast with other sectors of the economy - not started to develop. The peasant farms were not able to fully cover the domestic consumption of manufactured foods. The peasants' incomes were far below the as average income in industry. There was arisen an economic threat of mass destruction.
To prevent further collapse, common agricultural policy (CAP, Common Agricultural Policy) has been established.
In 1957, in 6 European countries (six) have signed the Rome treaty, which contained the main principles of the European Economic Community, including the common agricultural policy.
Principles of the Common Agricultural Policy:
• The products produced by member states without restriction may appear in the market. The products are quality, health, etc. requirements had to be standardized.
• Enjoy priority against third countries. To this end, the supports of domestic products have strong import protection.
• Producers get uniform, at the level of community determined support according to prescribed norms.
At the sixties (market organizations) were established. The most important regulations were made for cereals, oilseeds, protein crops, sugar, olive oil, tobacco, wine, beef meat, milk, sheep and goat sector. In the seventies it was developed a structural development. In the early eighties appeared the first problems with the CAP. The expansion of production incentive regulation has led to the appearance of surpluses. The most significant transformation of the CAP in 1992 has been implemented. The goal was the separation of price and income. The losses were offset by direct payments depending on the area or the number of farm animals' extent. It was made compulsory in some areas keeping them out of use.

In 2003 once again there have been reforms. The single payment scheme was introduced, a new system of direct payments. In this system the subsidies were no longer linked to production. The unified system is intended mainly to assist the farmers in return for ensuring that they comply with environmental, animal welfare and food safety regulations, and keep their land in good condition.
The assistance is conditional on the current registration system. This work will provide the LPIS (MePar, Mezőgazdasági Parcella Azonosító Rendszer).

Land Parcel Identification System (LPIS)

The Agriculture and Rural Development Office (due to 81/2003. government order) was created as a nationwide organization. ARDO has paying agency functions, dealing with grant applications, licensing, remittance, disbursement, accounting, and bookkeeping. Important area of the support system is the collection of data necessary for the functioning, processing and handling of them, checks.
ARDO is responsible for (amount others):

- The European Agricultural Guidance and Guarantee Fund (EAGGF) support for rural development. Single area based payment.
- The operation of control system, including host and a client, and the Land Parcel Identification System (LPIS) management-related tasks.

Through the eight directorates and further six units in Budapest and the 19 county offices does ARDO the control payment activity.

In the frame of Common Agricultural Policy (CAP) special measures were decided by the European Economic Community in order to improve the situation at farms. The CAP provided the bulk of the subsidies allocated to farmers. The basic condition for access assistance is that the farmer regularly provides detailed information on the economy, tillage, farm animals, production data, etc.
The Land Parcel Identification Numbers (LPIS) to the whole country established registration system, which system is necessary and required.

Geometric basis of LPIS is the nation-wide aerial photograph series. The register was started in 2000. With 150 to 160 thousand piecesof applications. The 7% of applications is regularly checked.

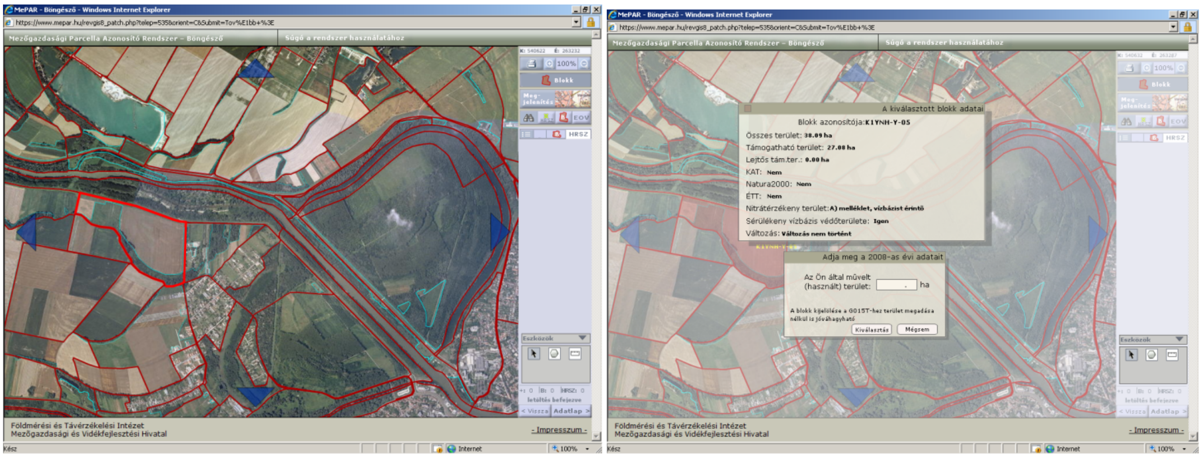


Figure 5.12. LPIS, Gyor, western area orthophoto

Aerial orthophoto for the whole country is the geometrical basis of LPIS. The farmer signals his area used for agricultural purposes on the A3 sized orthophoto. With this signed orthophoto and permission formula could ask applicator for area based payment.
(Source: Csornai G. - B. Csonka - Zelei Gy - Martinovich L. - A. Carter - L. Tikász - László I. - E. Bognar (2003 / a): The Land Parcel Identification System (LPIS) to build the Integrated Administration and Control System (IACS), as part of December 2003. Geographic Almanac, Budapest)

Plant monitoring (NÖVMON, Növény monitoring)

The NÖVMON is an estimate process on yield of the most important plants.
The NÖVMON provides a reliable quantitative data on the expected crop before harvest. The managers, policy makers also need to take stock of pre-harvest storage and transportation capacity, be prepared for storage, pre-planned in a cereal intervention. The first step is to buy cereal by the Agriculture and Rural Development Office.

The statistics and yield estimation for agricultural administration is a long-standing usable. The methods and results of individual countries differ. The advantage of NÖVMON is that it does not infer the statistics going back years, but using remote sensing data. A quantitative evaluation with high reliability (95%) are able to determine yields in advance 1-2 months before harvest and does not depends on the announcement of farmers nor the structure of estate. Particularly important the forecasts of different favored few years, for example: drought year then well-grown after each.

The Institute of Geodesy, Cartography and Remote Sensing, Budapest (Földmérési és Távérzékelési Intézet, FÖMI, Budapest) staff worked out between 1980 to 1996 the NÖVMON procedure. Operative started in 1997, the first for 6 and 9 counties, and then the whole country. Hungary is characterized by a large proportion of the total growing area as a whole compared. Hungary total area: 9.3 million hectares, production area: 7.689 m hectares > 80% of agricultural land: 5.817 million ha.

The eight major field crops that NÖVMON estimates:
- wheat
- winter barley, spring barley
- corn, corn silage,
- sunflower,
- alfalfa,
- beet.

The initial data:
- crop structure map,
- CORINE land cover,
- on-site data
- satellite images.

The crop structure map is given by the farmers. On this map we can read the sown area size, the geometrical position, registration ID, area sown, the crop sown. The 10% of total area is under fluent control. NÖVMON was interrupted in 2003 – 2010.

Source: G. Csornai - Suba Zs - Somogyi - Tarcsai B. - Tikász L. - Thurs Wirnhart (1995): Remote Sensing Monitoring of Cultivated Plants in the procedure under market economy conditions, the National GIS Conference, Szolnok

VINGIS

VINGIS is the national vineyard register in geographical information system. The EU requirement is that the plantations are eligible to be registered, which satisfies the 1: 10 000 scale mapping accuracy. The system geometrically is based on the aerial orthophotos, together with the cadastral layer.

The domestic system was the following schedule:

-First phase (2001-2002): Eger, Matra, Villány, Pannonhalma vineyardsSecond-phase (2002-2003): Buda-Etyek, Balatonboglár, Szekszárd, Sopron, Somlo, Badacsony, Mór Wine Region And third phase (2003-2006). Csongrád, Hajós-Baja, Kunság, Ászár-Neszmély, Csopak-Balatonfured, Balaton, Pécs, Bükkalja, Tokaj, Zala, Tolna wine region.

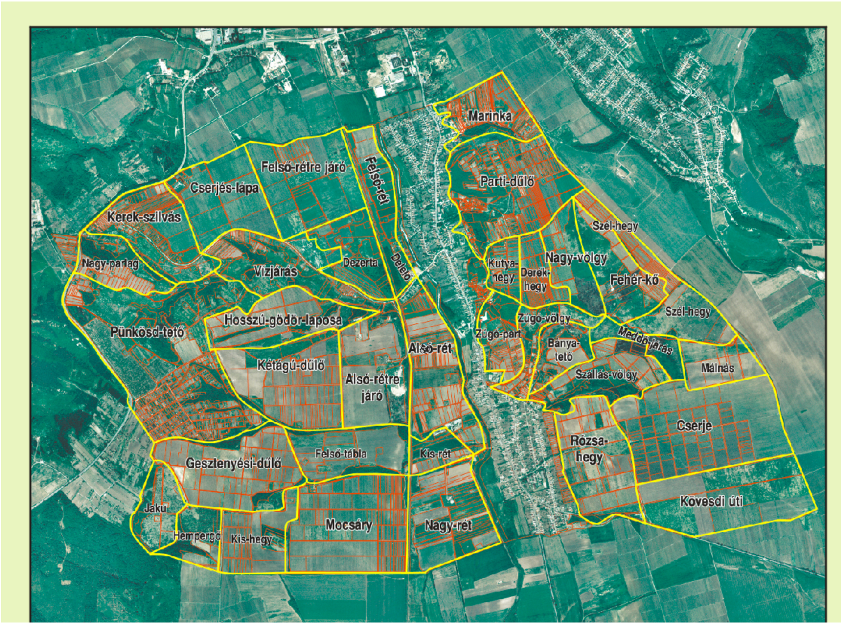


Figure 5.13. Geographical location is in the VINGIS, digital orthophoto
Source: FÖMI homepage

Ragweed map

The FÖMI visits field and uses satellite images to detect and prepare a summary map of the larger then 0.8 hectares ragweed areas. 2008. Act XLVI. Law of the food chain orders protection in the public interest against ragweed. To this end the survey and register is carried out with the help of Information System Ragweed.

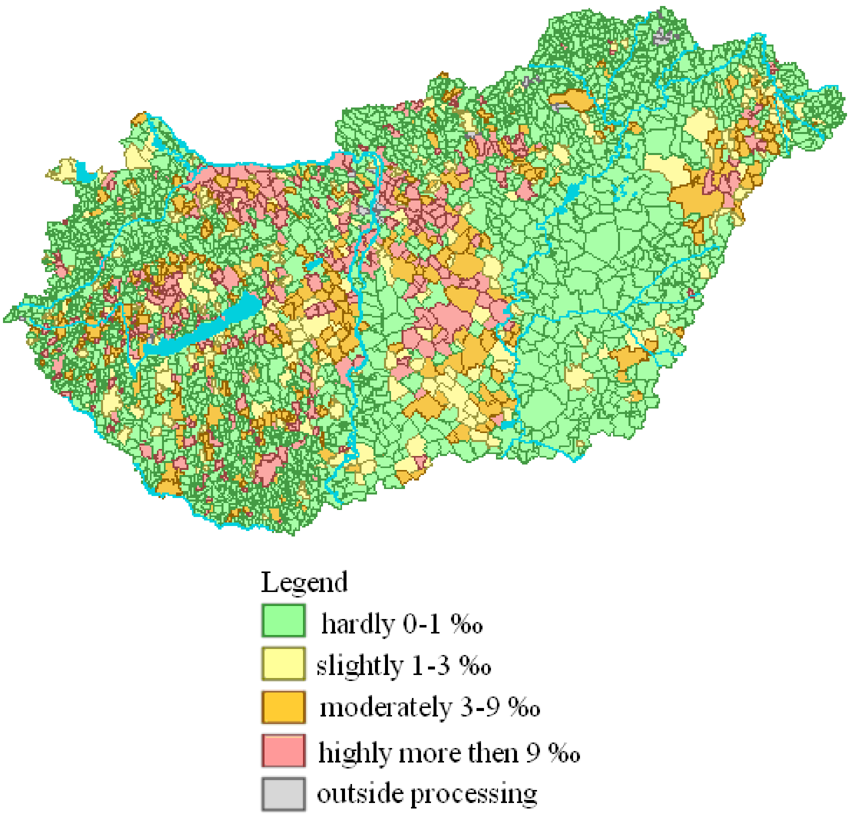


Figure 5.14. Hungary 2010th Areas of ragweed Source: FÖMI

5.2. Water databases

Written by Anikó Zseni PhD, Széchenyi István University, Győr

5.2.1. Hydrological data

A uniform system of cognition, data collection, data transmission and data evaluation is needed to establish for carrying out the tasks of water management activities, namely the treatment of the waters and water constructive works, the water damage averting, the water public utilities activity, and the supply of the tasks of the water resources management.

The hydrological measurements, tests and related data collection have more than 150 years of history in Hungary.

Water management needs meteorological, hydrological, hydrogeological data as well to establish and characterise the inventories, and to cross-check it with the consumption.

Over the past decades still operating information systems have developed from the hydrological, bed-morphological and hydrogeological data: for example hydrographical atlas of rivers, map of daily regime and the national hydrographical data store.

The initial paper-based data registration, processing and access are now being replaced by the continuous developing computer-based systems.

The Water Management Information System (VIZIR) is the system of recording and processing of basic data of the water management. It contains and manages the data which establish the decisions related to public need of water. The VIZIR is able to exchange data with informatics systems related to water management.

The VIZIR as a basic recording system of water management is built on the digital Water Data Store. Operating of VIZIR is belonging to the tasks of Central Bureau of Water an Environment and its regional offices.

The first operating applications systems of VIZIR are OTAR (Management System of Hydrographical Object and Basic Data), OHM (Operational Hydrology Module) and MAHAB (Hungarian Hydrological Database). The databases are in Microsoft SQL Server.

The realization of The Hungarian Hydrological Database (MAHAB) took place after preparatory work in 1999-2000. By autumn 2000 the computerized database was filled up with data from 1900 to 1998 of hydrographical basic stations. Uploading the database is the task of Regional Bureaus of Water and Environment, while running and servicing of database belong to competence of Central Bureau of Water and Environment (VKKI). The data stored here (of approx. 110 station (the basic stations)) are available in paper and CD formats in the Hydrographical Yearbooks distributed by VITUKI Kht. These data are also accessible to anyone in web site www.vizadat.hu that is operated by VITUKI and VKKI.

5.2.2. Data of emissions

Emission of water pollutants can be quantified and evaluated according to the reporting requirements of load of surface water and groundwater. Activities which load elements of the environment are obliged for registration and notification. The systematic collection of data operates from 1990 in the Regional Inspectorates for Environment, Nature and Water.

The 220/2004. (VII. 21.) Government decree (about the rules of protection of surface water quality) has introduced the institution system of the self-monitoring of emission of sewage and waste water. The government decree sets the recipients who are obligated to self-monitoring their sewage emissions to public sewage system or directly into surface water. The recipients who are obligated to self-monitoring must provide data about characteristics of their sewage emission and of technological processes (in accordance with the 27/2005. (XII. 6.) KvVM decree about detailed rules concerned control of emissions of sewage and waste water).

Data supply must be done for the competent regional Inspectorates for Environment, Nature and Water, with using the VAL (Basic registration form of water quality protection) and VÉL (yearly registration form of water quality protection) sheets. The 4th Annex of 27/2005. KvVM decree contains these VAL and VÉL registration forms.
The Annexes of 18/2007 KvVM decree contain the data sheets of necessary confession according to the directions of 219/2004. Government decree. These are the data sheets of:

- FAVI-KÁRINFO: taking into consideration pollution sources, polluted areas and remediation (in according to the 35th § 1 (b) of 219/2004 Government decree),
- FAVI-MIR-K: data supply of monitoring system of environment use (in according to 35th § 1 (c) of 219/2004 Government decree),
- FAVI-ENG: registration of licensed activities (in according to 35th § 1 (a) of 219/2004 Government decree).

5.2.3. Data of immissions

In Hungary there are regular measurements of water quality in surface waters since 1954. So that way fairly long-term data sets of the "conventional" water-polluting substances (organic matter, nutrients, mineral salts) are available. Between 1994-2007 the MSZ 12749 (a Hungarian Standard) included the basic requirements of operation and description of monitoring network of surface water quality.
The regular observation of water level of underground water goes back even earlier: the monitoring network of subsoil water level since the 1930s, of karst water level since the 1950s, of ground water level since 1970 exists.
The monitoring network of quality of underground water has worked since the mid-1980s. Three main sets of data gives us information about underground water's quantity and quality: the monitoring systems, statistical data supply of water exploitation, and research programs, periodic surveys.
The previous monitoring networks were replaced by the surveillance, operational and investigative monitoring systems from 2007 (according to Water Framework Directive, WFD: 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy). This has caused more or less change in the location and frequency of observation, and the measured parameters also.
The surveillance, operational and investigative monitoring systems are used for water status assessment and monitoring of both surface and underground water.
The surface water monitoring includes the determination of biological elements and special hazardous substances which are indicative for the ecological and chemical status of water. The surface water monitoring also contains the physical and chemical parameters and morphological characteristics, which affect the ecological status.
The aim of monitoring programs of underground waters is monitoring their chemical and quantitative status.
In Hungary the 31/2004 (XII. 30.) KvVM decree regulates the rules of observation of surface water quality parameters, the principles, system and professional requirements of the new monitoring system.
The WFD monitoring was designed in accordance with the requirements of the 31/2004 KvVM decree, based on monitoring programs operates since decades. Beyond the directions of WFD, the guidelines of other domestic legal and policy requirements have been taken into account, as well as the available measuring capacities.

The surveillance monitoring program of surface waters consists of two sub-monitoring programs: surveillance monitoring of lakes (23 sampling sites) and rivers (124 sampling sites).

In the case of the operational monitoring of surface waters there are three types of the investigation: according to the hydromorphological riskiness, to the riskiness of organic matter and nutrient content, and to the riskiness of hazardous substances.
The operational monitoring program of lakes according to hydromorphological riskiness has 19 sample sites, the operational monitoring program of lakes according to the riskiness of organic matter and nutrient content has 21 sample sites.
The operational monitoring program of rivers has 6 sub-programs. There are 4 sub-program for monitoring rivers which have any kind of hydromorphological riskiness (a total of nearly 600 sampling sites). There is one sub-program for monitoring rivers which have riskiness of organic matter and nutrient content (177 sampling sites), and one sub-program for monitoring rivers which have riskiness of hazardous substances (76 sample sites).
The monitoring program of groundwater according to WFD is laid down by 30/2004 (XII. 30.) KvVM decree (about rules of investigation of groundwater).
The groundwater monitoring system is built up by the territorial and the environmental usage monitoring system. The territorial monitoring means the monitoring systems operated by public entities. These programs are monitoring the quantity state of groundwater and their quality state resulting of natural factors (such as the leachable mineral content of rocks) and the anthropogenic diffuse effects (non-point sources of pollution), as well as the long-term variations of these. The aim of environmental usage monitoring is to observe the effects caused by point pollution sources of groundwater. Necessary data is provided by the measurements made users of the environment.
The territorial monitoring of groundwater has 6 sub-programs. On the sample sites of quality monitoring the dissolved oxygen, pH, conductivity, nitrate, ammonium and certain other parameters (according to the sub-program) are measured. The sampling frequency in vulnerable strata is yearly 1-2, in the deeper, non-vulnerable strata 1 per year, and in thermal water strata 1 in every six years.

5.2.4. **Urban Waste Water Information System (TESZIR)**

The Urban Waste Information System (TESZIR) is the recording and processing system of municipal waste-water treatment. The Council Directive 91/271/EEC concerning urban waste-water treatment ordains reporting and data supply requirements. The TESZIR contains and manages the information which can be used for decision making related to the implementation of the Directive, as well as provide the authentic basic registering related to waste water treatment and leading.
Within TESZIR the available data are the following (www.teszir.hu):

- settlements of agglomerations (settlements, population, number of homes, agglomeration),
- agglomeration of urban waste water disposal (name, rank, line length),
- sewage treatment plants (name, population equivalent, agglomeration),
- points of discharge (volume of waste water, name of waste water treatment plant).

5.2.5. KSH data related to public utilities and load of water

The Settlement Statistical Database System (abbreviated as T-STAR) has the richest and territorially most detailed data basis for built environment. T-STAR is the data product of Central Statistical Office (KSH); has operated from 1977. T-STAR is an electronic (Oracle based) database; only exist as a computer stock.
The data available for settlements are being classified to alphabet marked theme-groups. The theme-group marked by H consists of data of water-, electricity-, gas-supply, sanitation, and 8

kinds of environmental data. This 5-year frequency database is suitable for estimating the data of population's water consumption, and thus, indirectly - after taking into account sewage treatment - the estimation of contamination of surface water bodies caused by point load. So KSH data can be good control for data from other sources.

5.2.6. The data related to water supplied by OSAP

The implementation of statistical data collection can be based on obligatory or voluntary data-supply. The data sources and domestic relations of KSH (Central Statistical Office) are assigned annually by the tasks determined by the National Statistical Data Collection Program (OSAP). OSAP includes the statistical data collections of obligatory data supply. The registration system of data collection in OSAP is established and conducted by KSH. The KSH complies the draft program, then the National Statistics Council (OST) gives an opinion and after these the government gives regulation of the program and the reporting obligation.
Currently, the 288/2009. (XII. 15.) Government decree (about data collection and data takeover of National Statistical Data Collection Program) is valid.
Water-related data collection requirements (so called sub-programs) in OSAP are:

- 1062: Municipal water supply, sanitation and wastewater treatment.
- 1373: The agricultural water supplies.
- 1375: Groundwater exploitation, and monitoring activities of monitoring wells.
- 1376: The main technical-economic data of public water supply and sanitation activities.
- 1378: The water management data of non-public water users that have more than 5 m^3/h total water cycle, and more than 80 m^3/d fresh water uses.
- 1694: The data of surface water exploitations and discharges to surface waters.

5.3. Air databases

Written by Anikó Zseni PhD, Széchenyi István University, Győr

5.3.1. Data supply of sites (premises) that pollute air (data of emissions)

The 21/2001 Government decree (about rules of air quality protection) ordains obligatory data supply of sites (premises) that pollute air. The data supply must be submitted to the regional Inspectorates for Environment, Nature and Water until the following year 31st March using the LAL (Air quality protection data supply) and LM (Annual rate of air pollution announcement) sheets.

5.3.2. Data collection system of air quality (data of immissions)

The 21/2001. Government decree (about rules of air quality protection) regulates the basic tasks and responsibilities relating to air quality protection. According to this the air pollution of Hungary must be regularly monitored and evaluated with the help of Hungarian Air Quality Network (OLM). The decree claims that installing and maintaining of the Network is task of the state.
The Air Protection Reference Centre (LRK) performs the professional and quality control coordination tasks, in the framework of National Weather Service (OMSZ). The LRK is responsible for the quality control tasks of the monitoring network. It operates accredited calibration laboratory to carry out quality controlling tasks and as a National Reference Laboratory provides the comparability of network measuring.
The data collection of OLM, the final validation, the processing, the evaluation, the national and international data supply and the information of public is made by National Air Pollution

Data Centre (OLA). The website of OLM (www.kvvm.hu/olm) gives current air quality data and other related information.

5.3.2.1. Hungarian Air Quality Network (OLM)

The Hungarian Air Quality Network (OLM) has two parts: the automatic and the manual air quality network.
The automatic air quality network consists of continuously operating measurements stations. Their data are sent on-line, automatically to the sub-centres (which operate in regional Inspectorates for Environment, Nature and Water) and from there to the National Air Pollution Data Centre (OLA). There are 52 sampling sites in 31 settlements where priority air pollutants and meteorological parameters needed for evaluation are measured continuously (Fig. 2.3_1.).

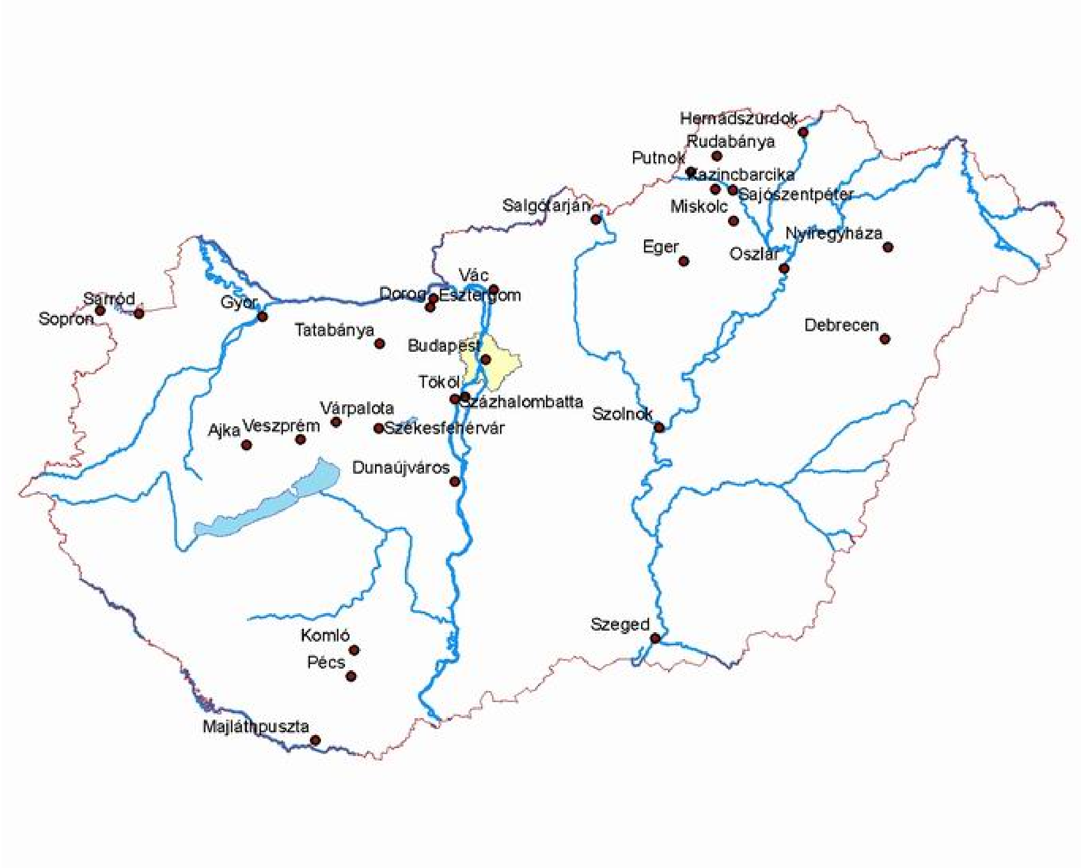


Figure 5.15. Settlements in automatic air quality network (source: http://www.kvvm.hu/olm).

Air pollutants measured by automatic air quality network are:

- SO_2 (Sulphur Dioxide) (g/m^3)
- NO_2 (Nitrogen Dioxide) (g/m^3)
- NO_x (Nitrogen Oxides) (g/m^3)
- CO (Carbon Monoxide) (g/m^3)
- O_3 (Ozone) (g/m^3)
- Particulate matter (PM_{10} and $PM_{2,5}$) (g/m^3)
- Settled dust (g/m^2 * 30 days)
- BTEX (xylene)
- H_2S (Hydrogen Sulfid)
- VOC (Votile Organic Compounds).

Meteorological parameters measured by automatic air quality network are:

- wind speed,
- wind direction,
- temperature,
- humidity.

The manual air quality network (formerly known as RIV: Regional Immissions Testing Network) being set up nearly thirty years ago. The samples after the periodical (24 h) sampling are analysed by accredited laboratories of the regional Inspectorates for Environment, Nature and Water. Results of measurements are sent to the sub-centres of regional Inspectorates for Environment, Nature and Water and finally to the National Air Pollution Data Centre (OLA). The manual air quality network currently operates in 131 settlements (Fig. 2.3._2.).

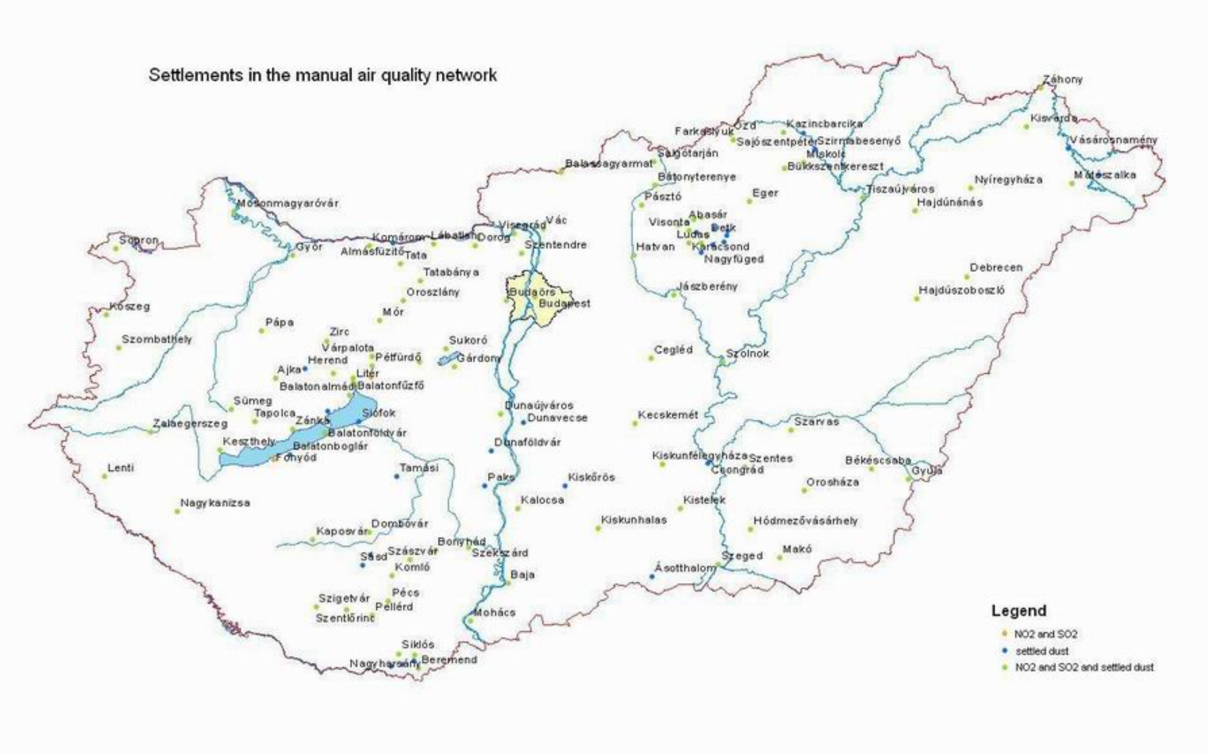


Figure 5.16. Settlements in manual air quality network (source: http://www.kvvm.hu/olm).

Air pollutants measured by manual air quality network are:
:

- SO_2 (Sulphur Dioxide) (g/m^3),
- NO_2 (Nitrogen Dioxide) (g/m^3),
- Settled dust (g/m^2 * 30 days).

According to the 2/2002 KvVM decree (about designation of air polluted zones and agglomerations) the area of the country is divided into zones. Depending on the level of contamination the air quality should be monitored by continuous measurements, periodic measurements or modelling in the zones.

5.4. Flora and Fauna database

Written by: Istvan Gyulai, PhD, Széchenyi István University, Győr

The classic environmental elements are: earth, water, air, wildlife, that is flora and fauna, and the built environment. The most complex component is the flora and fauna. To the wildlife belongs the man himself. The aim of environment protection is to guard man against adverse impacts.
In 1992 at the Rio Conference, where sustainable development as in past year's environmental strategy was adopted, determined separate contract dealing with the diversity of ecosystems: Biodiversity Convention. Many countries have joined to the Convention, including our country too.

The significance of biodiversity is that diversity of organisms ensures the viability. For example: a grass seed bag for installation of artificial turf can contain eight or more types of grass seed. If illness or other unpleasant (drought, frost) is in fact a part of the grass may destroy, the rest will be retained and ensures the continuity of the lawn. Comparing to the mentioned grass seed sachet also many times more plant species are able to incorporate a wild flower meadow.
Another example: in 2001. year Bovine Spongiform Encephalopathy (BSE) caused great losses to the cattle breeders among several EU countries, but the Hungarian Grey cattle are not affected.
The properties of different species, including nutritional habits, animal form, allow a genetic improvement of run-down stock-farm. That is why it is important to conserve the relative 'wild' species populations. This applies to plant and animal species whose recovery has not yet happened, but it may become in the future (herbs, special hormone producing animal or useful microorganism).
On the other hand the extinction of species refers to changes in living conditions, which started at a lower level, and yet not a direct threat to humans, but it indicates that there are problems and can have even more trouble!
To evaluate conditions it is necessary the continuous monitoring, the monitored species (groups), and designation of taxa (taxon), the choice of indicators.
The second National Environmental Program (2003 - 2008) identifies the tasks and monitoring programs:

- The Natura 2000 network monitoring
- The EU's Water Framework Directive monitoring tasks
- The Endangered Species Monitoring
- The specially protected and colonial nesting bird species monitor
- The national water bird monitoring
- Monitoring the effectiveness of conservation programs in the country
- The special importance of protected natural areas monitoring
- Monitoring of nature conservation activities
- Monitoring of harvested species

Natura 2000

Hungary joining to the European Union (2004) has agreed to corporate the Union's law on the domestic legal order - with appropriate adjustment. Thus, it happened to the legislation related to nature conservation, since the moment of accession in Hungary is also valid the two EU directives, the Birds and Habitat Protection Directive.
Due to directives our country has bound the natural habitats of Community importance, as well as animal and plant species, to protect designated areas, so that the Natura 2000 areas have become part of EU's ecological network
The network can infer the name of ideals: a valuable natural areas, habitats are more or less coherent chain of which the original European wildlife preserve. Selection of the territory of our country was nearly 21% of the Natura 2000 site. Almost all of the original protected areas have been included in the network, but other around 1.2 million hectares got Eu protection. No wonder that among these are a very high percentage of agricultural land, grasslands, lakes, rivers, which for centuries have been farming place. As for the Natura 2000 areas is particularly pronounced the protection’s method, activity of farmers, the maintenance, and the role of traditional farming methods.
Generally speaking, the Natura 2000 network-like protection differs from the reserve-like protection, in this case rather the social, cultural, economical, and nature conservation interests will be put forward and their coordination.

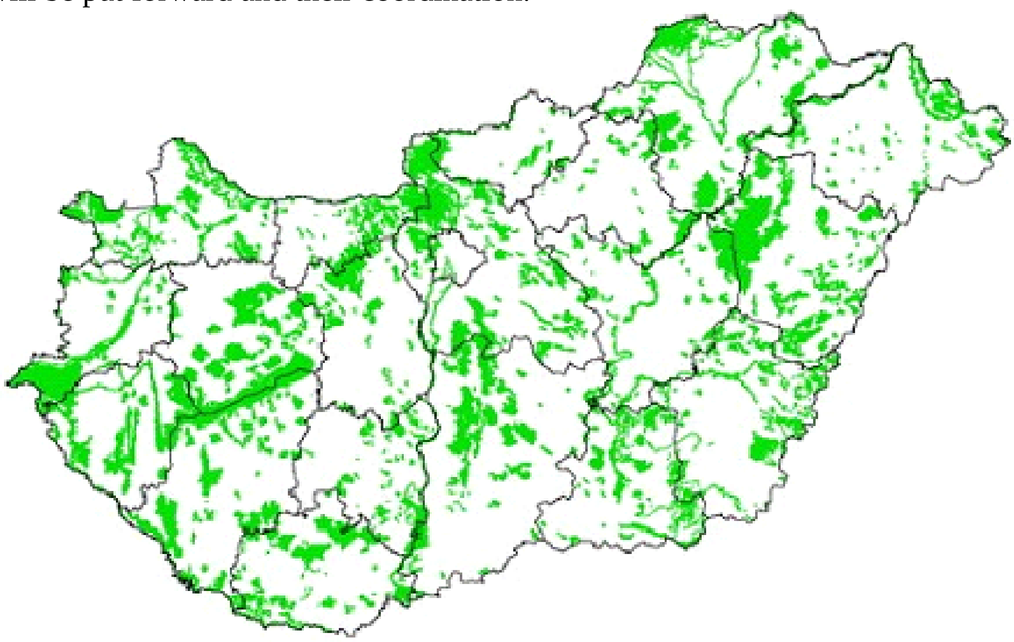


Figure 5.17. Natura 2000 sites

Nature Protection Information System (TIR, Természetvédelmi Információs Rendszer)

GIS database
It is one subsystem of the National Environmental Information System (OKIR) in relation to environmental and water management subsystems.
A national database will be a fundamental nature, nature conservation area in the country as a whole, very complex.
The objectives of TIR: the foundation of the professional decisions, to provide the state of the country's natural characteristics, the EU accession-related policies: to ensure requirements on nature conservation.

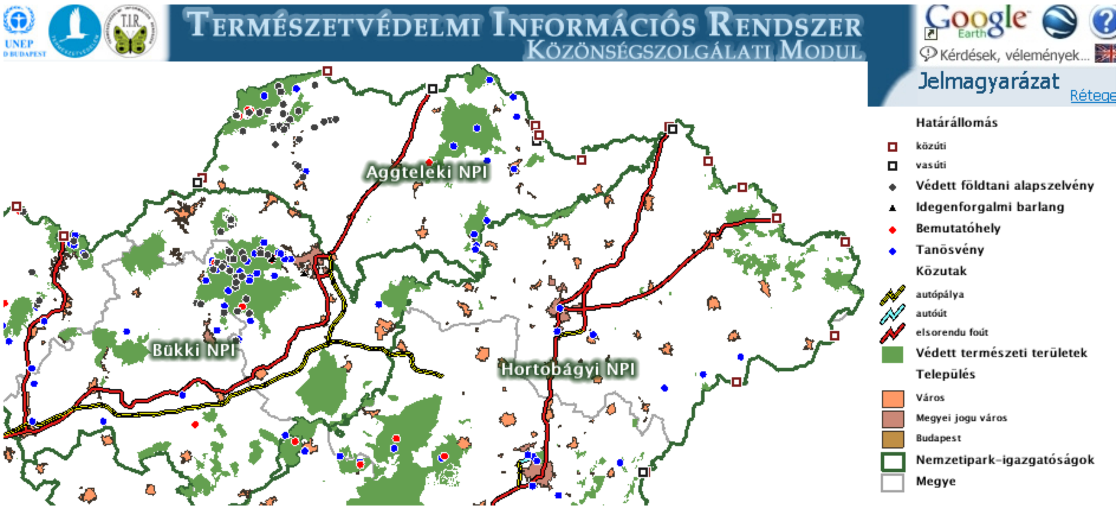


Figure 5.18. TIR Northeast details

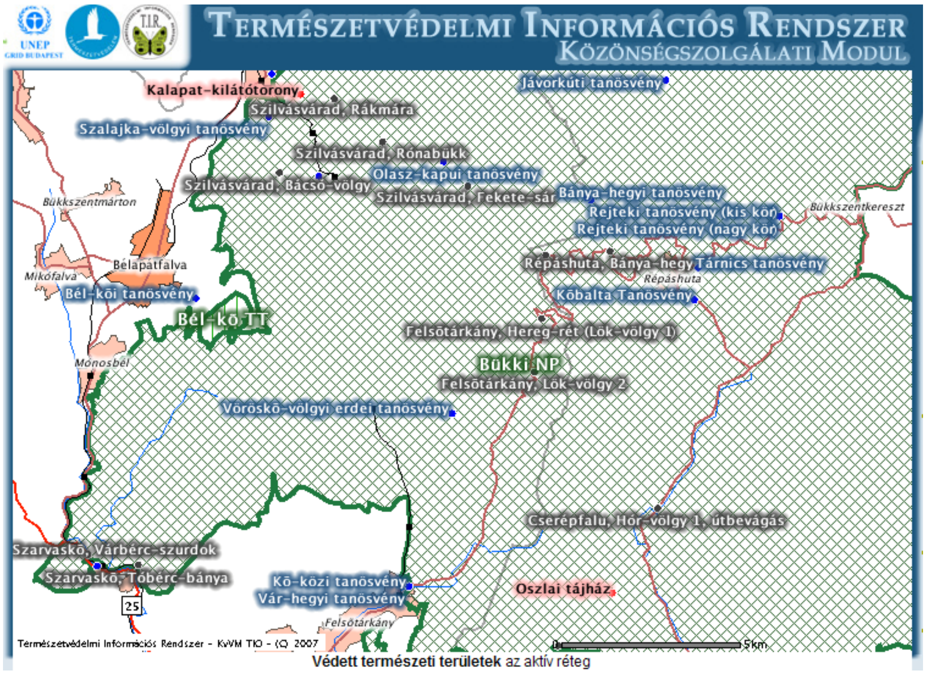


Figure 5.19. Internet TIR query: the values of the Bükk National Park

National Biodiversity Monitoring System, (NBmR) *Source: KÉP Report, 2006*

The sampling methodology guides have appeared in book series.

The monitoring system includes the major groups of animals and plants. The implementation of some groups of animals monitoring takes place in individual projects.

Perspective: Digital form will be available in the TIR.

Monitoring of our common birds (MMM Mindennapi Madaraink Monitoringja)

On the main habitat types available changes are to monitor on basis of nesting bird population. In long-term follow-up of changes by observational studies is on the common, well-known stock of nesting birds. A database made by the developed methodological guidelines based on annual results of the observations. The sampling carried out by members of the association.

Forest light trap network

An analysis is taking place on parasite insects of forests and insect fauna of forest carried out by: State Forestry Service. There are long-term studies on seasonal abundance of flying insects at forest stations, to measure changes. Permanent sample-points are at some point in the country.

Plant Protection light trap network

The network is for different habitats and testing of parasite insects and insect fauna of plants. It is carried out by State Forest Service, Plant Research Institute. Light trap data are conducted in different habitats, which are intended to describe the seasonal dynamics of flying insects. Some of the projects measure the invasion of pests, while others were established nature conservation purposes.

Standing timber National Archives

Digital data, the older data are mostly on paper.

The archives are kept on by State Forest Service with many aspects of the country's forests, taking into account the current inventory management purposes.

From 15 to 20 initially and then every 10 years since 1880, data contain (broken down per level forest parcels): the rate of species, origin, average height, age, yield class, area size, altitude, location, soil type, hydrological conditions, the population closure.

National Archives of Wildlife

Maps, digital database.

The system follows up the changes in boundaries of wildlife management units.

Szent István Egyetem (St. Stephen University) Wildlife Department

Wildlife Management Unit, wildlife information, wildlife management units to identify relevant data, 1:50.000

MÉTA-databases (Hungary Habitat Mapping Database)

Data are in digital form. The Hungarian natural vegetation heritage and current map and data base of landscape ecology. I70 000 peaces 35 hectares area, in contact with hexagonal pixel form vegetation list, vegetation type: naturalness, extent, isolation, adjacency, risk factors, classification of the hexagon ecological region, fallow and extent of invasive species, potential vegetation, grasslands, land use.

Man

The key player is man in the living world. The data about man and his relationship with the environment is characterized by two types of data: the immediate surroundings, that is the built environment, the other is the opinion-type statistics.

The collected opinion-type data are issued in the form of surveys, questionnaires, studies. Some examples: Euro barometer, TAI (The Access Initiative), quality of life measurements, Eco barometer 2001-2004, Micro-regional organizations and professionals in the questionnaires, local identity.

The society as an active factor in the environment is characterized by the following indicators:

- Population, demography
- Education, skills, abilities, skills
- Activity, employment
- Culture, recreation, art
- Access to basic goods and services, the situation of minorities

- Community awareness, identity, social state, trust and attachment to the place of residence, the nature in relations
- Political / community involvement, community work, civic activity
- Deviance

5.5. Settlement databases

Written by: Istvan Gyulai, PhD, Széchenyi István University, Győr

5.5.1. Built heritage, monuments record

Source: Bulla et al. (Ónodi Gabor, Faculty of Gödöllő): Environmental Impact Assessment, environmental monitoring, environmental status of Hungary, 2006

The built heritage, monuments, records of the Office of Cultural Heritage is carried out. The website has been declared a national monument in 2001 and the list of objects that can be downloaded (in xls format).

Directorate of Documentation of Office of National Cultural Heritage
There is here the declaration of a protected heritage, the register and context, tracing elements of cultural heritage property, inventory, and evaluation used scientific methods. Develop the heritage elements of the property protection policy. Structure:
• Registration Department,
• Department of Defense,
• IT Department.

The Registration Department is responsible for keeping records up to date, and value recover, the process of preservation, the official work of cultural heritage elements identified in the registration and ongoing maintenance of data, reporting directly to the department and other authorities and external parties.
The Defense Department deals with the declared protected monuments and archaeological sites, modification or removal of the protection order, preparing legislation. It gathers protected heritage items, makes scientific research and field tests.
The Information Technology Department is responsible for the processing of digital records and data service.

2.5.2 The Central Statistical Office (KSH, Központi Statisztikai Hivatal)) data series for the built environment
For the empirical regional studies for Hungary is the largest regional source of information available by the Central Statistical Office (KSH) the City Statistical Database System (abbreviated as T-STAR). These data products from 1977 run normally, with the richest content and detail.

The T-STAR Electronic (Oracle based) database. The system includes all of the collected or received by the KSH annually since 1990, for the current year or any time (preferably at 31 December) settlements detail on the full data available for municipal and urban settlements with the status of the data collected in urban stock. The T-STAR integrated the 1980, 1990 and 2001 censuses and the 1994 and 2000 General Agricultural Census data processed at the local level (In addition, the T-STAR-compliant files are also available in archived format the former (1980-84, 1986-89 years settlements data.
Every year on Jan. 1 has the valid settlement stock, and the number of towns (cities). The great importance of database is the completeness. The electronic format allows fast data processing.

T-STAR can also be easily feasible in practice, makes a very large number of territorial units for an arbitrary index and its aggregation of settlements. For these reasons, the domestic regional development practitioners, researchers, regional, and even some other field for almost unavoidable, but at least it is strongly recommended to use.
The settlement of all the data available in the following:
A: area, population, gender and age structure (the resident population figures since 1965, mostly in the permanent population in the 80s were available, 2003's total of 27 data).
B: vital statistics (the basic data continuously since 1965, to 2003').
C: municipal budget (since 2001's 32-year data).
E: industry (number of employees and plants, the value of fixed assets - from 1997 to completely gone).
F: trade, tourism and hospitality (structure, often changing, ever-expanding content - in 2003, 147 kinds of data -; since 1991, but there are no data on trade flows).
G: the size of the housing stock, housing and wound volume (builders, equipment, broken down by type and the 90s, every year since 1996, 39 kinds of data).
H: water, electricity, wired supply, sewage (mostly in the late 1980's, 2003 37) and 1993 from 8 kinds of environmental data.
J: health (in the 1980s, since the beginning of the variable part of the structure) and the social system (the 1990s) status, output data (for 2003's total of 66 data).
Q: Is the state of public education institutions, performance data (continuous, but since 2001 a new structure for 2003 has 59 types of data).
L: educational information (libraries, cinemas, cultural homes as well previously, decreasing level of detail, data for 2003 only 8).
M: a non-profit institutions in the supply of matches (yes, no) data (updated every 3 years; League in 2002, 37 different data).
O: the agriculture-state data (the agricultural census year, 2000 was 52 data).
P: Number of enterprises in different sectors, ownership forms and categories of staff (from 1992 onwards, the changing structure of the 2001's to 49 data).
Q: personal income tax returns data of 3 people (the tax base and tax amount, the number of taxpayers, the T-STAR is only included since 2001).
R: in the car and the stock, fixed, and cable television subscribers (since 1992, steadily expanding data type, 2003, there are 34 kinds of data).
S: the unemployment data (1993, 2003, 18 kinds of data).
T: the municipal aid figures, the growing of detail (from 1993 to 2003, has 21 pieces).
X: crime figures (from 2000 to 2001 from around 25 pieces).

The status of urban settlements in the current year in addition to the following facts shall be communicated to the T-STAR:
B: the constant in- and out invasion number (from 1977 until 2001, since then the total settlement available).
D: Investment performance (until 1996)
G: The management of real estate, housing sector data (mostly from 1986, 2003, 14 pieces).
H: some utility service data: district heating, hot water supply, street lighting, electricity supply, roads, sidewalks, green spaces, spas data (the 1970-80s in 2003 of 15 pc).
I: local bus services, post offices, the 1970-80s; (2003: 7) were, until 1990 a number of press publications, until 1995, fixed line phones as well.
Q: Is the town's institutions of higher education staff data (detail from 2001 to 2003 was 13 data).
L: theaters, museums, exhibitions (ex-library), the number and performance data

M: urban institutions in the supply (there is none; 3 years from 1988, 2002, 9 kinds of institutions).

The system of sets of data for each year (or any desired parts of it) can be produced by a query, and they are bought by outside users. The query results primary data files in a text format, but in recent years xls excel format tables as T-STAR data were distributed by the Central Statistical Office. Using the settlement code can we receive any data electronically, as for the T-STAR database - and growing number of public records at other geographical information system.

The additional annual basis the Central Statistical Office: regional electronic databases
Budapest in T-STAR one settlement appeared, while the mid-1990s, the Central Statistical Office in Budapest and Pest County Directorate of each year compiles and distributes the T-STAR via 23 districts of Budapest. The database structure is similar to the T-STAR. In addition since 2000.is joined to mapping system and can be accessed as GIS database. It can be used perfectly for spatial analysis and spatial processes of capital.

The KSH County Regional Statistical Database System is MR-STAR.
This contains practically all annually collected data by the Office for the counties and regional areas. The full stock is grouped for 27 themes that mean in a year more than 2,800 variables for the counties detail and some representative for regions. MR-STAR is distributed by KSH since 2003, but the time series data on social statistics in general since 1990 are in the system.
The most of MR- STAR data are published in KSH statistical yearbooks or the in corresponding special yearbooks, but some details are only available here. The particular time series are significantly easier and faster to compile using electronic database. The indicator development of the T-STAR is similarly to the database continuously year after year expanding.
At the sub-regional level there is no similar database system- regional data are not collected by the KSH - as for the micro-region it can be produced data like aggregated municipal T-STAR data.

5.5.2. The National Land Development and Land Regulation Information System – TeIR (Országos Területfejlesztési és Területrendezési Információs Rendszer)

TeIR aims to supply objective, accurate and fresh information those bodies which deals with land development and land regulation. The legal framework for regional development and spatial planning is 1996 year Act XXI. and the Governmental Law 112/1997. (.27 VI.). The law states: "In order to ensure the monitoring and forecast on the social, economic and environmental characteristics and changes in regional areas - regional information system should be established and operated."
The government regulated the process of operation and data service. The nationwide organizations like KSH collect data at a land level, and county municipal institutes collect the regional, county-level data.

The GIS-based urban information system uses geographical and settlement identities. So that way data can be aggregated for different size regional areas. The system has more than 35 thousand records for each settlement. The data are available through the network. However, data security reasons, only registered users have access to the entire system.
The user of TeIR:
- National Spatial Development Committee;
- State Audit Office;
- Prime Minister's Office;
- Ministries, autonomous public organizations and support organizations;
- County and municipal governments;
- The national and regional, provincial, regional development councils, regional associations of municipalities and their work organizations.

A freely accessible web site (http://www.teir.vati.hu/), are available to everyone the pre-prepared analysis, the meta-database system, database of concepts. The system gives a comprehensive picture of the society, economy, technical infrastructure, state of nature over various territorial units, representing the fields of data and indicators. It presents the regional institutional and financial assets. Data are about demographic trends, the society's composition, qualifications, given the economy and tourism image. Infrastructure, the living conditions of population coverage indicators provide information. The data derived from sectoral collections illustrate the environment, including the state of nature, regional perspective, the characteristics of the elements, together with their relevant data.

The main TeIR data groups:
- Demographics and society
- Unemployment
- Economy (industry, agriculture, tourism)
- Residents and business income
- Technical infrastructure networks of tracks, supply
- Land use
- Natural conditions and state of the environment
- The planning and development of legal instruments, decisions, decisions Main data
- Local authority management
- The financial instruments of regional development and resource use data
- Regional and urban concepts, plans, programs
- The organizations involved in land development and land use data
- EU regional data
- In addition to the information presented above is also available on the VÁTI TÉRPORT operated by a professional portal (http://www.terport.hu/), which is a land development and settlement-related documentation.
It can be seen an example of pointer catalogue, Central Statistical Office, Meta system
G: the housing stock data
- Housing
- Housing stock in 1990 on I.1
- Built-up 1990, the number of living quarters
- Built Homes (Timeshares excluded)
- Constructed number is admitted
- The built-in 12 to 20 m2 weekend
- During the year, has built a number of room apartments

- During the year, the number built two bedroom apartments (one and a half with 1,5 rooms as well)
- During the year, built three bedroom apartments and multi-number (two and a half room together)
- During the year, with a number of homes built with electricity
- During the year, and home-built water plumbing with a number of dwellings
- Discontinued number of homes built during the year, gas line with a number of homes (without the resorts)
- The number of homes built over 20 m2 of floor space, not built of wood with weekend house
- 20 m2 floor area not exceeding number of wooden chalets
- During the year, with a number of homes built in a bathroom (without resorts)
- During the year, the number of homes built resource state (without the resorts)
- During the year, number of dwellings built privately (without the resorts)
- During the year built, number of homes with a public sewage system (without the resorts)
- The total size of homes built during the year (without the resorts)
- During the year, with a number of homes built home plumbing (without resorts)
- During the year, home-built homes with a channel number (without the resorts)
- During the year, number of dwellings built privately OTP loan
- During the year, privately OTP number of homes built without a loan
- During the year, number of homes built in one room (no resorts)
- During the year, two-bedroom apartments built in number (one and a half room
- With resorts without)
- During the year, built three bedroom apartments and multi-number (two and a half rooms together, holiday excluded)
- During the year, with a number of homes built electricity (without resorts)
- During the year built, number of homes with running water utility (without the resorts)
- The number of homes had ceased during the year (without the resorts)
- During the year, the Council of State resource built housing number
- During the year, state resource other state number of dwellings built
- During the year, private, farmer organizations by number of homes built for sale
- The three-year number of homes built (the two together and half room, holiday excluded)
- During the year, built four bedroom apartments and multi-number (the three together and half room, holiday excluded)
- The number of dwellings built during the year (without the resorts)
- Year during the privately built public housing loan number (without the resorts)
- Year during the privately built homes without the state loan number (without the resorts)
- Modernization of state-owned reconstructed number of homes (without the resorts)
- Upgrading the state no longer owned Homes (Timeshares excluded)
- During the year, private family and private groups during the year in modern homes built in the form number (without the resorts)
- During the year the number of homes built by local government
- During the year, central government bodies built by the number of dwellings
- During the year, the number of homes built by enterprises (without housing)
- During the year, the number of homes built by housing associations
- During the year, the number of homes built by a natural person
- During the year, the number of homes built for sale
- During the year, the number of homes built for renting
- During the year, the number of service use in homes built
- During the year, number of homes built for own use
- During the year, the number of homes built in the form of detached houses (without the resorts)

- During the year, a group of modern homes built in the form number (Timeshares
- No)
- The number of homes built during the year mandate
- During the year, the number of homes built end mixed
- During the year, the number of homes built in housing estates in the form
- The multi-year, multi number of homes built in the form
- During the year group house (terraced house, chain house) Number of dwellings constructed in the form
- During the year-built shower room with wash basin Homes
- During the year, discontinued because of obsolescence number of homes (without the resorts)
- The number of homes had ceased during the year due to natural disasters (without resorts)
- The number of homes had ceased during the year due to the settlement order (no resorts)
- The number of homes had ceased during the year due to housing construction (resorts without)
- The number of homes during the year no longer flat because of the technical division (no resorts)
- During the year, number of flats has ceased for any other reason (without resorts)
- H: utilities, environmental load data
- Quantity of water supplied to households
- Public utilities and residential units switched water conduit net
- Number of housing units is on water conduit net
- Utility potable water network length
- During the year, number of housing units is on the water
- number of homes water conduit net connected, where the tap is not in the apartment, but the building plot is within the
- Total quantity of water supplied
- Total amount of sewage drainage into sewerage
- Led to all the purified wastewater into public sewer
- Utility number of homes connected to potable water network
- During the year, the utility number of homes connected to potable water network
- Public sewer network length
- During the year, invested in new public sewer network length
- Groundwater Precipitation closed channel length
- Utility and public utility nature, and separating combined sewer system length
- Public sewer and public utility nature is on the number of living quarters
- The number of housing units during the year enabled water conduit net
- During the year, the newly invested water conduit net length
- Utility qualified technician is on number of homes (where the tap inside the dwelling)
- Number of homes connected to water conduit net
- During the year the number of homes connected to utilities qualified technician (where the tap is within the dwelling)
- During the year the number of homes connected to public sewer
- Public utility sewage treatment plants (planned) capacity
- Households and sewage wastewater volume
- Sewage drainage, only mechanically treated wastewater
- Sewage drainage, biologically purified waste water
- Sewage drainage, III. Grade purified waste water purification
- Cleaned sewage wastewater volume
- The semi-annual average air pollution by sulfur dioxide during the heating period, the total stations with municipalities

- The use of sulfur dioxide air pollution in half the average for non-heating period, the total stations with municipalities
- The air pollution in semi-annual mean nitrogen dioxide during the heating period, the total stations with municipalities
- The nitrogen dioxide air pollution in half the average for non-heating period, the total stations with municipalities
- The settling dust air pollution in half-year average for the heating period, the total stations with municipalities
- Settling dust pollution in the air half-yearly average for the non-heating period, the total stations with municipalities
- The suspended particulate air pollution in half-year average for the heating period, the total stations with municipalities
- The suspended particulate air pollution in half the average for non-heating period, the total stations with municipalities
- Number of household consumers of electricity
- The quantity of electricity supplied to households
- Number of household gas
- Propane-butane gas for household consumers, the number
- The total volume of gas supplied wire (33.49 MJ converted
- The total amount of household gas (33.49 MJ for natural gas converted
- The total volume of gas supplied wire (without conversion)
- The total quantity of gas supplied to the volume of gas supplied to households (without conversion)
- The total length of gas pipe
- Total number of gas customers
- Gas-heated homes umber

Socio-economic data, for example in the capital:
KSH's publications
Statistical Yearbook, Demographic Yearbook, Economic Statistics Yearbook, the Regional Statistical Yearbook, etc..
Hungarian Statistical Pocket Book, Hungary, etc, other collections, analytical text books.
Budapest sources
priority records
building management, parcel register
Property records
central utility records
Utilities department data
Metropolitan Public Shoulder maintenance.
Electrical Works
Capital Gasworks
Capital District heating plants
Capital Spa manager
Capital Sewage Works
Budapest Telephone Board
Capital Horticulture shoulder.
Budapest Transport Company

Other data sources
discipline-specific utility data
property cadastre municipal (city, district)
population
monument protection (Budapest Inspectorate of Historic)
archives (Metropolitan archive)
Building database
geotechnical data
structural data (design institutes)
town planning (design offices)
street list
Address
road network data
environmental condition (Inspectorate)
data security, etc.

6. Environmental sources about Europe

Written by: Istvan Gyulai, PhD, Széchenyi István University, Győr

The European Union has a number of data sources, one sources of data have the member states, on the other hand summarized statistics data needed to run the union. Databases, mainly related to environmental protection are important to us. These are summarized below:
- Inspire - the EU's spatial information infrastructure ", scheduled begin in 2010
- EPER - The European Pollutant Emission Register
- SEIS, Shared Environmental Information System, according to a statement issued in 2008.

6.1. Spatial Data Infrastructure

INSPIRE, Infrastructure for Spatial Information in the European Community
Source: Inspire, funds, examples, test scores, editor: Matthaus Schilcher, 2009, 2010

In 2004, the motion is accepted, then in 2007 the European Environment Agency (EEA) started supporting the implementation of INSPIRE releasing the 2007/2/EC European Parliament and Council Directive of the spatial information infrastructure.
The agreement is, first, that "Member States shall make generally available free those services which provide searching and viewing spatial data sets " on the other hand, "the Member States' have the right to the restrictions on access to information, also the public access to the environmental information in accordance the Arhus Convention. " The agreed text provides, inter alia, that INSPIRE does not affect the existence or state authorities concerning the ownership of intellectual property.
The proposal included the environment state in particular with regard to those environmental information (including air, land and natural landscape data) are necessary for checking.
"The central objective of INSPIRE is more and better spatial data available to Member States at all levels of the Community policy-making and policy implementation. The INSPIRE focuses on environmental policy, but can be used and will be extended to other sectors such as agriculture, transport and energy sectors. "
This is expected to become more understanding the floods, problems caused by air and water pollution which do not respect administrative borders.
INSPIRE was launched with the aim to collect and develop the member state's regional geospatial standards of data (such as satellite images, temperature and rainfall) in order to plan EU measures on the environment, transport, energy and agriculture.
Chapter 26 of the INSPIRE directive sets the spatial frame of the EU. The description of spatial data includes 34 groups with following services:
- Search in metadata base (where and how data can be found?)
- Data visualization (navigation, zooming, etc.)
- Downloads (where you can download, or straight connection)
- Transformations (data model or coordinate transformation, image transformation, ortho rectification)
- Support service.

The cross-border services are made available through the geoportal.

Figure 6.1. EU Inspire geoportal, main menu

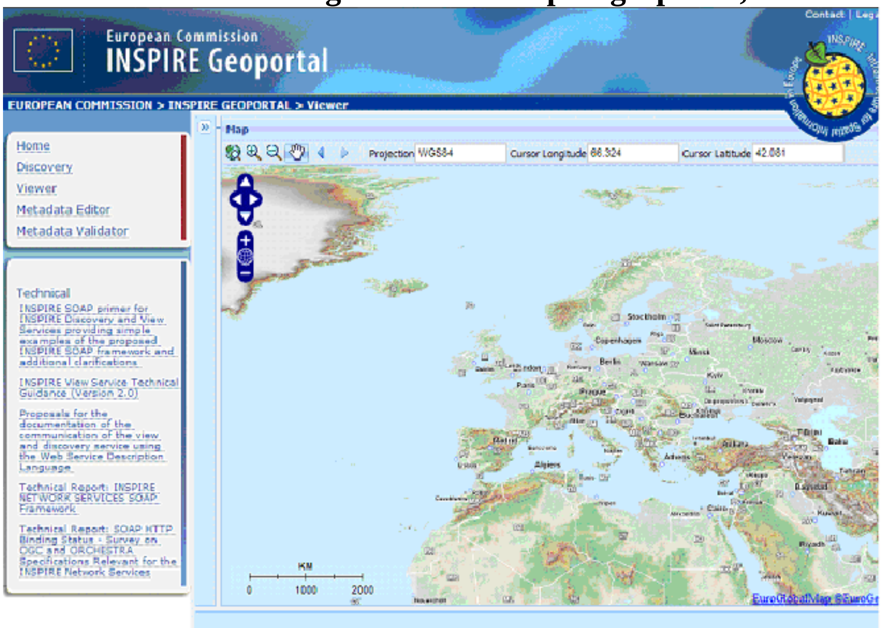


Figure 6.2. Inspire geoportál EU, Europe Map

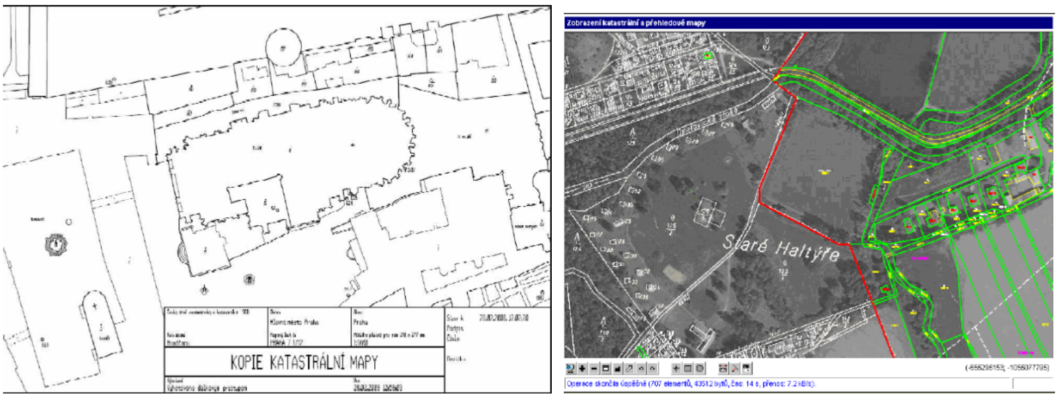


Figure 6.3. geoportal Czech Republic, cadastral map and Photo Map
Source: Role and Opportunities of the Czech Office for Surveying, Mapping and Cadastre at the implementation of the INSPIRE Directives, Vit Suchanek Valdov, Ivana, 2008

The spatial data infrastructure has the following components:
• spatial data and related metadata
• technical support, including services, portals, user interface, security, access control
• standards: enabling the uniform use
• a range of stakeholders, including service providers and users, controllers
• legal and institutional background, coordination and monitoring.

A metadata directive was published in 2008: 1205/2008/EK regulation. The regulation defines the concepts of metadata elements (identification, them groups, keyword, location, creation date, time validity, spatial resolution, quality, legal compliance, access and use restriction, organization responsible for data)
The theme groups are as follows (according to EN ISO 19115 standard):
• farming: livestock and / or crop
• biota: the natural flora and fauna
• administrative boundaries
• climate, meteorology, atmospheric
• business: activities, employment
• topography, altitude
• geology
• health: services, human ecology, security
• basic maps
• military bases
• geographical location, location
• ground water, water features, drainage
• oceans
• cadastre: a register of land and future functions
• man-made construction
• society and culture in the area
• transportation, utilities, telecommunications.

Global Monitoring for Environment and Security (GMES)
Source: Inspire, funds, examples, test scores, editor: Matthaus Schilcher, 2009., Inspire-GMES, fundamentalss, status,selected projects, Editor: Matthaus Schilcher 2010

This organization was set up by the European Commission and European Space Agency (ESA) in order to ensure environmental and safety-related information access through European collaboration. This goal is based on satellite images and in situ observations. The second flagship is GMES in space technologies next to the Galileo (1999, civil navigation program). The GMES objectives for 2014 year: to product a new geo information, 1:50 000 scale land cover / land use map, 1:10 000 scale city atlases in 38 European countries.

Some differences, which are characterized by the INSPIRE and GMES.
INSPIRE: the legal framework for data sharing, operational (network) deployment technology, and existing data in the member states, periodically update the specification for standardization, coordinated access services.

GMES: development of geo information, setting up investment in new, innovative technology imports (data collection, modeling of geodynamic processes), new data sources (and cross-border data covering the whole earth), continuous updating, data integration services.

INSPIRE and GMES, the joint platform was used to analyze a Konstanz lake region, such as test area. It was used the Württemberg, Bavaria, Switzerland and the Austrian information systems, for a cross-border regional analysis, which also was in line with the directives of INSPIRE. The joint platform was useful.

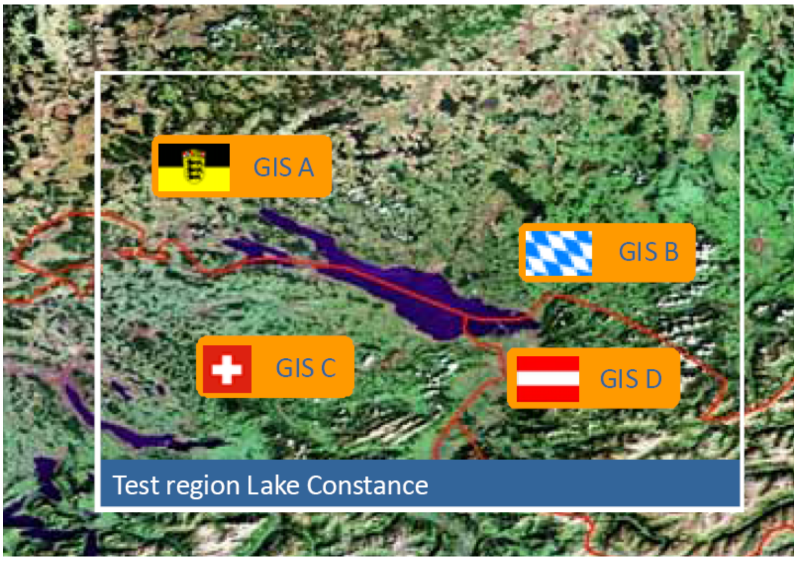


Figure 6.4. Cross-border test site (Bodensee)

6.2. European Pollutant Emission Register, EPER

Source: EPER website, 2009

The European Parliament and Council regulation 166/2006, 91/689/EEC and Council Directive 96/61/EC (the "E-PRTR Regulation) 2006 was adopted about the European Pollutant Release and Transfer Register.

EPER organization all over Europe gathers records and publishes the industrial polluters. The database contains 2001 and 2004 year data. The last mentioned data shows about 12,000 plant's (factory) emission data in 25 EU member countries. The air, water and land discharges can be viewed online. The following emission materials are collected:

Trichloroethylene (TCE), dichloromethane (DCE), ammonia (NH3), and arsenic compounds, benzene, toluene, ethyl benzene, xylenes, bromine biphenyl ethers, cyanides, total CN, and zinc compounds, dichloromethane (DCM), nitrous oxide (N2O), dioxins and furans, phenols, fluorides, hydro fluorocarbons (HFCs), total phosphorus, halogenated organic compounds, hexachlorobenzene (HCB), hexachlorobutadiene (HCBD) Hexachlorocyclohexane (HCH), hydrogen cyanide (HCN), and mercury compounds, cadmium and its compounds, sulfur hexafluoride (SF8), sulfur oxides (SOx), and inorganic chlorine compounds, chlorinated alkenes, chlorides, chromium and its compounds, methane, CH4, non-methane volatile organic compounds, nickel and its compounds, total nitrogen, lead and its compounds, total organic carbon (TOC), flour-carbons (PFCs), PM 10 (particles smaller than 10 micrometers), polycyclic aromatic hydrocarbons, copper and its compounds , carbon dioxide, CO2, CO carbon monoxide, organic compounds, ethylene-tetrachloroethane (PER), tetrachlorodibenzo-methane (TCM), trichloroethane, benzene (TCB), trichloro-ethylene (TRI), trichloro-methane (chloroform).

The login page images we see in the following figure. You can choose one of the countries; you can specify the language of the text read. You can choose from the water and the air emissions, or both.

Click map to query the data and place name. One example we search mode: Sets the country, then a list of which of the selected company, find out the details.

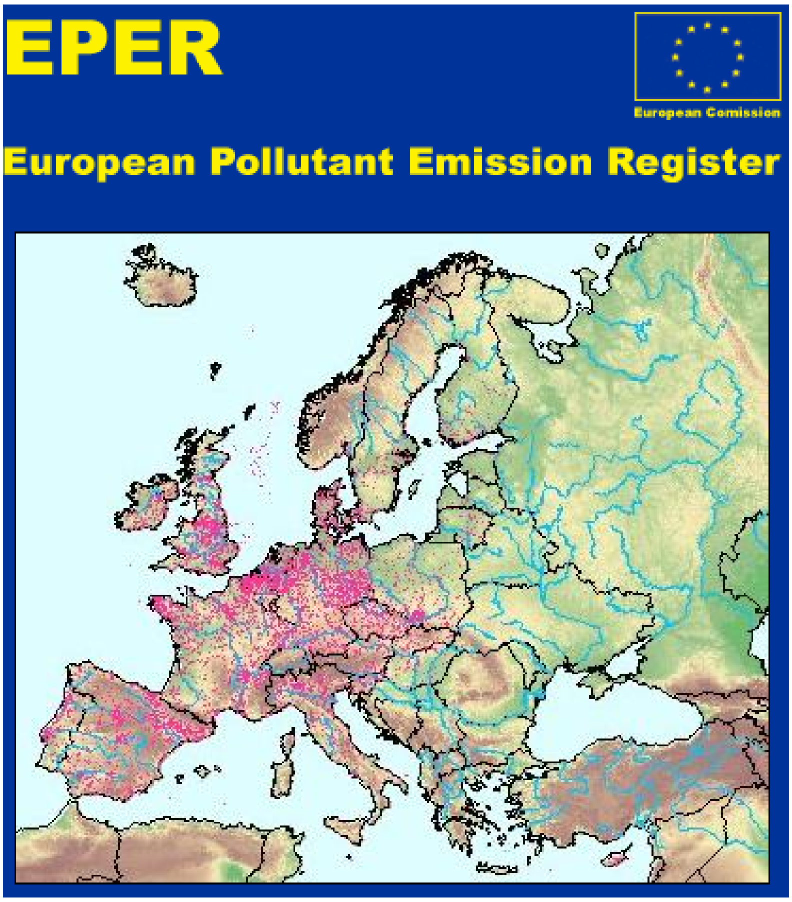


Figure 6.5. The first page of the EPER website

#	Facility	Postcode	Address	Town/village
1	AES Borsodi Energetikai Kft. Borsodi Hoeromu	HU-3700	Berente	Kazincbarcika
2	AES Borsodi Energetikai Kft. Tiszaújváros	HU-3580	Jedlik Ányos út	Tiszaújváros
3	AES Tisza Eromu Kft.	HU-3580	Verebély u. 2	Tiszaújváros
4	Agro-Chemie Növényvédoszer Gyártó Értékesíto és Forgalmazó Kft.	HU-1125	Bányalég u. 22	Budapest
5	Agroferm Lizin Zrt.	HU-4163	Nádudvari útfél	Kaba
6	Ajka Kristály Kft. Alkotmány utcai telep	HU-8400	Alkotmány u. 4	Ajka
7	ALPHARMA Gyógyszerészeti Kft.	HU-1107	Szállás u. 1-3	Budapest
8	Bakonyi Eromu Rt. Ajkai Hoeromu	HU-8400	Gyártelep	Ajka
9	BERT Kispesti Eromu	HU-1183	Nefelejcs u. 2	Budapest
10	Bige Holding Kereskedelmi és Termelo Kft.	HU-5000	Tószegi út 51	Szolnok
11	BorsodChem Rt.	HU-3700	Bólyai tér 1-2	Kazincbarcika
12	Brau Union Hungaria Sörgyárak Rt.	HU-9400	Vándor S. u. 1	Sopron
13	Budapesti Vegyimuvek Zrt.	HU-1097	Illatos út 19-23	Budapest
14	Bunge Zrt. Martfui Gyára	HU-5435	Szolnoki út 201	Martfu
15	Chinoin Rt.	HU-1045	Tó u. 1-5	Budapest
16	Columbian Tiszai Koromgyártó Kft.	HU-3580	TVK Ipartelep	Tiszaújváros
17	Csepeli Áramtermelo Kft. Csepel II. KCGT Eromu	HU-1211	Gyepsor u. 1	Budapest
18	Debreceni Kombinált Ciklusú Eromu Kft.	HU-4030	Mikepércsi út 1	Debrecen
19	DEKO-FOOD Konzerv és Hutoipari Zrt.	HU-4030	Monostorpályi út 92	Debrecen
20	Dél-Magyarországi Húsipari Zrt.	HU-7622	Siklósi út 3	Pécs
21	Dorogi Eromu Kft.	HU-2510	Esztergomi út 17	Dorog
22	Dreher Sörgyárak Zrt.	HU-1106	Jászberényi út 7-11	Budapest
23	Duna-Dráva Cement Kft. Beremendi Gyára	HU-7827	Hrsz 064/2	Beremend
24	Dunaferr Acélszerkezeti Kft. Tüzihorganyzó üzem	HU-2400	Vasmu tér 1-3	Dunaújváros
25	Dunaferr DBK Kokszoló Kft.	HU-2400	Vasmu tér 1-3	Dunaújváros
26	DUNAFERR Dunai Vasmu Zrt.	HU-2400	Vasmu tér 1-3	Dunaújváros
27	Dunamenti Eromu Rt.	HU-2440	Eromu u. 2	Százhalombatta
28	Dunapack Papír és Csomagolóanyag Rt.	HU-2400	Papírgyári út 42-46	Dunaújváros
29	Dunapack Rt.Csomagolópapírgyár	HU-1215	Duna u. 42	Budapest
30	E.ON Energiatermelo Kft.	HU-4400	Bethlen Gábor u. 92	Nyíregyháza
31	Eastern Sugar Cukoripari Zrt.	HU-4183	Meteorit út 5	Kaba
32	EGIS Gyógyszergyár Rt.	HU-1106	Keresztúri út 30-38	Budapest

Figure 6.6. 2004. Annual water and air emissions, EPER, Hungary, companies, detail

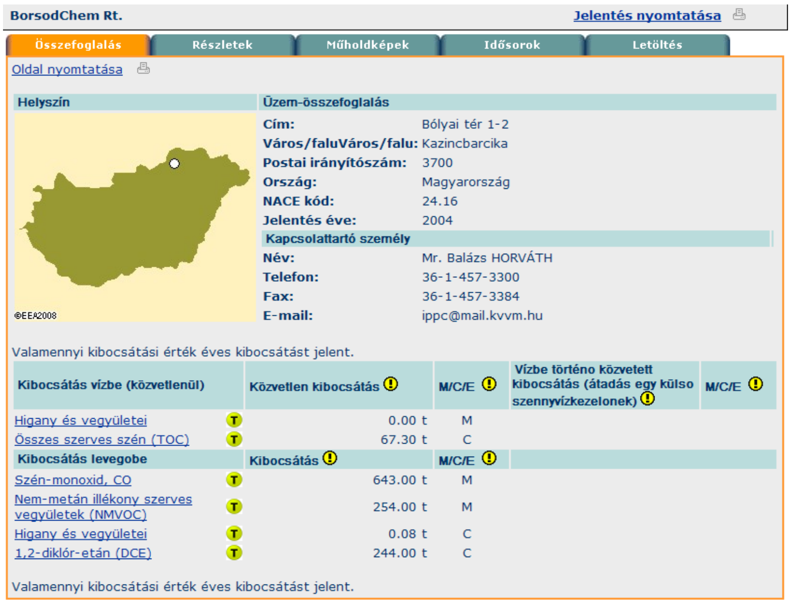


Chart 6.1. of the randomly selected BorsodChem details of the EPER database

The data will be set to the database so that the registrant companies have to notify to local authorities information, then the state shall provide a list to the European Commission. With the help of the European Environment Agency (EEA) will be posted on a public website.
The resulting collection activities are grouped in nine industries:
1. energy;
2. Production and processing of metals;
3. Mineral;
4. Chemical Industry;
5. waste and wastewater management;
6. paper and wood production and processing;
7. Intensive livestock production and aquaculture;
8. animal and plant products in the food and beverage,
9. other activities.

6.3. Shared Environmental Information System (SEIS)

Source: SEIS website, 2010

Figure 6.7. SEIS website

Fires, floods and droughts experiences show how different is the speed of environmental information during an emergency.
We are tackling today's environmental challenges, such as adaptation to climate change, ecosystems and the sustainable management of natural resources, biodiversity protection, prevention and management of environmental crises, such as floods, forest fires and water shortages. The effectiveness of this depends on how we can evaluate the data collected from different sectors and sources. It is therefore vital for the EU to have an information system which provides the latest information and communication technology used (ICT), for decision-makers at all levels (local to European), provides real-time environmental data, enabling them to take immediate and life-saving decisions.
As Stavros Dimas (commissar of Environment) states in the the SEIS release issued in January 2008 states: "Policy makers need to have timely, relevant and reliable information about the environment, to respond to the challenges of our time. But this is not enough. The citizens are also entitled to know how well the air and water quality of the environment, as well as whether floods, droughts and pollution risk their property and livelihood? This is why we need to further improve on our environment data collection, analysis and communication.

The challenge is now emerging is that of ICT in improving the cooperation between relevant organizations and civil society to create widespread communication. The European public organizations and the general public without a closer cooperation between the growth and security, jobs and freedom or health and good environment is much more difficult will be available.

The Shared Environmental Information System (SEIS) for the European Commission and the European Environment Agency (EEA) is initiative in order to build up by the Member States an integrated environmental information system. This system will replace all the existing data collection and flow of information relating to EU environmental policies and legislation. This will be the basis of technologies such as internet and satellite systems, and therefore the environmental information more readily available and will be easier to understand both the policy makers and the public.

The secondary purpose of the SEIS is to move from the paper-based report toward a system in which the management of information is as close as possible to the source and users can access openly and transparently. According to the SEIS concept the environment-related data throughout the European Union will be stored in electronic databases. These databases are interconnected virtually and compatible. The proposed SEIS will be a decentralized but integrated, web-enabled information system for environmental data.

7. Environmental sources of the world

Written by: Istvan Gyulai, PhD, Széchenyi István University, Győr

7.1. GEMS

Source: GEMS Global Environment Monitoring System, United Nations Environment Programme, 1990

In 1971, an international scientific committee has raised the idea that should be created covering the entire Earth environmental monitoring.
A year later, in 1972, held in Stockholm the UN Conference on Human Environment. It was one of the milestones of environment protection. The result of the conference was the UN Environment Programme (UNEP). The basis of control is Nairobi (Kenya) where the program is managed by the council as the main body. To the council delegate Europe, Asia, Africa, America, a total of 58 states.
At the Stockholm conference was proposed the creation of GEMS (Global Environment Monitoring System) covering the entire Earth, which in 1975, a small secretariat was established and started functioning.

GEMS: the concept
GEMS is a world—wide collective effort to monitor the global environment, and make periodic assessment of the health of its constituents. Data are collected through monitoring and assessment activities covering most of the important environmental parameters; all told, 142 countries participate in at least one of these activities. The systems involves the collaboration of hundreds of national and international organizations, of which the most important are the Food and Agriculture Organizations of the United Nations (FAO), the world Health Organization (WHO) the World Meteorological Organization (WMO), the United Nations Educational, Scientific and Cultural Organization (Unesco) and the International Union for the Conservation of Nature and Natural Resources (IUCN), the United Nations Environment Programme (UNEP).

GEMS networks monitor changes in atmospheric composition and the climate system, freshwater and coastal pollution, air pollution, food contamination, deforestation, ozone layer depletion, the build-up of the greenhouse gases, acid rain, the extent of global ice cover, and many issues related to biological diversity.
For convenience, this publication divides GEMS' work into five areas: atmosphere and climate, environmental pollutants, the Earths' natural resources, environmental data and GRID. These divisions help focus on GEMS' major goals but the divisions are somewhat artificial; in practice, there is considerable overlap between them.
The collection of data is not an end in itself, and GEMS is charged not only with monitoring the environment but also with making periodic assessment of its health on the basis on the data collected. These assessments, in their turn, can lead to improved environmental management-the better stewardship of the Earth' that is the object of all informed environmental action. Improved management is not part of GEMS' direct brief-but improved monitoring and assessment are. The GEMS assessments made so far have played important roles in stimulating international environmental action. For example, the monitoring of ozone levels in the atmosphere was one of the activities that led to the Vienna Convention for the protection of the Ozone Layer in 1985, and the FAO/UNEP assessment of tropical forests in the early 1980s helped pave the way for the tropical Forestry Action Plan a few years later.

The purpose of GEMS:
- Increased environmental impacts, scientific fastidiousness in order to achieve a suitable environment and proper resource management.
- The data collected and analyzed at the appropriate time to raise awareness of the environmental changes.

The method of GEMS:
- Monitoring the development activity
- To improve the quality and comparability of data collected
- Improve and expand the existing network.

The data collected are grouped into
a) Atmosphere and climate
b) environmental contaminants
c) ground-based renewable resources
d) environmental data.

a) Atmosphere and Climate

Before the establishment of GEMS there were already environmental data collected, especially in economically developed countries, but the result of mutual cooperation can be booked on a global phenomena - such as ozone layer, greenhouse effect of carbon dioxide, global warming - to be recognized.
The first monitoring system, which is supported by the GEMS is established, the background air pollution monitoring network (BAPMoN). More than 150 are deployed in a local air monitoring stations, which are expected to have no direct pollution, thus putting them in the air of contaminated areas.

Another program implemented in the long-haul air transport better understanding of the effects of installation of monitoring stations. Initially Western and Eastern Europe, then Canada and the United States also joined the monitoring stations. The burning of aircraft fuel is a result of a significant effect of nitrogen and sulfur-containing acid rain falls to the ground.
Another central area of the stratospheric ozone layer is thinning and climate change. In the eighties, significant measures are being taken to the reduction of air entering industrial chemicals, chlorine or fluorine-containing hydrocarbon. Scientists and politicians have joined the call for attention, what actions have been committed: they came to the Vienna Conventions, in which 20 countries signed a convention on ozone layer protection in 1985. Then in 1987 come after the signature of the International Convention for the reduction of CFC gases.
The climate change program is coordinated by WMO. One of UNEP's role is to monitor the social impact of climate change on human-caused greenhouse gases in the air access rates.
In the history of GEMS was a milestone the conference in Villach (Austria, 1985) which is organized by UNEP and the WMO. The conference brought about a turn-based approach to climate change. Building on scientific data and analysis drew attention to the fact that rapid changes to be expected and must find a way to avoid the downside. One way of it is decreasing amounts of fossil fuels and more efficient use of them. To do this, international agreements and action programs are necessary.
The climate change indicator is one of the high mountains and snow and ice in the Polar Regions and population decline. The first report on this in 1985 was based on data from the GEMS. 750 stations in 21 countries established to monitor constantly icy and snowy areas. These areas since 1895 have been operating in the International Snow and Ice Committee.

Ozone (O_3)

The ground-level ozone, a pollutant in our immediate environment should not be as a strong oxidizer, inhaled into the respiratory system it causes damage.
A very different role has the stratospheric ozone. 20-50 kilometers above us located in ozone layer absorbs ultraviolet from the sun (ultra violet, ultraviolet, UV) radiation and forms positively the ground temperature. Ultraviolet radiation damages organisms. The radiation we cannot see, but we feel on our skin, which may cause more pigment selection, high levels of radiation is not recommended to stay in the sun because our skin blistering and it causes damage to eyes. Shorter or longer period of time can cause blindness.
UV radiation may do setback to the development of plants, a poorly developed crops produce lower yields. The negative impact may take on marine life from UV radiation, including the edible fish. The algae-eating fish are threatened, because the algae are very sensitive to radiation and die when it exposes high levels of radiation.
GEMS has significant role in the ozone and other gases making up air monitoring, studying the interaction of them. It was observed a 50% reduction, which has been falling off during just 15 years to such an extent, presumably as a consequence of human activity.
The refrigerators and other electronic products used in the manufacture of chlorine or fluorine hydrocarbons, in particular, may blame for sick ozone layer. These materials arise into the ozone layer, separate the third oxygen atom, thus increasing the number of molecules of oxygen instead of ozone. The Vienna Convention and the Montreal protocol to which joins a growing number of countries prohibit the use of CFC gases and restore the previous state, but the toxic gas migrate upwards slowly, so the process is long, the additional observations are needed.
The climate change
At the Vienna conference took place estimates for the global average temperature increase. Then 1.5 to 4.5 ° C increase predicted by 2030. UNEP has already been issued reports in the mid-seventies, for climate change. In 1978 an international conference was held on the topic. Since 1978 the meeting, started the World Climate Programme (WCP). This program has 4 components:
-Climate-monitoring
-The climate-utilization data collected for the society
-Climate systems research
-Climate variability and long-term assessment of changes and its impact on society.

Monitor of the changes and research of causes it means for GEMS additional tasks, e.g. at 11 selected corn-growing areas and investigation of vulnerability on the environment - in the light of global changes. Another investigation was the relationship between the occurring drought and changes in Africa.
The accumulation of carbon dioxide in the atmosphere increases the greenhouse effect and global warming. The heating leads to expansion of the oceans. This increase is estimated at 50 cm expected by 21 mid-century. In the past 100 years the increase was only 12 cm. Due the rise in water level 50 million people have to be relocated because they could not save her home due to rising water. Particularly the developing countries are threatened by danger because most of people live there the beaches close. In 1987 the Dutch government agreed with GEMS in intensive study of sea level rise. Two years after the report was prepared in which the vulnerable countries were mentioned: Bangladesh, Egypt, Gambia, Indonesia, Maldives, Mozambique, Pakistan, Senegal, Thailand and Suriname.
In the late nineties a number of international were organized conferences on the atmospheric changes. The GEMS helped Asia and America to assess the potential impact of climate change and to form the development policy in the future.

In 1988 a body established by UNEP and WMO began its activity: Intergovernmental Panel on Climate Change (IPCC). The panel prepared a program and it has been disclosed. The program is a response to changes in the policy making environment in the next century until an acceptable level does not decrease the rate of greenhouse warming. It is sad liable to the warming the anthropogenic (a consequence of human activity) carbon dioxide emissions. This is touched most advanced industrial countries (the United States, China, Japan, Russia, Western European countries). The action started and CO_2 emission quotas were determined for the individual states. Those states purchase quotas which has more emission then others. There are debates about the correctness of this practice.

b) Environmental pollutants

The GEMS's major aim is the monitoring of environmental polluters. The chemical pollution of air, water and food pose a constant threat to human health. Sometimes they are in the form of difficult to determine effects of several decades sometimes in dramatic suddenness. For example, in the sixties and early seventies, the chemical pollution of the sea in Minamata Bay (Japan) led to human mercury poisoning in 798 cases as a consequence of consuming those fish which had in their body. Further 2,800 suspected cases there were observed disease caused probably by poisoning. . The polluting firm was punished for 80 million dollars.

The illness and death in other cases monitoring has proceeded.

This rate of water and food contamination fortunately is rare, but many countries see the importance of air, water and food contamination monitoring.

The monitoring is assisted by 3 participants: the FAO (UN Food and Agriculture Organization) WHO (World Health Organization) and the GEMS Monitoring and Impact Assessment Research Centre (MARC). The latter is based in London. In 1988 they declared the major targets: the urban air pollution assessment and natural waters and food. In developing countries also was offered assistance and training in these areas. In the contamination monitoring more than 70 countries is taking part European, American, and Asian and African countries.

In the first 15 years of monitoring measurements and evaluations were reported positive changes, for example in Europe there has been a reduction of sulfur dioxide pollution. In developing countries was reduced lead content in metal boxes of canned food.
Initial successes were encouraging, but new problems have arisen for monitoring, for example the origin of chemical or microbiological pollution, In the eighties and nineties, using the results of food tests were extended not only to finished products, but also extended to the feedstocks. Not only GEMS collection of data, but other sources were also involved in the analysis. It was tried to improve and expand the monitoring and in the same time to achieve the compatibility of data and introduce computer model.

The state of urban air

Representative of 35 cities were tested from air pollution point of view. The towns are situated in different climatic belts. Industrial, commercial and residential quarters have given collected data. Due the measurements and other reports a summary of the data a total of 50 countries in urban areas has been prepared. Five impurities were analyzed, which proved injurious to health: sulfur dioxide, particulate matter, nitrogen dioxide, carbon monoxide, lead.

A 1988th annual summary states:
- 30% of the cities examined in the sulfur dioxide pollution has exceeded the WHO (short period) limit,
- 55% exceeded the CO limit
- 30% of lead that exceeded or was close to the border,
- 20% - were inacceptable conditions.

Most of the pollution due to fuel combustion derived either industrial or transportation source. Because of the large-scale industry of is 200 years old and has previously been observed and its effects were observed. In industrialized countries sulfur dioxide, lead and particulate matter reduction was achieved. Technological change and cleaner production could reduce these contaminants, and it was found that nitrogen oxide and carbon monoxide pollution is caused more by traffic. In developing countries is yet not so dense monitoring network, as in the developed ones, but concluded that the five components are growing due urbanization and industrialization. The uncontrolled spread and the city's industrial growth make a permanent urban air pollution problem. The most populated cities in developing countries will the urban population increase then every second resident in the country will live in cities.

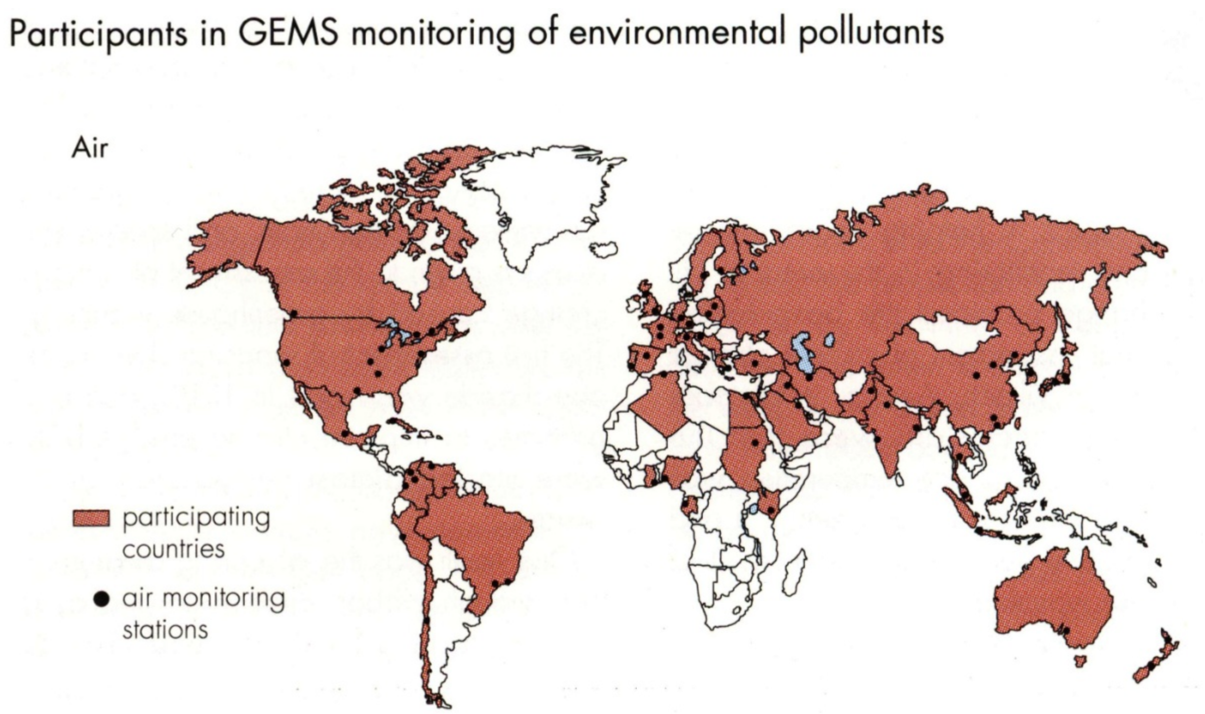


Figure 7.1. The air monitoring of the participating countries
Source: GEMS Global Environment Monitoring System, United Nations Environment Programme, 1990

The water status

1977-1988 period were studied the waters of station 344, of which 240 stations were on rivers, 43 lakes, 61 groundwater. There were different types of rivers, lakes and more ground water wells in order to determine the background pollution.

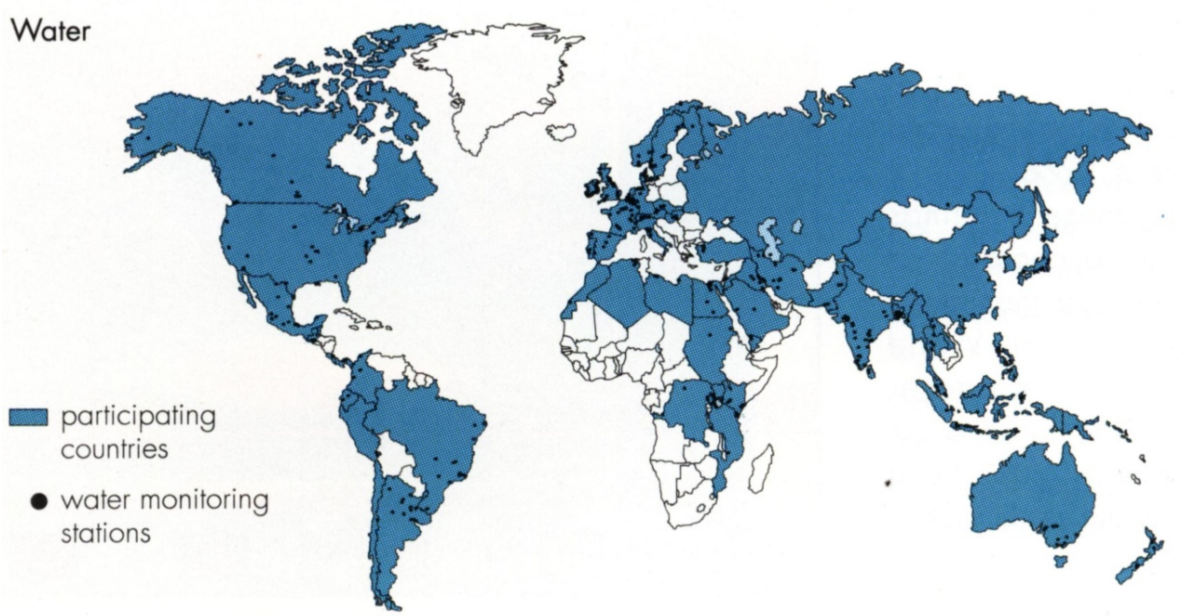


Figure 7.2. of the countries participating in water monitoring
Source: GEMS Global Environment Monitoring System, United Nations Environment Programme, 1990

The water quality study was extended not only for human health, such as aspect, but in general the water purity, methods of use of agricultural, industrial and commercial purposes, and the existence of aquatic life. More than 50 parameters were analyzed: e.g. micro-nutrient content dissolved salts, suspended solids, organic and inorganic micro-pollutants, pH, and nitrate value. At the program evaluation revealed, which occurred among those pollutants that are harmful to human health: sewage, nutrients, toxic metals and chemicals from industry, agriculture. In developing countries, they present serious health risks, until not to treat the contaminated waters.

Relative the world's biggest problem is waste water organic matter content leaving the household. Many European rivers have high pathogenic (disease) material, due to the fecal load. Coli are characterized by a high number of monitoring stations in the two-thirds of developing countries. In these countries water pollution is a serious health problem and causes infant mortality. The increasing urbanization and population increases the bud. One example: the number of Jamun River coli 7500 pc / ml in New Delhi before leaving the city and 24 million pc/ ml. A city without a sewage system and the growth of concentrated waste water allowed to live water causes many health problems.
The largest sources of water pollutants are water blending chemicals from the household wastewater and also the runoff from agricultural areas. Most of these threat the drinking water. They raise most the nutrient content of the water. European rivers have 2, 5 times more phosphorus-contain comparing with unpolluted background rivers, in case of nutrients for nitrate 7 times more.

The nutrient accumulation is occurring in other places problems, for example. In China, 25% of the lakes are eutrophicated.
The GEMS program is tested 20 components. The data are comparing to the WHO limits. In developed countries the incidence of mercury and lead are in high concentrations in the rivers near industrial and mining areas. The conventional water treatment is sufficient to protect the

drinking water in these areas. In Asia and South America lead and cadmium content was high in the quarter of investigated rivers, in other areas the chemicals were found above safe levels. The food safety

Monitoring with participation of 13 countries for food began in 1976, and the number of countries in 1989 was already 40. The focus here is on endangering sources or directly on ready meals and canned meals. Usually are tested 18 components: chemicals, metals such as lead and cadmium, which are outputs from the industrial areas into food, than in agriculture used pesticides, such as accumulating chemical residues. The conclusions of the examination derived from 1200 samples which were in food offered for both adults and children.
The comparison of samples was based on the FAO and WHO limits. The limits are two kinds: one is the acceptable standard specified the maximum contamination, the other is the tolerable rate of long-term: daily or weekly intake level.
The limits apply are only recommendations for countries because each country has to decide to impose more stringent regulations might lead to more lenient in their field. If pollution of hazardous substances is increasing due the monitoring, it will be the responsibility for the state and the food manufacturer's.

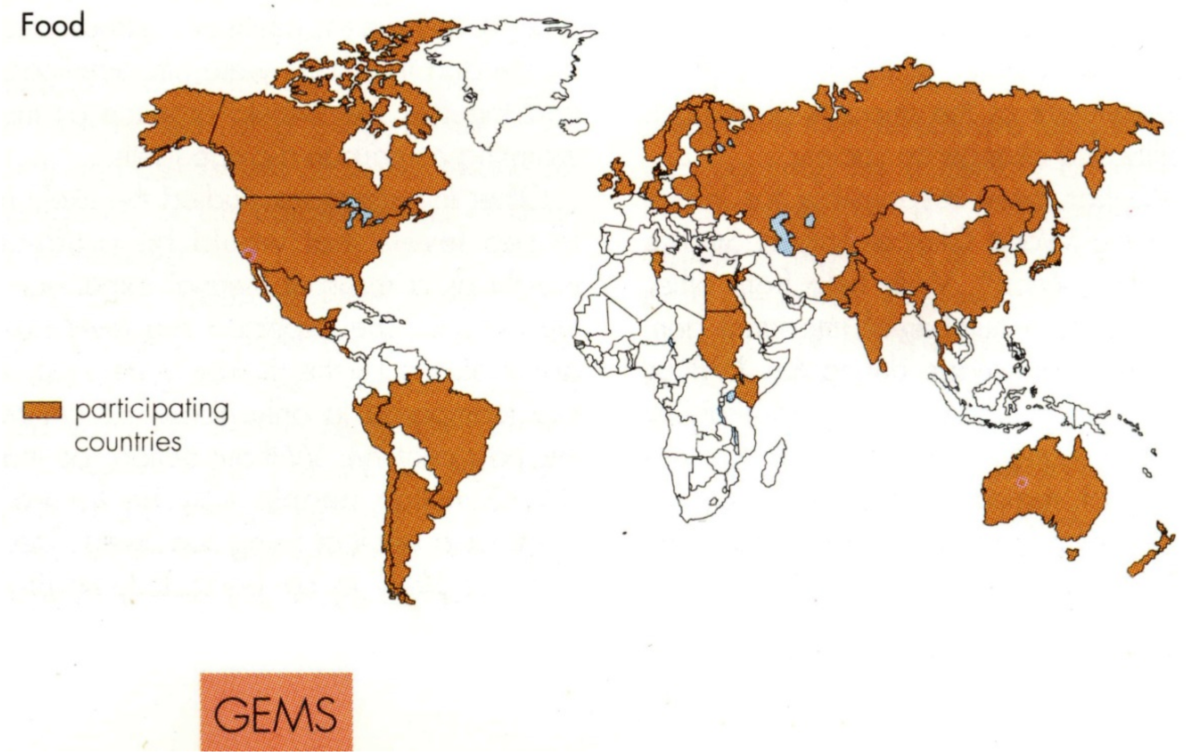


Figure 7.3. The monitoring of food
Source: GEMS Global Environment Monitoring System, United Nations Environment Programme, 1990

Between 1971-85 the result of monitoring was that developed countries no longer poses a health threat to the levels of pollution, because all decreased compared to the original. Example: the lead content fell to fifth, tenth, after pl. canned food abandoned the rigid boxes such as soldering shutter in the United States. On the other hand negative contaminants were detected in agricultural products which are derived near industrial estate or busy road. It was not a good situation in developing countries, either, because the chemicals used in agriculture and uncontrolled areas. In this cases incurred the need for an extension of monitoring.

Although the advanced industrial countries due the GEMS measures food contamination reduced, it does not mean that everything has been resolved. When admitted the study of microorganisms, they become one of the main pollutants. The incidence of salmonella and listeria drew attention also to the problem of changing world. For this reason, more attention should be paid to microbiological contamination, such as health-threatening factors.
The GEMS by monitor pollutants: polychlorinated biphenyls (PCBs), lead, cadmium, mercury, aflatoxins, pesticides: aldrin and dieldrin, hexachlorobenzene, lindane, endosulfan, endrin, diazinon, heptachlor, heptachlor epoxide, fenitrothion, Malathion, parathion, parathion-Metylan.

Nuclear radiation
Individual states are responsible for the continuous monitoring of radiation. The 1986 Chernobyl disaster it was decided not only to build a radiation monitoring, but also the exchange of data between countries. The WHO and the UNEP advocates GEMS network, which in case of danger the data routinely will be supplied to the interested countries, it would be a GERMON (global environmental radiation monitoring). A GERMON would monitor radioactivity in air, in precipitation, in milk and other materials. The frequency of monitoring is every day in our immediate surroundings in the air, weekly in the higher air (1000 meters high) and quarterly in rain, snow and milk. The crossing institutions would publish the results.
If the monitoring observes abnormally high values, GERMON network immediately transmits the information to the stakeholders. The actions are task of state bodies, GERMAN supplies only the data. Of course, some states may extend the own monitor use, and can connect to the GERMAN it.

c) Ground-renewable resources

Sustainable development as a world-wide environmental strategy rests on two pillars, as the Brundtland Commission report (Our Common Future, 1987) shows. One is that in order to economic growth we cannot unilaterally consume the natural resources, because the growth will last as long as the resources. The second pillar is that the growth should be planned on renewable resources.

Tropical rain forests
The greatest threats to tropical jungles means change farming and the economic interest of farming. At traditional farming the land was used for 2-3 years, and then was left to regenerate for 20 years. More and more land was enrolled in a managed way, exterminating the forest. The commercial interest was sold the timber. Hardwood sale ensured solid many source. The extent of the cut forests were only estimates before the initiation of GEMS, some of it overstated, and the other was estimated to be insignificant.
In 1982 a report used real data supplied by the GEMS. Although the loss is significant, but not so great that now we can do nothing against it. In the past 20 years fallow period can shorten to 10 or up to 5 years, and the fertility can restore. A lot of missed forest was utilized for fuel and industrial purposes. The largest deforestation sites were: Cote d'Ivoire in Africa, Asia, Thailand, America, and Venezuela. After the report the same processes began over the Amazon, Central Africa, and South-East Asia. For all these observations GEMS takes into account and processes satellites data.

Soil degradation

The soil loss is similar to cutting down forests. Erosion and deflation, particularly in the dry (arid) and semi-arid zones cause loss of productive soil. In the Middle East 60% of the soil suffered erosion-related damage, in North Africa 35% of the total.

Wageningen in the Netherlands, the International Soil Information Centre prepared global soil degradation study (GLASOD) with the help of the FAO. 1: 10 million scale map indicates the locations of soil degradation. The data in digital form were red into GRID (Global Resource Information Database). The GIS implementation of the GEMS is GRID.

The oceans

70% of Earth is ocean surface. It has large role in the evolution of weather and climate. In addition, it is the habitat of saltwater plants and animals. Coastal areas are densely populated, particularly in Asia. These areas ensure the livelihood of many people.

A lot of monitoring was born for analysis of marine life, e.g. the regional program of the offshore sea conditions survey, the Mediterranean Action Programme, marine mammal program, ocean pollution assessment project.

d) Environmental Data

The data collected by the GEMS has no value without any processing. During processing is determining the credibility of the data, comparing with other data series, and the analysis of trends, changes and monitoring the impact of interventions.

Individual states supply the raw data or processed data. The processing in many cases is long and laborious work, but inevitable. For example, where the meteorological data are collected continuously every day of the year, works out a lot of data but still cannot say anything. Data should be broken down into parts, put together so that it can be read out the main trend. The London-based research center GEMS has got a lot of experience in data processing, analysis and impact assessments.

However, the institute did not work with lock of georeferenced data; therefore geographical information cannot be compared. It carries out the GRID.

GRID (Global Resource Information Database)

Source: GRID Global Resource Information Database, United Nations Environment Programme, 1990

In 1985 GEMS celebrated its 10th anniversary, when a Russian U.S cosmonaut and inaugurated the revived form of GEMS: the GRID. The GRID has meant a GIS solution, where the geographic (fixed coordinate system can be specified, georeferenced) data can be manipulated with other data, location and attribute could be linked.

The most important task of GEMS is data collection covering the entire Earth. The data differ because of reliability difference in certain locations, countries, methods used, form of data, measurement accuracy, the frequency and. These data are not comparable; they must be processed, for example digital, tabular form taken to be identified, etc.

In addition, the data also are connected, for example. The erosion of the soil not only depends on the quality but also to land use, the falling rain, wind speed, slopes of the slope, the surface cover. To show this data together and separately needs a reference-linked system.

The coordinate system is based on data related to the earth's surface. In a coordinate system we draw onto different layers the coordinate network, field use, topography, surface vegetation, wind direction and speed, precipitation, etc. These layers can display in the geographic information system known as GIS software. It is suitable for the purpose of the GRID.

The essence of GIS is that the objects of land surface can be ordered descriptive (attribute) data in a table form. GIS software prepares a table for each digital object drawn on the map. The table contains the object ID, the number of layers, thickness, color, etc. We can extend the table, for example: giving a name to object, an indication of branches in farming: arable land, forest, grassland, or grapes. Point features on map may be geodetic control point, pylon, fountain, water separator pins, wood, etc.; line object can be water, sewer, gas lines, etc. Closed polygons (e.g. rectangles) may be house, land parcel, agricultural plot, forest, waste deposition yard, etc. All this tedious work has to be prepared over the entire study area. Then, however, data will be useful for multiple purposes, it may disclose to users.
If you are an analyst (user) and take command "i" (information) and click cursor on the map to a point we shape, then screen brings up the attribute table, which shows that the object basin water separator. If you click a closed shape, we learn that is arable land. This is pointing query, but if you ask by attribute, e.g. where are the land parcel which value is greater than 200 gold crowns? In this case, we select the cultivation layer, retrieve the table, you invoke the GC> 200 (query) command and the software markers asked arable land parcels on the map.
The GIS software is capable of uniting layers / cutting as well. For example, a GRID attempt was to examine the possible habitat of elephants in Africa. GRID prepared the layers, which affect the elephants stay: vegetation, rainfall, presence of tsetse fly, human population density, etc. The layers were laid on each other then queried areas in which these criteria are favorable. In 1989 a report was issued on the experiment. Field trials have shown the presumed habitats except in wooded areas.

GRID story
In 1981 the idea was raised, and then drew up an expert group on standards in 1983. In 1985, the formation of the two centers in Nairobi and Geneva, in January 1989 joined Bangkok, in August 1989 established the GRID - Arendal.
In 1997 creation of GRID-Budapest raised up with the Norwegian assistance - such as Central Europe GRID center ...

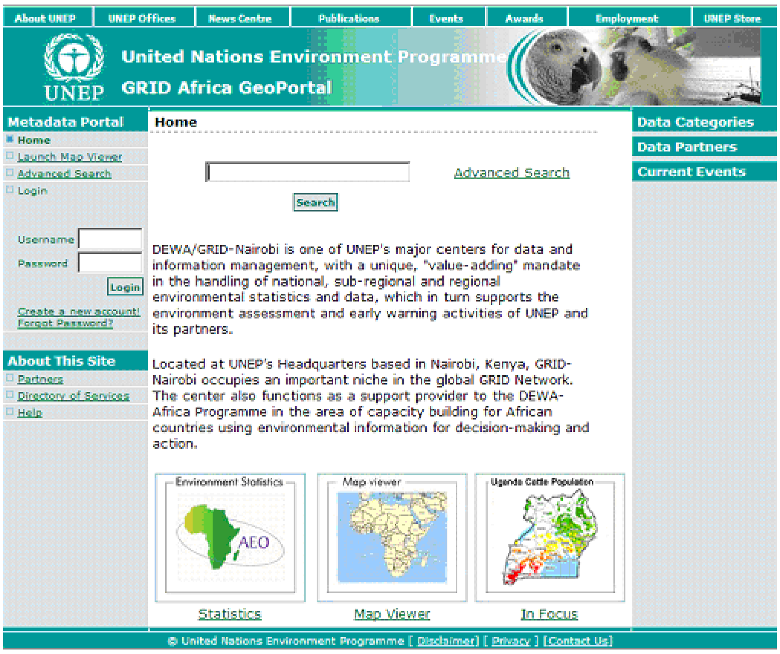


Figure 7.4. a GRID portal Kenya

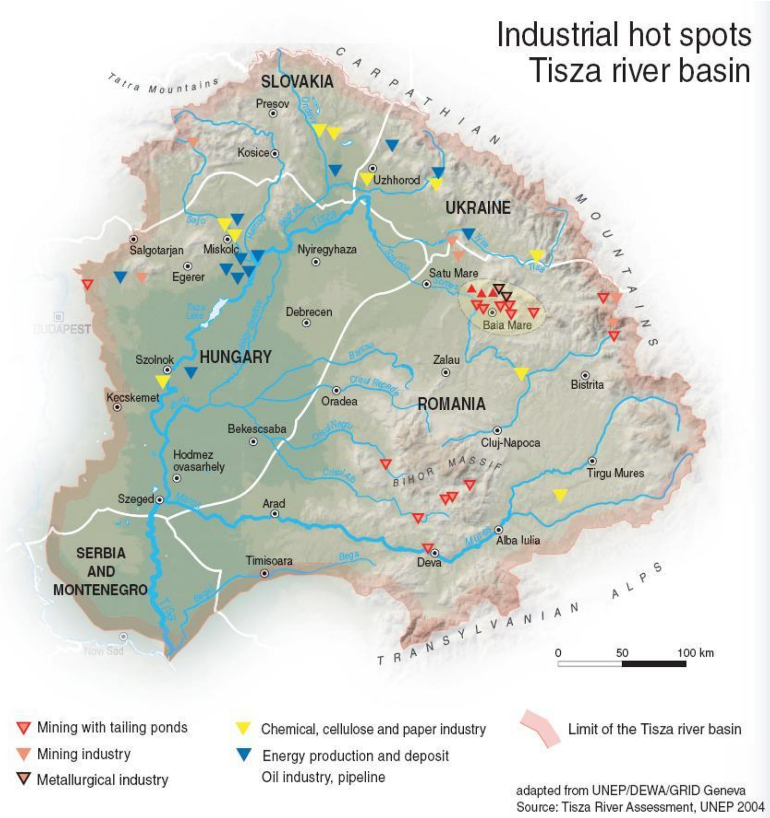


Figure 7.5. a GRID portal Geneva 2004. The Tisza cyanide pollution
Source: UNEP / GRID-Arendal Website

The GRID-Arendal
Source: UNEP / GRID-Arendal Website

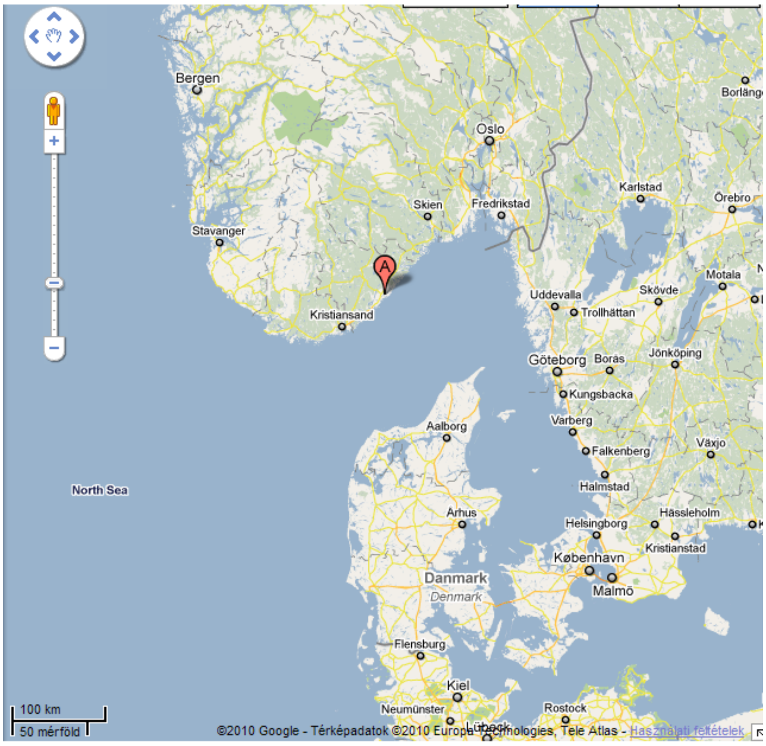
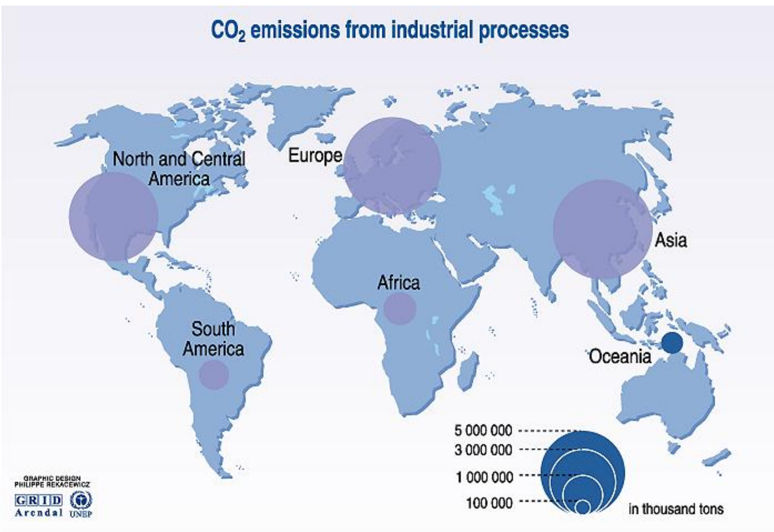


Figure 7.6. GRID-Arendal location on the map ***Source: Google map***

The GRID-Arendal is the 11th official GRID center collaborating United Nations Environment Programme (UNEP). Its residence is in Arendal (southern Norway). In 1989 was it founded by the Norwegian government. It has office still in Ottawa (Canada) and Stockholm (Sweden).
The center has a role to assist decision makers and raising attention of the following topics:
-Environmental information, assessment and treatment
-Capacity building-services
-Contact recording and communication tools, methods and products
As the Arctic Centre of UNEP, GRID-Arendal participates in related arctic programs, but extends its investigations to other parts of the world's oceans, sustainable development of waterfronts.
Its staff is international professionals in various occupations. Formulating their mission is to positively change that is while to compile a matter of knowledge on environment. This is achieved through to the available environmental data are collected, organized and reliable scientific product of the subjects developed an innovative communication tools and services are supplied.

Figure 7.7. The Grid-Arendal Website



Source: United Nations framework convention on climate change (UNFCCC).

Chart 7.2. of the world's carbon dioxide emissions (2010)

7.2. GEO

At the 2002 World Conference on Sustainable Development in Johannesburg it raised the importance of observations and coordinating such activities in the state of Earth.

In 2003, an ad hoc committee met in Washington created the GEO coordinating group and decided a 10-year Implementation Plan for Earth Observations preparation. The Plan was adopted in 2005 in Brussels.

The international Group on Earth Observations (GEO) strives to build a system which is coordinated by the earth exploration systems, and allows a single data use. This system was named GEOSS (Global Earth Observation System of Systems). The group is a voluntary organization to which government level or at the level of international organizations can you join.

More than 80 countries and more than 50 organizations are partnered with this group (2010. years).

Governments are represented at ministerial level in the group. They meet annually and the decisions are taken by consensus. The first plenary meeting was in 2005, in Geneva.

The ongoing care is in action for the GEO 2005 - 2015 period 10-year implementation plan. The plan sets out the vision established nine topics: disaster, health, energy, climate change, water, weather, ecosystems, agriculture and biodiversity.

The Group's activities result the benefits to society, including the following:

–Natural disasters and man-made damage reduction, such as. forest fires, volcanic eruption, earthquakes, tsunamis, landslides, avalanches, floods, environmental pollution incidents. The better organized controls, risk assessments and early warnings will reduce damage in human life and property alike. National, regional and global levels has the ability to respond the established system.

–Understanding the state of the environment and the effective factors of human health and welfare. The observations include air, water, state of stratospheric ozone, persistent organic contaminants, nutrition and disease, weather-related factors. The health statistics, prevention and development impact.

– Improve management of energy resources. The responsibility for environment management provides the energy supply-demand balance, reduce risks, accurates inventory of greenhouse gases and pollutants, will explore the potential use of renewable energy sources.

– Understanding, analyzing, forecasting the climate change process, improving the adaptation. In order to reach scientific consensus on causes of variability and change it needs a construction and ongoing basis of monitoring system for sufficient and reliable data and analysis. Thus, the dangers can be avoided from human and economic aspects.

– The water cycle and thereby a better understanding of water management in the stockpiles. The water-related issues in the following GEOSS observations can be solved: rainfall, soil moisture, flows, reservoir levels, snow cover, glaciers, ice, evaporation, water use, water demand and capacity, in situ networks, automated data collection.

– To improve the weather information, forecasting and warning. The GEOSS is focused on short-and medium-term forecasts. It is characterized by wind, humidity, precipitation, oceanic monitoring sites, reliable prediction, forecasting extreme-hazardous events.

– To improve taking care of terrestrial, coastal and marine ecosystems. It is accounted the status of those territories, natural resources stocks, impact areas, resource use, the possibilities and limitations. It continually evaluates the color of the ocean, the temperature and the fishery. The monitor the carbon and nitrogen cycle in ecosystems.

– The promotion of sustainable agriculture, help the fight against desertification. Collecting statistics: crop production, animal husbandry, fisheries, food security, drought, nutrient balance, farming systems, land use, surface coverage, land degradation, desertification, adverse changes, and global satellite images. Agriculture, forestry data, applications, relationship between food supply and poverty, international planning, sustainability.

– The understanding of biodiversity, monitoring, maintaining. Incurred collecting data on this topic:
ecosystems, populations, species status, genetic diversity, taxonomic and regional differences.

Chart 7.3. of the European Space Agency (ESA) GEO Portal (see also: GMES, INSPIRE)

8. ENVIRONMENTAL ASSESSMENT; EVALUATION of the NATURAL RESOURCES

Written by Miklós BULLA, Széchenyi István University, Győr

ABSRTACT: The greatest challenge of environmental management is to create balance between increasing civilisation demands and decreasing natural resources. There is an essential need of the information about the current state of the environment and tools for predicting how this state would be change due to different effects. So the theme of the essay. The presentation of an environmental analysis model Aim and utility: environmental condition varieties as well as effects on people; economic and social activities behind the effects and their influence on changing environmental policy regulations; establish a conceptual organization which can support the analysis of interactions. We propound the requirements of evaluation of the state of the environment, then review three Soft Computing methods and their feasibility in modelling environmental processes. The GRID based on CNN, FUZZY RULES and CA seem to be promisable for modelling complex, highly nonlinear processes and able to ground tool-kit for supporting environmental decision making.

INTRODUCTION

Towards (getting ready) for the next millennium, the environment and development inconsistently connected tend to become a key issue or rather the key issue.

On one hand huge technological and consumption systems have been established, urged forward by the desire and pressure of expansion. On the other hand lack of development still prevails from the point of view of the vision of the industrial consumption, moreover, humiliating poverty, which makes everybody think of their attitude to nature.

Therefore, development is not only right but it's must. This should mean change at the same time as regarding “traditional” growth compared to the monotonous quantity production and consumption which shouldn't be continued. To be more precise, it could be continued somehow, nobody knows how long, but its dangers are to be seen more and more clearly.

This is a hard limit and a warning as well, the effectiveness of plundering environmental resources can be maintained only with joint effort. Maintaining the wastage (material, energy) or even the expansion or it would be followed by losses and sacrifices.

The state of the environment is continuously changing. Partly due to the never-ending or recurring geomorphologic and biosphere-forming events, partly due to impacts of activities of - today already prevailing – anthropogenic (social and economic) origin. So the balance between the increasing civilization demands and the natural resources has to be created. This is the duty of environmental management. In order to reach all these aims, the management has to be organized i.e. such environmental policy should be established in that environmental management makes environmental protection part of the activities so separate “environmental policy” disappears. Generative research has begun at the Department of the Environmental Engineering, cooperating with the Institute of Information Technology and Electrical Engineering of the Széchenyi István University. The central topic of this research is modelling and controlling extremely complex, non-linear and non-deterministic/non-casual environmental processes.

8.1. MATERIALS and METHODS

8.1.1. Requirements of the evaluation/assessment of the state of the environment

In order to handle the emerging tasks it is indispensable to get to know the changes forming the quality of the environment, to explore the causes of the changes and the expectable consequences thereof.

It is necessary to have information that:

- provides the actual state of the environment,
- explores the casual connections,
- indicates the probable trends of the changes.

All these mean that the determination of environmental policy objectives and tools and the elaboration of an actual environmental policy are not possible without exploring the state and the changes thereof, the more and more exact evaluation. So the first, basic step is the evaluation of the state of environment. In order to fulfil this task – since it is a rather complex one – it is necessary to integrate the results of basic and applied research of different sciences in an interdisciplinary way. According to the objective (examination of the sustainability of regional development), the evaluation of the state of the environment is part of the comprehensive environmental management.

Within the frame of this, it is necessary to perform the analysis of the changes in state occurring in the environmental media and systems (soil, water and air) and the economic and social processes causing them. Knowing all these the occurring processes can be understood and characterised so the effects may be calculated and forecast.

Since the data sources and the information sets are wide-ranging, their simultaneous illustration and analysis, the derivation of the models require information systems and GIS within this.

Adequate aspects – where the selection of criteria includes value selection – are necessary to the state evaluations supporting the decision-making as well as application of evaluation methods (professional systems). So the evaluation aspects also have to be elaborated.

The requirements according to the evaluation aspects are those on whose basic any states of environment or environmental process can be considered as “good”, “bad”, etc. So these are the reference bases of evaluation. In this classification system we consider long-term human biological and economical-social demands against the environment as evaluation criteria. As a matter of course, the validation of these aspects makes necessary the common, optimised consideration of many, relatively well separated aspects.

In the evaluation aspects there are well-formulated requirements towards the state and the quality of environment. These three: ecology, human ecology and economy evaluation aspects cover the whole spectrum of adequate demands against the environment.

The applicability in the evaluation of the state of the environment of these aspects provide the solution of three further tasks:

- Firstly, a set of parameters suitable for classification of the change according to the given aspects can be specified (and the actual values of these parameters can always be obtained!).
- Secondly, a value scale has to be constructed for the chosen parameters so that the environmental state can not only be described but also evaluated.
- Thirdly, evaluation algorithms are to be implemented, which can carry out a reconstructable and objective evaluation. These will allow for the investigation of more alternative scenarios and interactions described by a large number of parameters. They will also increase the reliability of decisions.

Together with all these, it is also necessary to built in highlighting processes into the algorithms.

8.1.2. Aims and Objectives

There are two approaches to the environmental future. Regarding the objectives the environment (earth, water, air, vegetation, settlements, landscape) must be protected and improved. In order to attain this, economical and social task should be defined (production, consumption, industry, agriculture, transport, forming of consciousness).

The task of research-development: to analyse

- the changing conditions
- the cause of the changes, artificial or natural.

The aim is to sketch the right survey and then have known the correlations we can work out intervention programmes.

The analyses of the environment: the comprehensive analysis of the components and connections of environmental management needs, the applications of the results from other sciences. There is not one environment science which can join together the natural (or close to this state) and built environment changes as well as interactions of social activities.

However, it is essential to take into consideration another attitude and approach which looks at the changes and regulations in a different way: a reasonable, conscious and rational management of environmental resources.

The environment should provide the basic essentials (social and biological). In order to attain this defined goal we need – in a systematic form – information from the exact sciences and their suitable application which can help work out the causes of changes of the environment condition.

The protection of the environment, especially the establishment of long-termed and preventive policy does not aim at cancelling or liquidating the harmful effects on the environment, or several and varied tasks, but joining together, interlacing and coordinating.

(I.) Defining the informative needs an their fulfilment on a geometrical basis, the foundation of a network, operating on the complex analyses.

(II.) Taking account of the risks, ranking according to the condition evaluations. Analysing the risks and setting environmental policy priorities.

(III.) National summary; regional, thematic reports; analyses and informative materials.

(IV.) The analysis of international domestic, social and economical relations from the environmental point of view. Estimation of international commitments and stipulations. International relations (especially CEE and EC).

(V.) The follow-up of the public opinion regarding the demands of environmental policy.

(VI.) Set our objectives, implementing methods, work out the policy form. Preparation of environmental improvement strategy:

- national environmental policy
- department, section tasks
- in the form of regional improvement roles, namely long term national strategy, priorities and intensive programmes.

(VII.) Examining the effectiveness of controls and regional programmes.

(VIII.) The implements for achieving this policy, juristic and the proposal of economical controls. The resource utilities – a comparative economical analysis.

(IX.) Exploring and supporting professional knowledge. Ensuring the flow and availability of professional data, coordination of knowledge acquisition.

(X.) Environmental conscience formation, collaboration with the state education development (high school curriculum retraining courses).

(XI.) Editing publications, preparing materials for the Press, public relations.

(XII.) Keeping in touch with other institutes and environmental activities and campaigns.

8.2. MODELING of the ENVIRONMENTAL – as well SOCIAL and ECONOMICAL – PROCESSES

8.2.1. Environmental Model

The introduction to the problem sphere helps in analysing and finding out connections (Figure 8.1.)

The advantage of this “problem-sphere” model is that it is very descriptive. Environmental problems are complex, multiphased, stereoscopic and they have involved from several causes. In order to handle them we should analyse the causes of state changes – effects – economical and social activities: defining and eliciting the causes, as well as the dominant effects / identifying the causes or effects. The model comprises the means of regulation – or rather presents – (to a certain extent), regarding the choose of methods, but it cannot offer a proposal. Similarly it does not describe the measurement of the risks that derive: public health, ecological and economical risks. Neither are the different preventive and preceding measures analysed.

However, it was suitable for pointing out the connections and it can be improved according to the above mentioned needs and demands.

The environmental “problem–sphere” model therefore in the interest of the concrete program formation as a “decision tool” first of all supports the risks and input, namely the aims, priorities and the social groups involved.

All these define and complete the dimensions of political changes. As well as the components of the process and interaction, information types, necessary disposal definition.

The result the model of the analysis of environmental management (Figure. 8.2.) does not include the natural interactions and it does not describe the details: environmental media, effects, social and economic activities, causes, constituents of policy change, means of institutionalizing. But it is suitable to define these, namely this is the main aim of the following analysis. Without the exploration of the components and connections of environmental economy there are no possible, effective means to define the objectives of environmental policy, to indicate/mark priorities, improvements, interventions of varied scales, regional, local and punctiform effect. By no means: working out environment protection programmes, achieving them, supervising them, summarizing the results, indicating new aims, priorities and tasks.

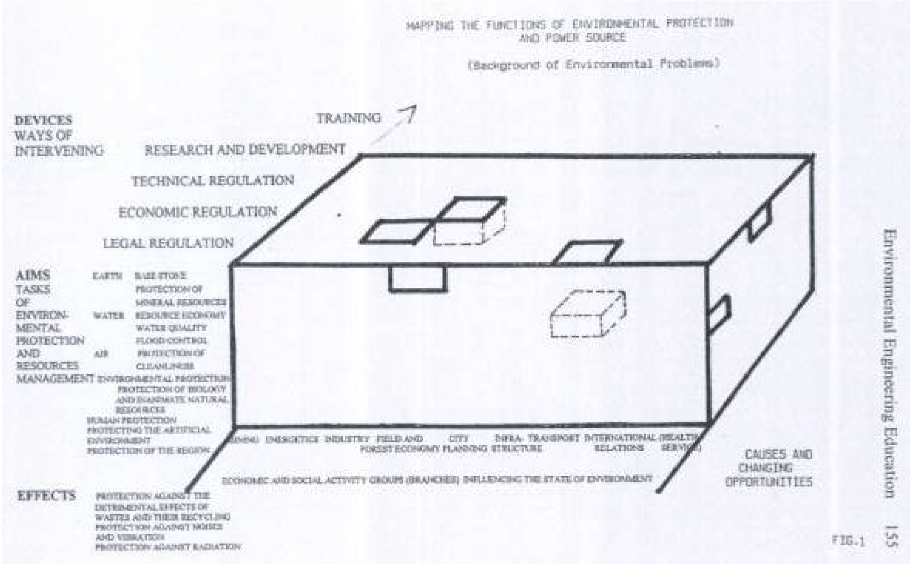


Figure 8.1. Sources: Bulla, 1989.

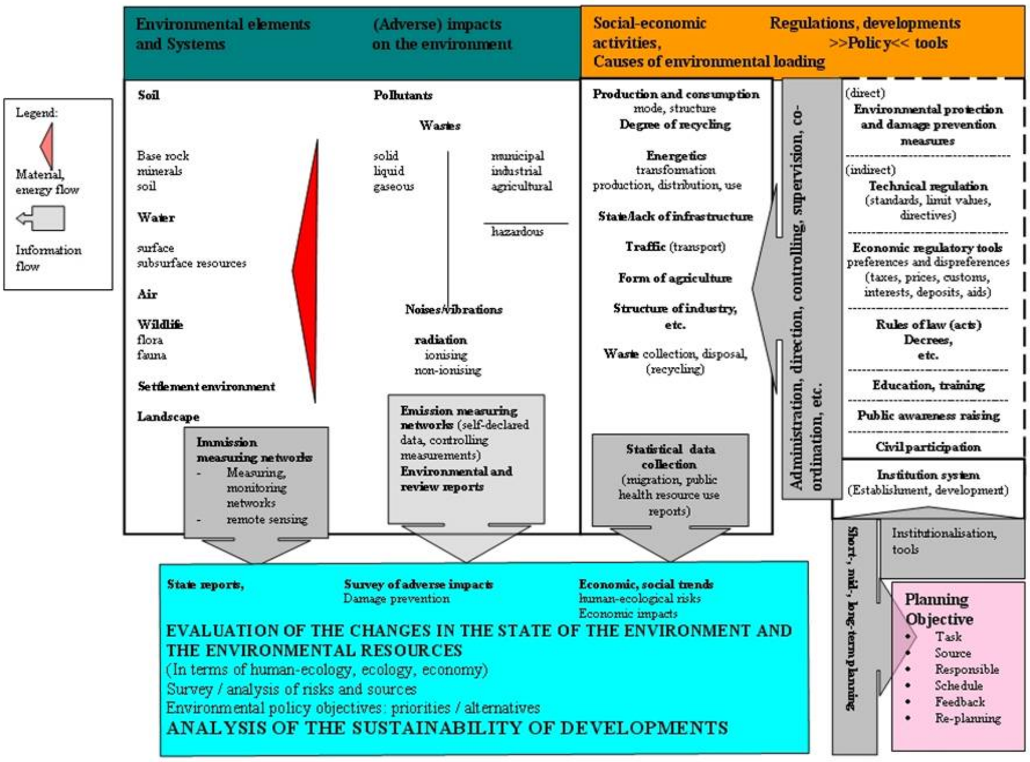


Figure 8.2. Model of environmental management and analysis (Bulla, 1993, - 2003)

In short the never-ending management of environmental economy is continuous.

The environmental economy is the conceptual term of this new environmental strategy. this, as a new paradigm expands not only the direct relationship of people and environment but on economy and society as well. Namely it is integrated, systematic and pragmatic contrary to environmental protection which is elaborated in a different way and it is mainly defensive and analytical.

The use of the model serves the realization of system-principled analysis. The information flow, the structures, material, energy – that is, it aims at supervising and controlling the statical, dynamical and guiding systems.

Considering that the drawing up of the environmental aims and means cannot be done without exploring the condition and its social background, the first step is the evaluation of the environmental state.

We deal with the establishment and development of suitable expert systems based on proper mathematics that is suitable to evaluate the state of the environment in a wider sense. The aim is to analyse the relationship of the changes as consequences of (adverse) impacts on the environment, as well as the relationship of social, economic and technological processes being the sources of these impacts.

With the help of this analysis the state changes depending on the changes of environmental loading can be forecast and the environmental and impact assessments can be expanded and developed further. In the course of the regional programmes and development the expected impacts of political programmes aiming at the regulation of the users of the environment can be predicted, so they can be implemented. Regarding the costs it is possible to choose and elaborate the most favourable and suitable ones.

8.2.2. The modelling process (Source: M. J. Barnsley: Environmental Modelling 2007.)

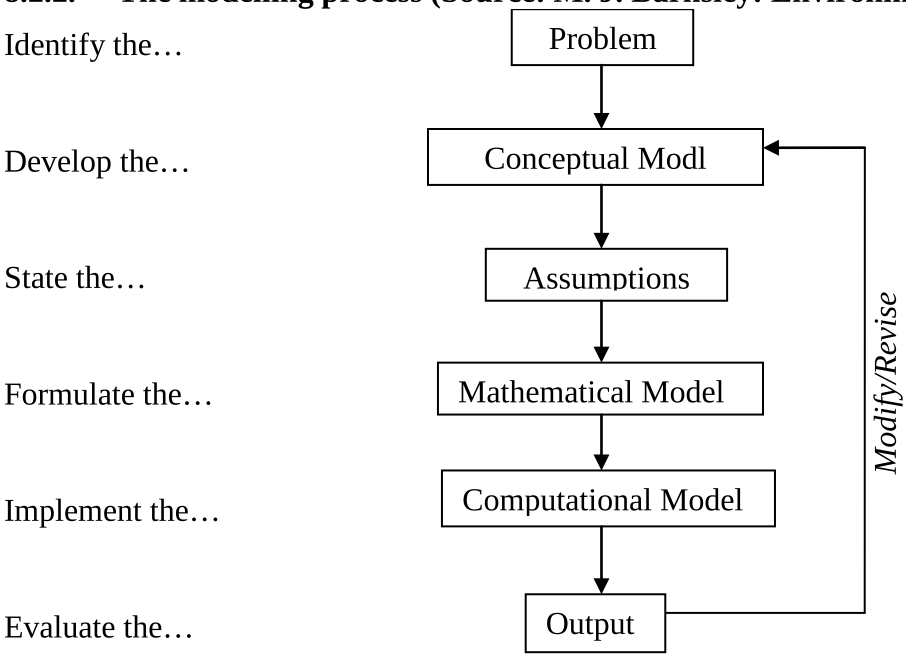


Fig 8.3. Schematic representation of the modelling process.

A model is a simplified representation of a more complex phenomenon, process or system; an environmental model is one that pertains to a specific aspect of either the natural or the built environment. Environmental models have been developed to represent, among other things, elements of Earth's climate system, hydrological processes, ecosystems and biogeochemical cycles. The principal purposes of these models are threefold: to increase knowledge, and hence to reduce uncertainty, of the phenomenon, process or system that the model purports to represent (i.e., to improve understanding); to provide a tool with which to estimate the state of the phenomenon, process or system at times and locations other than those for which observations are presently available (i.e., to facilitate prediction); and to provide a framework within which "what if" questions can be asked about possible changes to the state and operation of the phenomenon, process or system under specified conditions (i.e., to perform simulations).

The production of an environmental model involves a process of abstraction: in the sense that most environmental models deal with abstract concepts and ideas (i.e., mathematical formulae and computational code) rather than physical objects and events (i.e., conceptualization); in terms of identifying and extracting the most important elements of the phenomenon, process or system and discarding the least significant ones (i.e., selection); and in the sense of summarizing the essence of the phenomenon, process or system (i.e., encapsulation). Building a well-designed model therefore forces one to examine carefully, analytically and in detail the component elements of an environmental system, the processes and structures that govern the relationship and interactions between them, and the spatial and temporal scales over which they operate.

In principle, the process of designing, building and using an environmental model can be divided into a series of discrete stages. These stages are shown schematically in Figure 3., and are described in detail below. In practise, the boundaries between the different stages are not always well defined and progression from one stage to the next is seldom as straightforward or as linear as Figure 3. implies. Nevertheless, this diagram provides a useful framework within which to introduce the basic concepts.

The first step is to identify the specific science question, or problem, that is to be addressed and then to establish both whether and how a model will help to answer this question (Wainwright and Mulligan 2004). The problem should be sufficiently well defined and focused so that it is amenable to solution using the knowledge, skills and resources at hand (these factors influence the tractability of the problem), but it should also be sufficiently generic so that it is of more than just parochial interest (this implies that a compromise is negotiated between the specificity and the generality of the model). If the problem is poorly defined at the outset, the model-building process is likely to be more difficult, more time-consuming and more complex. Worse still, the resultant model may not be appropriate to the task for which it was originally intended.

Table 8.1. Four main phases of systems analysis (after Huggett 1980).

Phase	Actions
Lexical	Define the system boundaries (closure). Choose the system components, i.e., state variables (entitation). Estimate the values (i.e., the state) of the state variables (quntitation).
Parsing	Define verbally, statistically or analytically the relatinoships between the state variables.
Modeling	Model construction. Model operationalization (i.e., running the model).
Analysis	Model validation and verification (i.e., compare the results of the model with observations of the target system).

A related consideration is the scope of the model, in terms of those elements of this science question that the model is, and is not, intended to address. The scope of the model may have to be limited in various ways to produce a tractable solution. For instance, the model may need to be designed so that it represents a selected part of the target environmental system, a particular spatial domain, a specified period of time, or perhaps a combination of all three.

After specifying the science question, the next step is to develop a conceptual model of the problem. The term conceptual model is used here to refer to a model that is expressed verbally or in written or diagrammatic form (i.e., concepts), as distinct from one that is represented in terms of mathematical formulae (i.e., a mathematical model) or one that is constructed from physical materials (i.e., a physical model).

The development of a conceptual model necessarily involves a comprehensive analysis of the target phenomenon, process or system with the aim of identifying its component parts, their respective inputs and outputs, the relationships between them, and the processes and structures that govern their interaction. This stage in the model building process is therefore closely related to the lexical and parsing phases of systems analysis, a branch of science concerned with the study of complex systems, including their composition, structure, function and operation (Huggett 1980, Table 8.1) In each case, it is assumed that the "real world" can be divided into a number of more or less discrete systems, which can be further sub-divided into their component parts and processes, identified by careful analysis and detailed observation (Hardisty et al. 1993).

Table 8.2. Important definitions in environmental modelling

Element	Definition	Example
Constant	Quantity whose value does not vary in the target system.	Speed of light
Parameter	Quantity whose value is constant in the case considered, but may vary in different cases.	Total solar radiation at the top of Earth's atmosphere.
Variable	Quantity whose value may change freely in response to the functioning of the system.	Amount of precipitation.
Relation	Functional connection or correspondence between two or more system elements.	Rainfall, run-off and soil erosion.
Relationship	State of being related.	-
Process	Operation or event, operating over time (temporal process) or space (spatial process) or both, which changes a quantity in the target system.	Evapotranspiration.
Scale	Relative dimension, in space and time, over which processes operate and measurements are made.	Local, regional, global; diurnal, seasonal, annual.
Structure	Manner in which component parts of a system are organized.	-
System	Set of related elements (e.g., constants, parameters and variables), the relations between them, the functions or processes that govern these relations and the structure by which they are organized.	Forest ecosystem, drainage basin, global carbon cycle, Earth's climate.

The component elements of an environmental system typically include inputs, outputs, constants, parameters, variables (also known as stocks, stores, pools and reservoirs), processes (flows), relations (links or connectors) and structures (Edwards and Hamson 1989); see Table 8.2. for definitions. The boundaries, or limits, of the target environmental system must also be specified. In this context, environmental systems are sometimes classified in terms of their degree of openness: open systems, also known as forced systems, have exogenous (or forcing) variables; closed systems, also known as unforced systems, have no exogenous variables (i.e., all of the variables are endogenous to the system) (Hardisty et al. 1993).

8.2.3. Transport model

Environmental assessment approach

1) Stochastic method
2) Deterministic method
3) Holistic method

Stochastic method – classical approach

Aims at the repeated survey and recording of the elements of the environment (soil, water, wildlife etc.) and the complex elements (landscape and settlements).

Changes can be detected by comparing two succeeding data of recording.

Major disadvantage: there is no way to identify the causes responsible for the changes → not (or very limited) suitable for environmental prognoses.

Deterministic method

Drawback of the pervious method can be eliminated by exploring the external effects, paths and effects of polluting materials, noise and radiation in the environment.

Complex type of survey, doesn't separate media of the biosphere, tries to trace the whole transformation process on the limits of measurement and analysis capabilities.

Still analytical, but only one factor can be observed at a time. Theoretically possible to sum up this threads, this is not sufficient to describe the real changes in state of the system.

Holistic method

Examines the interference of various activities, measures as well as the systems consisting of one or all environmental media.

Integrating measurement, data management and processing, analysis and evaluation phases into a common technology makes prognosis making possible.

Development measures can be worked out on the basis of alternatives with known consequences.

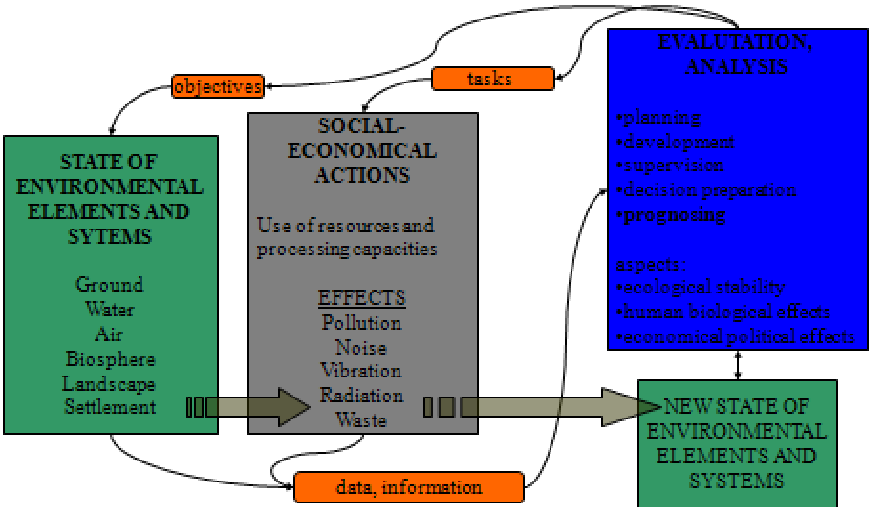


Figure 8.4. The structure of environmental state evaluation (Bulla, M. 2004)

Basic principles and demands in informatics:

- decentralised information systems
- information system based on regional principle
- multi-purpose utilisation
- friendly decision support information (and analysing) system

The transport equation from the water and inertia balance, with slow flow:

$$L(h) = \underbrace{S\frac{\partial h}{\partial t}}_{\text{Storativity}} - \underbrace{\nabla \cdot (K f_{\mu} \cdot (\nabla h + \Theta \xi))}_{\text{Flow due to hydraulic potential differences and gravity}} - \underbrace{\epsilon Q_{\rho}}_{\text{Sources and sinks}} = 0$$

Figure 8.5. Transport equation (Bulla, M. 2004)

In the next chapters three interrelated techniques will be briefly introduced, which will be suitable for modelling and controlling the above mentioned processes, and this way serving as tools for the construction of the policy supporting system. They are all soft computing techniques: cellular neural networks, fuzzy logic based rules and cellular automata. They are applicable separately and in combinations as well.
Evaluation of the model results

- Transport processes
- physical processes
- chemical processes
- biological processes
- radiations

are extremely very complex, non-linear and non-deterministic phenomena.

8.2.4. Application of CNN (Cellular Neural Networks) for modelling environmental processes

The CNN paradigm has been playing an important role in digital signal and image processing during the past decade. CNN is a special technology within the broader field of neural networks [1, 2].

Any physical implementation of the CNN can be considered as a multidimensional array of processors, in which the processing units are connected only to their neighbouring processors. So the communication of the processors is limited to their immediate neighbours.

The weights of the coupling between the neighbouring processors are expressed by the elements of so called template matrices. In the case of a classic rectangular grid where the radius of neighbourhood is defined as one unit, the template matrix contains 9 weight elements.

The state equation of the state-output in the so called full range CNN and the expression of the limitation which follows each integration step is given in the following equations:

$$\begin{aligned} \dot{x}_{ij}(t) &= -x_{ij}(t) + \sum_{W^x_{rij}} \mathbf{A}_{kl} x_{ij}(t) + \sum_{W^u_{rij}} \mathbf{B}_{kl} u_{ij} + z_{ij} \\ x'_{ij}(t) &= \frac{1}{2}\left(|x_{ij}(t)+1|\right) - \left(|x_{ij}(t)-1|\right) \end{aligned}$$

Here $x_{ij}(t)$ is the time-dependent state-variable, $x'_{ij}(t)$ is the limited state, u_{ij} is the input variable, z_{ij} is a constant, which does not depend on time. **A** and **B** are the *template matrices*. The domains of summing W_{rxij} and W_{rui} represent the *r* radius neighbourhood of x_{ij} and u_{ij} respectively.

One of the most promising directions of the application of CNN models is the numerical integration of partial differential equations of physics. Since the transport processes in the environment protection are described by spatio-temporal equations, a multilayer CNN approach is proposed for model generation, recombination and transport processes, such as drift and diffusion.

As an example, consider the continuity equation for a pollutant, in a single layer CNN model. The continuity equation describes the time dependence on the concentration of a given pollutant in a particular point of space, assuming generation, recombination, drifting in a given direction and diffusion.

$$\dot{c} = g - r + h\, div\mathbf{D} + k\, div\mathbf{grad}c$$

c is the concentration, *g* is *the* generation rate, *r* is the recombination rate of the pollutant, **D** is the drift vector moving the pollutant, *h, k* are constants.

On a grid of a two-dimensional plane the components lead to spatial discretisation. The expressions describing drift and diffusion of the right side of the equation can be expressed by two template matrices as follows:

h div ***D***$\rightarrow T_{ij}^{D}$, *k div* ***grad*** *c*$\rightarrow T_{ij}^{c}$

where

$$T_{ij}^{D} = \begin{matrix} h & 0 & 0 \\ 0 & -h & 0 \\ 0 & 0 & 0 \end{matrix}\ , T_{ij}^{c} = \begin{matrix} k & k & k \\ k & -8k & k \\ k & k & k \end{matrix}$$

Using these templates, the CNN-like form of the continuity equation is as follows:

$$\dot{c}_{ij} = g_{ij} - r_{ij} + \sum_{w_{ij}} T_{kl}^{D} c_{kl} + \sum_{w_{ij}} T_{kl}^{c} c_{kl}$$

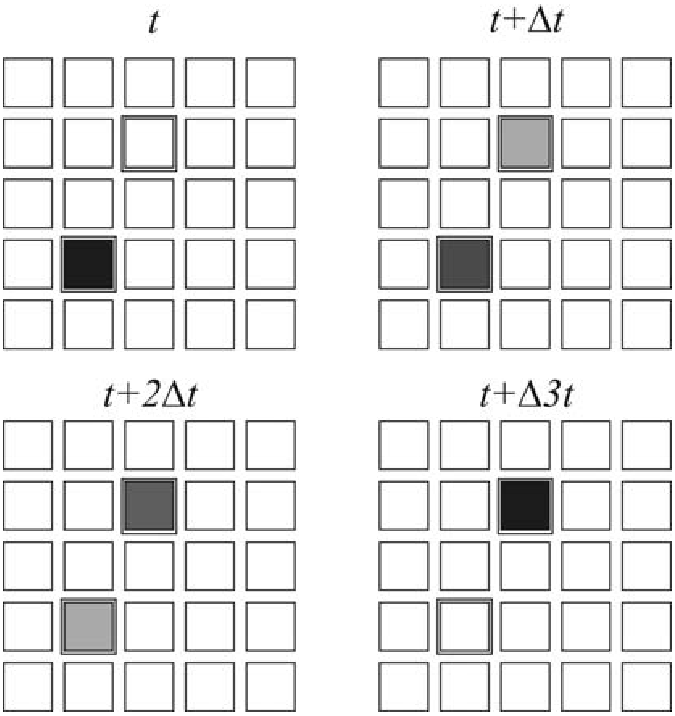
Here w_{ij} is the unity radius environment of point *ij* which assigns the following matrix:

$$\begin{matrix} c_{(i-1)(j+1)} & c_{i(j+1)} & c_{(i+1)(j+1)} \\ c_{(i-1)j} & c_{ij} & c_{(i+1)j} \\ c_{(i-1)(j-1)} & c_{i(j-1)} & c_{(i-1)(j-1)} \end{matrix}$$

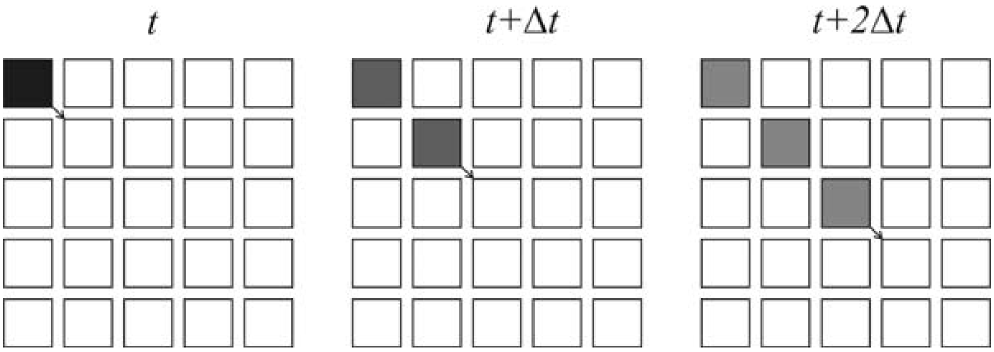
The simplest numerical integration in time of the CNN form of the continuity equation is the forward Euler:

$$c_{ij}(t+\Delta t) = c_{ij}(t) + \Delta t \left(g_{ij} - r_{ij} + \sum_{w_{ij}} T_{kl}^{D} c_{kl}(t) + \sum_{w_{ij}} T_{kl}^{c} c_{kl}(t) \right)$$

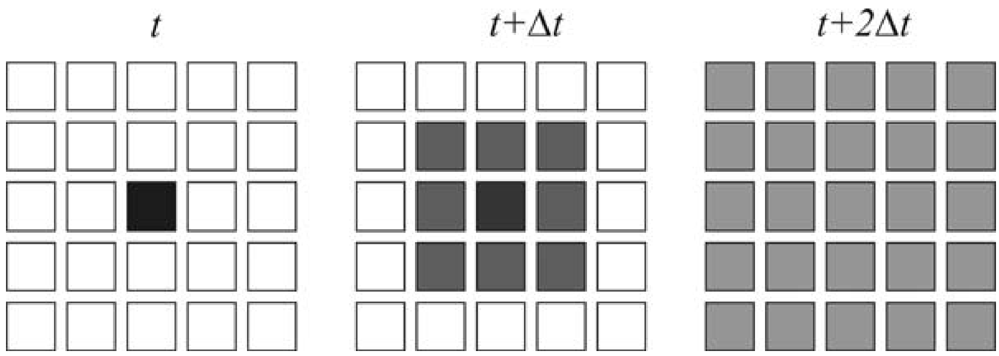
Illustrations:



*Generation and recombination. Generation: the grey points of the grid in time **t** will be darker from time to time. Recombination: The dark (black) points of the grid in time **t** will be lighter from time to time.*



Drift from a dark (heavily polluted) point to south-east direction

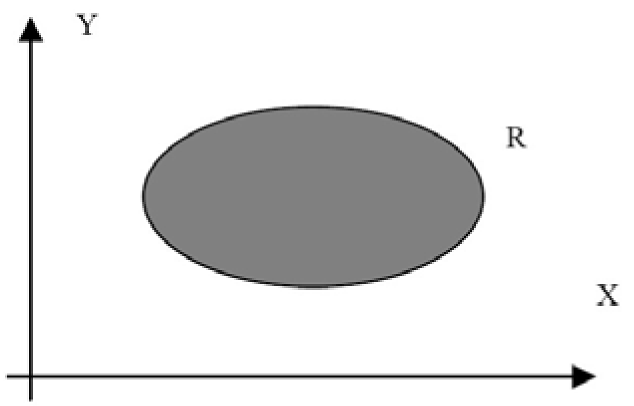


Diffusion from the black (heavily polluted) point of the grid to all directions

8.2.5. Fuzzy logic rule bases

Another very powerful approach for modelling very complex, non-linear and non-deterministic phenomena is the application of fuzzy logic based **If…then…** rules and various algorithms for obtaining conclusions for facts/observations. The starting idea for these techniques was the crucial paper by Zadeh [6], where he suggested the combination of that time classic expert systems rule bases with the idea of linguistic variables and values represented by fuzzy sets over the universes of discourse corresponding to input and output state variables for describing very complex systems. The new element in this approach was that rather than using symbolic logic and discretised state space representation, the ordered and continuous metric structure of the state space allowed the reduction of the actual symbols and terms, which could produce by their partial overlapping an interpolation type approximative calculation technique. Soon Mamdani [7] completed the idea by introducing a projection based representation for fuzzy sets and relations and so he and his collaborators succeeded with a very powerful and efficient controller for a highly non-linear steam engine system. The main idea is that if given an input universe of discourse

$X = \prod_{i=1}^{k} X_i$, where X_i are the input state variables, and *Y* is the output universe, any rule in the form **If** *x* **is** *A* **then** *y* **is** *B* can be represented as a relation *R* of the *XxY* space, cf. The figure.

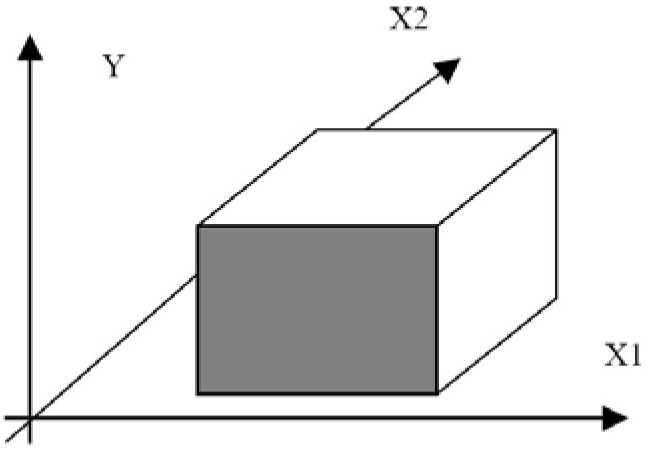


In Mamdani's approach the structure of the possible fuzzy relations is more restricted as only those that can be generated as the Cartesian products of orthogonal projections are allowed –

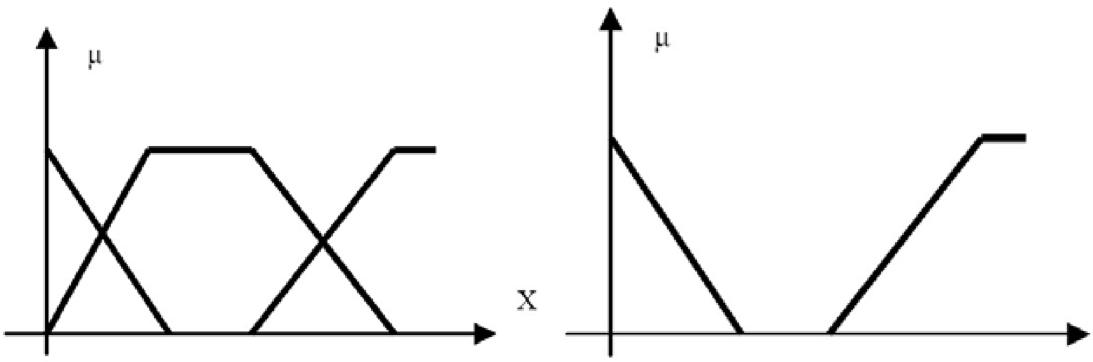
on the other hand however, this restriction allows a much better computational complexity. The rule base in this approach has the following structure:

If x_1 **is** A_1 **and** x_2 **is** A_2 **and … and** x_k **is** A_k **then** y **is** B.

The figure presents a simple two-dimensional case



Based on Mamdani's algorithm a series of commercial applications were implemented and the so called „fuzzy boom" started especially in Japan. However, it turned out soon that no real implementation was possible for more than 5-10 input dimensions because of the high computational complexity of the model: (t^k) , where t denotes the (maximum) number of terms for each dimension. Further advance towards larger dimensionality was offered by the rule interpolation algorithm introduced in [5] and finally by the combination of hierarchical structuring the rule base combined with the sparse approach in the rule interpolation technique [6]. The figure presents the difference between the Mamdani-approach and the interpolative sparse technique.



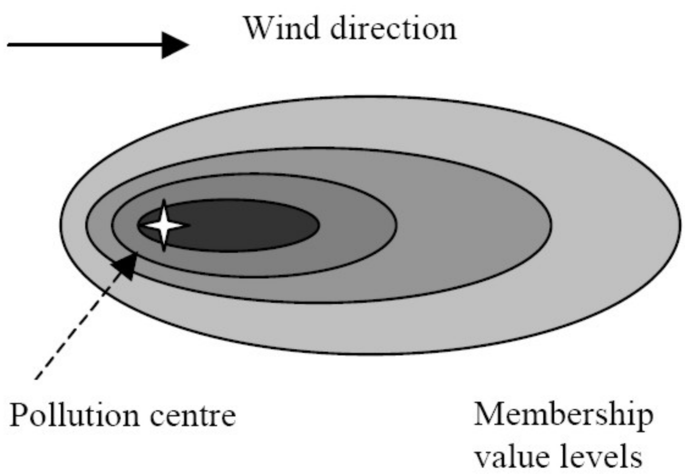
The hierarchical method deals with a multilevel rule structure where meta-level rules have symbolic output:

R_0: **{ If** z_0 **is** A_i **then** R_i **}.**

Where each R_i is of the type

R_i: **{ If** x_i **is** A_{ij} **then** y **is** B_j **}.**

This latter type of rule base allows dealing with very complex systems with a reasonable accuracy. We suggest that pollution drift, expansion, etc. is dealt with by applying the last, more complex but more effective technique. If there is a reasonable way to group variables according to one or more key variables (z_i), it will be possible to segment the model and this way effectively reduce the value of k locally. The extension of various pollutants in a geographic area will be well described by fuzzy sets whose time behaviour can be modelled by the rule bases as suggested above.



8.3. The REQUIRED ENVIRONMENTAL RESEARCH INFRASTRUCTURE and required ICT infrastructure

Introduction: This document presents the opinion of several ENV projects. The environmental sciences are increasingly data rich and they are also developing into a data driven science. Environmental research infrastructures are large data resources and have to include innovative ICT and e-infrastructure services. The common priorities are summarized below.

Environmental systems are inherently complex. They are characterized by a multitude of interrelations at various temporal and spatial scales and sometimes by self-organization resulting in a high variety of diversity and complexity. The systems are diverse: Earth deformation processes and plate tectonics; physical and chemical dynamics of the atmosphere; the marine systems covering two/thirds of our planet, and living world on this substrate from single proteins up to ecological communities. Understanding these system is not possible by simply extrapolating from the single units which constitute these systems. A different methodological approach by analysing the correlation properties of all (ensembles of) units with modelling and simulation methods assists in detecting patters of strong correlations, the underlying processes and sometimes evidence for collective organisations. This methodological approach assumes the availability of sufficient observatories and sensors, large-scale databases with observations and measurements on the components of the biodiversity system together with advanced analytical and modelling software. In addition it requires computational capacity in the order to run the demanding statistical work flows on the huge data sets. These requirements together define an infrastructure environment which brings together the observatories, sensors, data, software and computation facilities at an appropriate integrated large scale.

The laboratory for research on our planet's environment is the whole planet. Such research is inherently multidisciplinary and scientific data are of various kinds. Scientific questions drive a variety of experimental and data driven analytical methodologies. Data are generated with a related variety of instrumentation and observations. A specific requirement is that historical environmental data gain in value through time and must be preserved and curated to secure their future value for research. The same holds for analytical capabilities and research workflows to support knowledge development. Workflows constitute a special data category in environmental research. Frontier research will exploit the wealth of all environmental data and workflows. This landscape presents important implications for data management, data access and data preservation. A landscape that integrates supporting technology for data generation, and capabilities to access data through analytical and modelling tools framed in virtual environments.

The required ICT infrastructure at the data level (for primary, processed and workflow data) must provide (automated) mechanisms for transferring data to any storage systems, together with identifiers and generation of metadata to support semantic interoperability for a variety of user communities. In addition, the organisation and architecture of data services has to meet the typical demands of users in environmental research (which are humans, other facilities or machines). This holds for flexible authentication and access rights for users outside NRENs or in remote areas, for pre-processing data into usable formats, for the management of complex data records (data uncertainty, fuzzy data, data calibration, data validation, data transformation, data fusion, privacy issues), for workflow enhancement and scalability, for fast access to and processing of selected distributed and large heterogeneous data sets and tools, and finally for knowledge development. But also the essential policies to govern, manage and operate the data services for environmental research infrastructures and their users. This includes elucidating the roles of public and private bodies and associated business plans for sustained operations.

The organisation and architecture of data services has to accommodate the ways how users (not only researchers, but also public and private organisations) will deploy these services. Users want to “see” data through their preferred application services, and they want to interact in virtual environments in order to study environmental models and test model parameters. Any researcher or distributed researchers group should be able to find or construct preferred application services in personalized environments. Associated super fast data transfer and HPC capabilities are crucial to allow for new e-science approaches in environmental research.

A three-way dialogue between the communities of environmental research infrastructures, the e-infrastructures providers and with the Grid services in necessary to specify the common requirements and solutions. User involvement and engagement is a key to promote early adoption of new developments in the daily research practice. This must go hand in hand with outreach activities to secure the best and cost-efficient use of the capabilities and to foster technology transfer. This holds internally for the scientific users community by creating awareness, to motivate, train and teach them to benefit for the whole cycle from data generation up to open access publications. This should go together with education and training in utilizing the (evolving) e-infrastructure capabilities. Externally, outside the scientific community, there are also public authorities, NGOs and the private sector who can better benefit from the environmental research councils for decision-making or for new products and services. ICT capabilities and outreach activities have to take this into consideration. This also holds for new finance mechanisms. Technology transfer amongst stakeholders in public and private sectors is important to share and promote innovation.

In respect of the ESFRI Preparatory Phase projects, it is essentials that these requirements are addressed by close co-operation between the new infrastructures themselves. The communities which generated the PP proposals contain the people who are best aware of the importance of the data from each new facility and the potential possibilities for their exploitation, and they also have the best overview of user requirements. Each of the current and planned environmental PP projects has some strengths in a few of the above mentioned ICT areas, but a broad collaborative effort is the only way to ensure that each of them can fully benefit from integrated new ICT capabilities. In addition it will strengthen the European contributions to GEOSS the Global Earth Observation System of Systems. As such it is recommended that these development activities are identified as top priorities in the Framework Programme.

8.4. Discussing and Concluding Remarks

(1) The main processes of social and economic life (production, consumption, transport, etc.) fall on the environment, existential interests and way of living is closely related to it and powerful organizations support it. But environmental interests are difficult to recognize, they do not seem of vital importance at first. With restricted resources, the deteriorization of renewable ones, their impoverishment and growing pollution it is obvious that economical development is subject to production increase which cannot be the desired alternative.

The continuous decay of the environment indicates that the efforts already taken are not satisfactory, it is not convenient even for the stability of the condition. Year by year the polluted environment can increase the losses and damages. Owing to the social, economical and international importance of environment protection this practice should be stopped.

Fundamental changes and an intensive ecological strategy is needed which besides moderating the losses and highlight prevention.

(2) The effectiveness of environmental protection depend on objective natural and social conditions. These can be and should be transformed. Therefore a social background is necessary, which explores the regularities (that is, the effects arising from the utility of environment, and the causes that bring about the effects). These should be utilized and applied by environmental protection and resource supervision, namely the management of the environmental economy.

The problem, therefore is manifold: firstly, the way the various environmental elements and resources are utilized and related to each other should be identified. Secondly, the conclusions, requirements and political intentions should be formulated. Thirdly, the relevant legal, economic and administrative rules should be worked out.

In short: the alternatives of “what can we expect to achieve and how”. The next task should be institutionalizing all these, supervising and controlling the ongoing process.

Thus, our aims concerning environmental protection and sate improvement can be realized only within the sphere of social and economic development. In order to achieve them, we need regulators that are based on the exploration of their relationship and are capable of affecting it.

(3) When formulating the aims of environmental policy, we need to break away from the method which proposes to continue present trends, since these trends will lead to a crisis. We need change in the relationship of economics, society and environment. In order to fully exploit the perishing natural resources, at first we need to set the aims to be achieved, and then decide upon the possible ways and means of how to achieve them. (Future planning)

It is impossible to develop an environmental policy which aspires majority furtherance without a trustworthy and detailed evaluation of state as well as its social awareness.

(4) Naturally, it is not an unprecedented task to assess the state of environment. There exist a number of methods or “technologies” to actually qualify the state and unveil the (deleterious) processes and effects.

They can be grouped according to their governing ideas:

The “classical” approach characterises the changes by means of disclosing the difference between two consecutive states through gauging and recording the elements of environment (earth, water, air, flora and fauna) and the complex formation (area, settlements) on a regular basis. The fundamental defect of this approach is that it does not specify the causes of the changes, giving us very limited, if any, possibilities for prognostication, thus it does not allow for planned development or prevention.

It is essential that the analysis and evaluation necessary to realize environmental management examine, within their sphere of action, the interactions of different activities and interventions, as well as, those of environmental systems consisting of individual or the total of environmental elements. In order to do so, we need measuring-observing, data-connecting and transmitting, information-creating and processing, analysing and evaluating phases to be created and organized to be technological. All these will make prognostication possible, enabling us to elaborate alternatives with predictable effects, as well as, regulating and developmental interventions so that the alternatives can be realized.

(5) Both the system of standpoints for evaluation and the selection of the qualifying criteria are questions of decision on selected values, which depend on the desirable aim. Without standpoints it is impossible it qualify, only the description of the state is possible, without the knowledge of what can be done about it.

The standpoints can be diverse but at the same time they can be organised into a system as follows,

(i.) Of natural science (oecological)

The endurance, stability and regeneration of environmental elements and systems are to be examined, since they provide the conditions for the biological and social being of man.

(ii.) Of public health (humanocological)

Biological endurance of men. If seen as a different standpoint (from the previous one) it raises a difficult philosophical issue, namely, the selfishness of men towards his environment. However, this standpoint needs to be addressed, because at places intervention has reached such an extent where protection of environmental elements and systems – in obedience to (i) – is not enough in itself to protect mankind and to meet the conditions of healthy life.

(iii.) Economic

As well as biological needs, possible ways to satisfy needs of man as a social being have to be considered. Accordingly, when qualifying the state, we need to interpret the environmental elements and, mainly, the systems area, settlement) as an economically handlable change in use-value.

(6) The interventions, which are based on conclusions gained from state analysis – with the exception of regenerative interventions – do not have to be aimed directly at the environmental elements and systems, since they change slowly, much slower than the changes in the effects and activities that cause the alterations. Consequently, our aims have to be defined with regard to the state of environment but it is the activities that have to be regulated. Our tasks will arise while elaborating on the technical, legal and economic interventions and regulations. It is essential that efficiency be considered and predicted while interventions are being planned. In order to do so we need to estimate and compare

a) the scale of the effect to be influenced or regulated; the extent of the damage to be warded off and the pollution sources to be dislocated

b) the amount of money and equipment needed to exempt, elicit or regulate; their availability and the efficiency of their use.

Their priorities of environmental economy – with regard to the size of the area – can be set by means of comparing the orders designed through state evaluation, qualification and effectiveness-analysis of interventions.

(7) Until the perfection of environmental economy, a transitional period is needed during which we have to continue parallelly:

– the protection against occurring damages
– elimination and prevention of pollutions
– doing away with existing pollutions, clearing the polluted areas.

The elimination of the pollution accumulated in our environment and the damages so far occurring continuously and inevitably, requires years of coordinated and conscious effort (according to international example, too) in order to achieve such an environmental state, which ensures healthy living conditions, the stability of the ecological system, provides a basis for a steadily sustainable development.

8.5. **Conclusions**

(i) Characterization as well as prediction of the changes in the status of environment essential for realization of the sustainable development

(ii) Just then the environmental processes are complex, highly non-linear, secondary and subsequent reactions occur also consideration only of the causal physical –chemical – biological transmissions would even not be enough, if they could be exactly well known due to computational complexity of the task

(iii) Consequently/accordingly modelling is necessary where not only the results of changes but regulaties are generated by the model-algorithms themselves

(iv) In our opinion the soft computing methods, in this case the application of GRID based CNN as well as FUZZY RULES seem to be promisable for modelling the environmental processes

(v) As a consequence the targeted aim of research would make by our is: building up a tool-kit for supporting the environmental decision making.

9. References

[1.] [1] Kerekes, S. Bulla, M. (1994): Environmental Management in Hungary. *Environmental Impact Assesment Review,* 14 (2-3):95-101.

[2.] [2] Bulla, M. (1992): State of the Environment in Hungary. Appendix I. in: *Environment and Development in Hungary*. A Blueprint for Transition. Ed. Z. Bochniarz., S. Kerekes. University of Minnesota, Minneapolis USA.

[3.] [3] Bulla, M. Széchy, L. (2003): Basic Theory of an Environmental Support System and Implementation Using GIS REGIONET III. Workshop University of Manchester. UK.

[4.] [4] L.O. Chua and L Young (1988): Cellular Neural Networks, Theory and Applications, *IEEE Trans. Circuits and Systems 35* pp. 1257-1290.

[5.] [5] L.O. Chua and T. Roska (1993): The CNN Paradigm, *IEEE Trans. Circuits and System 40* pp. 147-156.

[6.] [6] L. A. Zadeh: Outline of a new approach to the analysis of complex systems and decision processes, *IEEE Trans. on Systems, Man and Cybernetics SMC- 3*(1973) pp. 28-44.

[7.] [7] E. H. Mamdani, S. Assilian (1975): An Experiment in Linguistic Synthesis with a Fuzzy Logic Controller. *International Journal of Man-Machine Studies 7* pp. 1-13

[8.] Kóczy, L. T. and Hirota, K. (1993): Interpolative reasoning with insufficient evidence in sparse fuzzy rule bases, *Information Sciences* 71 pp. 169-201.

[9.] Kóczy, L. T. and Hirota, K. (1997): Interpolation in hierarchical fuzzy rule bases with sparse meta-levels, Tr. 9 7-3, Tokyo Institute of Technology, 12p.

[10.] Barnsley, M. J.: Environmental Modelling – A practical Introduction CRC Press Taylor and Francis Group, Boca Raton, London, NY. 2007.

[11.] Bulla, M. : Environmental management model: an analysis on the relations of the components of environmental management. in: Environmental Engineering Education and Training p.: 151-159. Wessex Institute of Technology, UK. 1996.

[12.] Biggs, N. L.: Discrete Mathematics. Oxford: Clarendon Press, 1989.

[13.] Donovan, T. M. and Welden, C.W.: Spreadsheet Exercises in Conservation Biology and Landscape Ecology. Sunderland, MA.: Sinauer Associates Inc., 2001.

[14.] Edwards, D. and Hawson, M.: Guide to Mathematical Modelling. Mc Millan; London, 1989.

[15.] Grossman, P.: Discrete Mathematics for Computing. Basingstoke, Hampshire: Mc Millan Press Ltd., 1995.

[16.] Hardisty, J., Taylor, D. M. and Metcalfe, S. E.: Computerised Environmental Modeling: A Practical Introduction Using Excel. John Wiley and Sons: Chichester, 1993.

[17.] Kirkby, M. J., Naden, P. S., Burt, T. P. and Butcher, D. P.: Computer Simulation in Physical Geography, Second Edition. John Wiley and Sons: Chichester, 1993.

[18.] Piff, M.: Discrete Mathematics: An Introduction for Software Engineers. Cambridge University Press: Cambridge, 1992.

[19.] Verstraete, M. M., Pinty, B. and Myneni, R. B.: Potential and Limitations of Information Extraction on the Terrestrial Biosphere from Satellite Remote-Sensing. Remote Sensing of Environment. p.: 201-214., 1996.

[20.] Wainwright, J. and Mulligan, M. (Eds.): Environmental Modelling: Finding the Simplicity in complexity. John Wiley and Sons: Chichester, 2003.

[21.] Bulla, M.: Modelling of Environmental Processes. Applying soft computer methods. State University of California, Incentives of Soft Computing, 2004.