



**MINISTRY OF ENVIRONMENT AND WATER  
OF THE REPUBLIC OF HUNGARY**

**Second National Report of the Republic of Hungary  
on the implementation of the  
United Nations Convention to Combat Desertification**

**2006**



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**(ii) SUMMARY<sup>1</sup>****Background**

Hungary is situated in Central Europe, in the middle of the Carpathian Basin, and belongs to the continental climatic zone with considerable influence by the Atlantic and Mediterranean streams. According to the worldwide used aridity index, the ratio of annual precipitation to potential evapotranspiration (P/PET), Hungary can be identified as an “affected country” under the terms of the UNCCD. In fact, drought is a considerable risk factor, especially on the Great Hungarian Plain and other parts of the country, and the signs of desertification can also be found.

The country suffered from numerous droughts in its history, and drought events have become more intensive and more frequent during the past decades. Despite the fact that the agricultural sector is the most directly exposed to the harmful impacts of extremely dry conditions, it is also becoming more and more evident that all living organisms, the natural habitat, all other sectors of the economy and a significant part of the society suffer from the adverse impacts of drought.

As far as future tendencies are concerned, based on the analyses of climatic data on long term observations and taking into account the recent investigations on the effects of climatic changes in Hungary, it can be stated that an increase in temperature and a significant decrease in precipitation as well as in average soil moisture content is anticipated, and therefore the interest in the fight against drought and desertification is a priority in the country.

**1. Focal point institution**

The National Focal Point of the UNCCD is located in the Ministry of Environment and Water, Budapest. The relevant contact details of the National Focal Point are as follows:

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<sup>1</sup> The summary and the whole report is structured in accordance with the Explanatory Note and Help Guide of the UNCCD for the national reporting process of affected country Parties

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In the present situation there is no country-specific website devoted to the problems of drought and/or desertification in Hungary. General information can be found on the homepage of the Ministry of Environment and Water on the following address: [www.kvvm.hu](http://www.kvvm.hu)

## 2. Status of the National Action Programme (NAP)

The National Drought Strategy, as a basis of the National Action Programme is now in the very final stage of Governmental acceptance. According to an earlier decision of the Hungarian Government (Decision No. 2142/2005), the responsible authorities have to elaborate the National Action Programme on Drought in 2006, based on the aims and tasks laid down in the National Drought Strategy. The main Governmental body to prepare the NAP is the Ministry of Environment and Water in close cooperation with the Ministry of Agriculture and Rural Development, with the involvement of other related ministries and national authorities. Formulation of the National Action Programme is under way, expected approval of the NAP by the Government is the end of 2006.

The Hungarian NAP will be harmonised with the National Development Plan and with other related policies and strategies, especially those dealing with climate change and biological diversity. Hungary takes fully into consideration the principles and provisions of the Aarhus Convention as well.

### 3. Member of SRAP/RAP

At the moment Hungary is not involved in subregional or regional cooperation framework organized officially on drought or desertification, however there are several international technical and scientific bodies in which the country is represented.

Hungarian experts were invited to contribute to the preparation for the establishment of a Subregional Drought Management/Monitoring Centre for South-Eastern Europe promoting the implementation of the UNCCD aims at a subregional level.

### 4. Composition of the National Coordinating Body (NCB)

For the elaboration of the National Drought Strategy and the National Action Programme, a National Coordinating Body was established by the Ministry of Environment and Water in close cooperation with the Ministry of Agriculture and Rural Development. In this Body the representatives of all other relevant ministries and national authorities interested in drought mitigation are involved, together with the representatives of the academic and scientific sphere and the non-governmental organizations as well. The National Coordinating Body has an interdisciplinary and inter-ministerial staff in which besides hydrologists, meteorologists, agronomists and forestry experts also engineers, hygienists, economists, catastrophe experts and other relevant professionals are involved.

### 5. Total number of NGOs accredited to the process

The total number of the members of the NCB is 22, among which 6 representatives belong to non-governmental organizations, especially to technical and/or scientific associations dealing directly or indirectly with the problems of drought and desertification. Among the non-governmental organizations could be mentioned the Hungarian Hydrological Society, the Hungarian Society for Agricultural Sciences, the Hungarian Meteorological Society as well as the representatives of the St. Istvan University, Gödöllő and the Corvinus University of Budapest.

## 6. Total number of acts and laws passed relating to the UNCCD

The most relevant acts and laws and/or regulations relating to the UNCCD are as follows:

- National Law No. LXXXI of 1995 on the promulgation of the UN Framework Convention on Biological Diversity
- National Law No. LXXXII of 1995 on the promulgation of the UN Framework Convention on Climate Change
- Parliamentary Resolution No. 47/1999. (VI. 3.) upon Hungary's accession to the UNCCD
- National Law No. CVII of 2003 on the promulgation of Hungary's accession to the UNCCD
- Government decision No. 2142/2005. (VII. 14.) on the preparation and elaboration of the National Drought Strategy and the National Action Programme related to the fight against drought and desertification in the country

## 7. The consultative process

Notwithstanding that Hungary has very good contacts with international technical and scientific organizations in this field, and that Hungarian authorities have excellent official cooperation with neighbouring countries, there is no specific partnership agreement with any of the UNCCD Parties on the joint implementation of the Convention. However, Hungarian officials and experts are interested in participation in *meetings and consultative events* concerning drought mitigation and/or the fight against desertification.

Hungarian experts have actively been participating in the annual congresses and regional conferences of the International Commission on Irrigation and Drainage (ICID), like the congresses in Montpellier, France (2003) and Beijing, China (2005), and in the 21<sup>st</sup> European Regional Conference of ICID – 15-19 May, 2005, Frankfurt (Oder) / Slubice, Germany and Poland, where numerous questions of drought and desertification have been discussed.

Besides, a representative of Hungary is a member of the Group of Experts (GoE) of the UNCCD who has actively taken part in the elaboration of interim reports, project proposals and other technical papers in the frame of the work plan topics of the GoE. The National Focal Point served as one of the vice-presidents of the Sixth Session of the Conference of the

Parties (COP6) and participated in the work of the Bureau of COP6 during the period of 2003-2005.

#### 8. Projects currently under implementation related to the UNCCD

There is a national research and development project dealing partly with water management and water scarcity problems in agriculture, entitled *Agroecology*, under the leadership of the Research Institute of Soil Science and Agro-chemistry (RISSAC) of the National Academy of Sciences, and with participation of several academic and scientific institutions of Hungary. The project is going to give a comprehensive outlook on the different problems of agro-ecological systems, and making proposals for a better and environmentally safe operation of these kinds of systems, with special regard to the most effective use of the national water resources and water retention possibilities under different climatic and ecological conditions.

Another project for the preparation and laying down the foundation of the National Drought Strategy was initiated and sponsored by the Ministry of Agriculture and Rural Development between 2001-2003, in which the experts of several research institutions and universities were involved. This material became an important document and starting point for the formulation of the present Strategy.

## **DETAILED REPORT**

### **Introduction**

Hungary is situated in Central Europe, in the middle of the Carpathian Basin, and belongs to the continental climatic zone with considerable influence by the Atlantic and Mediterranean streams. The natural-geographic conditions are favourable for agricultural production and around 70% of the total area of the country is cultivated. The biggest and most significant area for agriculture is the Great Hungarian Plain, where – and also in other parts of the country – drought is a considerable risk factor, and some signs of desertification can also be found. The Great Hungarian Plain belong to the dry sub-humid and semi-arid climatic belt, and according to the worldwide-used aridity index, the ratio of annual precipitation to potential evapotranspiration (P/PET), Hungary can be identified as an “affected country” under the terms of the UNCCD.

The country suffered from numerous droughts in its history, and drought events have become more intensive and more frequent during the past decades. The epistemic community described that the years between 1984 and 1993 constituted the driest period in Hungary since 1881, and the years of 2000, 2002 and 2003 were droughty and extremely droughty, too. Despite the fact that the agricultural sector – and especially plant production – is the most directly exposed to the harmful impacts of extremely dry conditions, it is also becoming more and more evident that all living organisms, the natural habitat, all other sectors of the economy and a significant part of the society is exposed and suffer from the adverse impacts of drought.

As far as future tendencies are concerned, based on the analyses of climatic data on long term observations and taking into account the recent investigations on the effects of the climatic changes in Hungary, it can be stated that an increase in temperature and a significant decrease in precipitation as well as in average soil moisture content is anticipated, and therefore the interest in the fight against drought and desertification is a priority in the country.



Until now desertification is not a definite phenomenon, but it could be developed first of all in those areas, where soil and habitat degradation processes take place, especially in the middle region of the country between the River Danube and River Tisza, but in some other parts of the country as well. On account of valuable soil conditions and the great importance of agricultural production, the causes of soil degradation have been investigated very intensely in Hungary, and the requirements of soil protection and conservation are mainly built in to the everyday agro-technical practice, and into the best agro-technical technologies. The fight against drought as a first and most important step of combating desertification is of high interest in the country, and all effort should be done for the prevention of the damages caused by droughts. This is the reason why in the frame of the implementation of the UNCCD *drought mitigation and preparedness* are among the most important tasks, and this report is also focusing to that.

**(iii) Strategies and priorities established within the framework of sustainable development plans and/or policies**

One of the most relevant document in which the criteria and requirements of sustainable development is formulated is the *National Development Plan*, which summarizes the required tendencies and necessary actions for the long-term development of the country. First version of the National Development Plan (NDP) was approved by the Hungarian Parliament in 1996 for the period of 1997-2002, and now the second version for 2003-2008 is valid, according to which all the different sectors are obliged to elaborate their own development plans.

As far as the laws are concerned, there are two main statutory provisions adopted by the Hungarian Parliament that are fundamentally important from the aspect of the specific tasks: one is the *Act No. LIII of 1995 on the general rules of the protection of the environment*, another is the *Act No. LIII of 1996 on nature conservation*. Both provide for the most important rules and recommendations which shall be taken into consideration either in further legislation or in practical actions.

Based on these laws, several other legal measures have been developed and adopted, *inter alia*, the *Act No. CXIV of 1997 on the development of agriculture*, facilitating the proper national support for environment-, nature- and landscape protection also in agricultural practices. This Act lists among its main priorities the harmonisation of production activities

with the social interest of preserving the environment and sustainable agricultural development, as well as the better utilisation of the land, and the preservation and improvement of the quality of the land, maintenance, increase and protection of forests, support in improving the quality of agri-environmental management. On the basis of this law and on the requirements of the *National Environmental Programme* (adopted by the Parliament in 1997), the *National Agri-Environmental Programme* was developed, the formulation and introduction of which support the implementation of both the National Environmental Programme and the *National Regional Development Concept*. The establishment of the *Environmentally Sensitive Areas Network* is also a related task that forms a part of the planned measures of the agri-environmental programme.

All of the above mentioned laws and framework legislation constitute the basis of the national plans and strategies in relation with drought, desertification and land degradation in Hungary. Both the *National Soil Conservation Strategy* and the *National Drought Strategy* are in the process of finalization. These documents address the risk imposed by threats arising from these natural disasters, and summarize the necessary steps to be implemented for the mitigation of their harmful effects.

#### **(iv) Institutional measures taken to implement the Convention**

In Hungary, the responsible *national coordinating body* of the UNCCD is the Ministry of Environment and Water, and the *national focal point* is a representative of this Ministry. One of the Hungarian leading experts is a member of the UNCCD Roster of Independent Experts on mitigation of drought and desertification, and also as a member of the Group of Experts of the UNCCD. The experts have active contact with the International Drought Information Center, University of Nebraska, Lincoln, USA.

In the international context, the UNCCD can be declared as one of Conventions of the Rio process. This means that it has significant synergies with the *United Nations Framework Convention on Climate Change* and the *Convention on Biological Diversity*. Consequently, the national coordinating body for the national level implementation of the above mentioned conventions is the Ministry of Environment and Water, and therefore the national focal points of the conventions can work in tight cooperation with each other. The principles and

provisions of the Aarhus Convention are fully taken into consideration in Hungary, as the country is a Party to the Convention.

At the national level, the *National Environmental Programme* for 1997-2002 and its second version for 2003-2008 incorporate drought mitigation issues to handle and tasks to fulfil as long-term objectives. Furthermore, the *National Agri-environmental Programme* identifies land degradation and drought as issues of cornerstone importance, and determines measures for mitigation. Hungary as a Member State of the European Union has prepared its National Development Plan, which determines a frame for future activities, *inter alia*, for drought mitigation actions. All these programmes are in harmony with each other, and serve the overall purpose of approaching sustainable development.

The Ministry of Environment and Water – as the national coordinator of UNCCD – is working in close connection with *other ministries* involved, with special regard to the Ministry of Agriculture and Rural Development, the Ministry of Foreign Affairs, the Ministry of Internal Affairs, the Ministry of Economic Affairs and Transport, and the Ministry of Finance. Other national development strategies are also taken into consideration, such as the *National Hydrological Programme*, which was developed on the International Hydrological Programme of the UNESCO, and the requirements of the *Water Framework Directive of the EU* are also taken into account.

The *National Drought Strategy* (NDS) is in the final stage of acceptance. This Strategy summarises the necessary concepts, methods, steps and sources of prevention and drought mitigation in the country, and provides a basis for further detailed and short-term actions in this field. The Strategy is taking into account other relevant national policies and strategies.

A *National Action Programme (NAP)* on drought mitigation will be prepared on the basis of the NDS.

Beside of these, two other important *national strategies* are under preparation in relation to drought and desertification, namely the Strategy for Sustainable Development and the National Climate Change Strategy; both of these are based on the results and proposals of a recent comprehensive research and development work conducted by the Hungarian Academy of Sciences.

**(v) Participatory process in support of the preparation and implementation of the action programmes**

The whole text of the Convention was translated into Hungarian and made available to the public, and on the recent occasions of the World Day to Combat Desertification and Drought, research institutions organised expert meetings supported by the Ministry of Environment and Water with the aim of focusing on the complex issue of land degradation.

One of the most important organisations in the field of environmental protection is the *National Environmental Council* in Hungary, established in 1996 as an advisory organ of the Government. The Council operates with at most 22 members in order to provide wide-ranging social, scientific, and professional foundation for environmental protection. It takes up position on matters of principle of different environmental programmes, on regulations and decisions relating to environmental protection, and on other environmental issues. In the Council, the following shall participate in equal proportion: a) non-governmental organisations registered with environmental goal, b) representatives of professional and industrial advocacy organs elected according to their own rules, and c) representatives of the epistemic community delegated by the President of the Hungarian Academy of Sciences. The Council elects the chairman from among its members, and the Minister for Environment and Water representing the Government is the co-chairman of the Council.

In Hungary, the operation of the Council constitutes a forum where representatives of business federations, non-governmental organisations and science experts discuss the risks and possible solutions of environmental problems regularly. The Member States of the European Union also pursue different practices as to the level and way of composition in the councils and authorities. In the future, the Council will try to further incorporate its activity into the decision-making mechanism of the Government to a greater extent in order to reinforce its place and role in this process. Especially the following priorities are to be covered in its further activities:

In the participatory process, there is a determining role of *non-governmental organisations, foundations, scientific, education and research institutions*. In Hungary, many such kinds of organisations exist, and a number of them are dealing with water and land degradation issues.

Among significant scientific institutions, the *Hungarian Society of Agricultural Sciences* and the *Hungarian Hydrological Society* should be mentioned, in which different sections are dealing with drought, desertification and land degradation questions.

Environmental protection branches and special courses are in the curricula of most of the Hungarian universities, and most of the research institutions are dealing with special environmental problems. A rather wide range of experts in environmental protection issues are continuously educated and trained in order to solve pollution and degradation problems occurring in the everyday practice, including desertification and drought problems.

**(vi) Consultative process in support of the preparation and implementation of national action programmes**

One of the most effective consultative and preparatory actions was our participation and leading role in the related ICID programmes. The *International Commission on Irrigation and Drainage* (ICID), and its working groups started to deal with drought problems in the year of 1992. ICID – focusing on irrigation, drainage and flood control questions – is practically active in all problems related to agricultural water management. It has been established as a scientific, technical, professional and voluntary, international non-profit and non-governmental organization, and dedicated, inter alia, to enhance the world-wide support of food and fibre for all people. ICID strives to achieve this by improving water and land management, and the productivity of irrigated and drained lands through the appropriate management of water, environment and the application of irrigation, drainage and flood control techniques. ICID is interested in matters relating to the planning, financing and economics of the mentioned fields.

In the frame of ICID, several working groups are operating, among which two are closely connected with drought problems: 1) the Working group on Irrigated Agriculture under Drought and Water Scarcity (WG-IADWS), and 2) the European Regional Work Team on Drought (EWTDR), the latter operating in the frame of the European Regional Working Group (ERWG). Hungary is represented in both, but participation is more active in the work of the EWTDR, which was established on a Hungarian proposal. This is a task force of the ERWG to assist and co-ordinate member countries interested in drought mitigation.

One of the main task of the EWTDRO was to compile a guide – entitled *How to Work Out a Drought Mitigation Strategy* – for summarising all the necessary information which is important to drought prevention, which should be taken into consideration during the elaboration of a drought mitigation strategy, and which can be used in the case of the occurrence of drought for a reduction and/or tolerance of the caused damages. The guide was completed in 1999 on the basis of several earlier initiatives taken and proposals made at former ICID meetings and by individual experts, members of the EWTDRO and other organisations.

Furthermore, Hungary has played an active role in organizing national and international *conferences and workshops on drought mitigation*. A report on these scientific and technical events and their results can be found in the country's First National Report on the Implementation of the UNCCD.

#### **(vii) Measures taken or planned within the framework of national action programmes**

As it was referred to earlier in this report, the National Action Programme will be elaborated on the basis of the National Drought Strategy in the second half of the year 2006. Therefore, herebelow only some elements and past experiences are summarised.

Until the present day, there have been several measures taken by both governmental and non-governmental organisations to mitigate the harmful impacts of drought in Hungary. However, in most cases, those measures have been inadequately consolidated. Most of the measures have been reactive rather than preventive, and the actions have had partial effects. In order to learn as much as possible from the past experiences of drought mitigating measures, it is essential to carefully analyse those measures, and to draw the conclusions of their evaluation as precisely as possible. Attitude towards drought mitigation actions should shift from the crisis management type of actions to *risk management*, where a proactive approach is taken well in advance of drought events, so that mitigation can really reduce drought impacts.

As a result of frequent drought events in the country, Hungarian experts in water management, in agriculture and in agro-meteorology have been involved in drought investigation. *Intensive research work* has been carried out in the following main topics:

- evaluation of the effects of drought events;
- determination of the reasons and circumstances in which drought occur;
- finding out the effects of drought on plant production and animal husbandry;
- developing methods for reduction of harmful impacts of drought.

The results of research works have been discussed, and the experts evaluated the situation within the framework of *consultations and symposia*. One of the most important evaluations of the experience of the drought of 1983 was made by the special group of the Hungarian Academy of Sciences during the next ten years, in which the experts have made:

- mathematical evaluation of climatic data series and climate-yield correlation,
- analysis of plant production on the basis of data gathered on several cultivated plots and plants,
- correspondence analysis of different factors on yield,
- historical evaluation of drought events and the role of the ever existing Hungarian governments in drought mitigation, and
- summary on the future tasks and possibilities.

Among the final conclusions already at that time, the necessity of a *strategy on drought mitigation in agriculture* was raised as a complex system of means and measures for the reduction of drought damages in agricultural production. Also the necessity of the establishment of monitoring systems and the use of the methods of informatics have been emphasised as well as the well organised complex research work on different impacts of drought. The Hungarian Academy of Sciences established a special temporary commission for the coordination of these kinds of research activities.

A significant drought hit the region in 1992, the evaluation of its Hungarian impacts was made in a meeting held in the Ministry of Agriculture, organised by the Hungarian Association of Agricultural Sciences and the Hungarian Hydrological Society. In this conference a manifold and interdisciplinary analysis on the reasons and effects of drought has been made with the clear conclusion that *prevention* is the most important and *preparedness* should be increased including the help of a better forecast service for drought mitigation. Also more effective *international cooperation* has been urged.

Very important part of the fight against drought damages is *plant breeding*: to develop drought tolerant varieties of the cultivated crop species. Especially in the very drought sensitive areas the farmers can use these type of crops and avoid the complete destruction of yield. Hungarian plant breeders are doing continuous research and development work for having a wider offer from more drought tolerant crops.

A new and comprehensive *information system* should be established including mapping of drought prone areas, specific database of relevant meteorological, hydrological, agrotechnical, social and other data, with the help of which a *better forecast* can be given on drought occurrence as well as on estimation of drought impacts.

Based on the results of recent country-wide research works carried out on the better understanding of drought impacts and adequate drought mitigation technologies – both for dry and irrigated farming – have been developed and are available for farmers. In other branches of the economy there is a lack of similar technologies, even some new research work is necessary. However it is imperative that in the National Action Programme a separate chapter should be devoted to new and common research tasks, co-operation possibilities in the field of research and development, and financial resources for solving research priorities in the given region.

One of the most urgent research tasks is *drawing a drought sensitivity map*, not only for Hungary, but for the whole continent or at least some part of it. An international project proposal has been made and sent to the European Commission as an Expression of Interest (EoI) for the Sixth Framework Programme for Research, Technological Development and Demonstration (FP6), but the proposal was not approved by the European Commission.

However, for effective drought mitigation and prevention, it is unavoidably necessary to know: *where are the territories exposed to the most frequent and severe drought events?* – This question could be answered only if the most drought sensitive areas could be determined and drawn on the map of Europe. This kind of a map – drawn on the basis of scientific knowledge and using the well determined calculation methods of drought severity – can be a great help in the realisation of the national – and even regional – drought strategies and action planes, and also in the implementation of international efforts to combat desertification and



drought in the European countries involved, because it shows clearly the most drought prone areas on which all means and measures should be applied to prevent drought damages.

Drawing a drought sensitivity map needs a well determined and commonly accepted method by the help of which drought sensitivity can be expressed, and which can be used as the basic method for the map drawing. Many trials have been made separately in the countries to have good indices expressing drought severity, and – as a result – we know several indices and calculation methods for that purpose. One of the major tasks of the proposed research work is to evaluate the existing calculation methods and find out the best one that can be used for the map drawing. Solving this task needs an international co-operation among scientists and experts of the countries involved in drought mitigation research, and this type of co-operation will accelerate the research activities in all institutions taking part in the project. One country and one institution can not solve this problem alone, because a consensus should be reached among the interested parties both in the methods of basic calculations and in the methods of the map drawing.

One of the most important general preventive actions is *forecasting*, and all the methods awakening to the consciousness in the people giving as wide and detailed information as possible. An *early warning system* should be established and operated as a basis of further and necessary decisions in due time before severe drought situation develops, especially in those areas where drought is occurring frequently. For this, the *drought sensitive regions* should be known in each country involved.

Using and evaluating the existing calculation methods and indices by which the occurrence and the expectable degree of dryness can be continuously calculated and forecast can be made, it is possible to determine the main drought prone areas and to draw a map with the differently sensitive territories of the country or even a greater region. If the method of the calculations and the mapping are the same or harmonised, it is possible to draw the drought sensitivity map for the whole continent as well.

**(viii) Financial allocations from national budget in support of implementation as well as financial assistance and technical cooperation including their inflows**

Financing of drought mitigation actions from the national budget has not always been adequately coordinated. The system of governmental and local authority control, regulation and support should be further elaborated, and the sources and means of compensation or disaster aid should be determined, the use of which can be planned based on the continuous drought calculations. Besides individual drought protection, the insurance system has an important role for those who are suffering the most from drought damages, and also central or regional relief funds and guarantee funds are necessary to establish for people who have great losses due to drought impacts.

According to the information submitted by Hungary to the UNCCD FIELD database, Hungary is determined to continue preventing and mitigating the effects of drought, in co-operation with relevant institutions such as the ICID European Regional Work Team on Drought, the Hungarian National Committee of ICID (mainly technical and scientific support); providing financial resources from the annual budget of the Ministry of Environment and Water and the Ministry of Agriculture and Rural Development.

In Hungary there are completed and ongoing projects concerning drought analysis and the elaboration of the National Drought Strategy and National Action Programme, as it was mentioned above.

**(ix) Review of the benchmarks and indicators utilized to measure progress and an assessment thereof**

Although a separate drought early warning system has not yet been established in Hungary, early warning activities are based on different indices. With the objective of providing a more comprehensive framework for improving early warning and drought monitoring and mitigation techniques, the creation of a regional drought preparedness network for countries with similar geographical characteristics and drought patterns may be useful.

There are *several indices used for drought estimation and forecasting* in Hungary.

At the Hungarian Meteorological Service (HMS) an operational statistical (analogue) technique for long-range forecasting was developed and has been used for 20 years. The forecasts are generated for six months ahead. Temperature and precipitation forecasts are produced as one month average values for ten Hungarian towns, and are issued on monthly basis. The application of the dynamical seasonal forecasts started in 1998, in the frame of which forecasts of precipitation, surface air temperature and mean sea level pressure are given both as ensemble mean anomalies and as probability plots. Programmes are under development for the automatic data-reading from the forecasted fields, for the automatic data processing and verification. To consider drought severity the well-known *Palmer Drought Severity Index (PDSI)* is used. On a country-wide scale both the index values and their spatial extent are important.

In some cases *Standardised Precipitation Index (SPI)* series of 3-, 6-, 9-, and 18-month time scales are calculated. SPI's of shorter time scales can characterise water supply changes in short time periods in the year. One advantage of using SPI is its explicit time scale in contrast to the PDSI which is reported to respond to moisture anomalies on the 6-12-months scale.

Hydrologists and Water Authorities prefer to use the *Palfai Aridity Index (PAI)* for drought prediction and evaluation. The main aim of this method is to calculate the possible situation until the end of the year in case of the given spring conditions. In the base-formula to calculate the aridity index  $PAI_0$  the mean value of the air temperature of the period from April to August was divided by the precipitation depth summed up by the weighted monthly values of precipitation of the period of October to August, and multiplied by 100. The monthly weights for the precipitation values were based on the conditions of moisture-storage and on the changing general water demand of the crops. For more accurate expression of aridity the base-value of the index should be corrected by three other factors, namely with the temperature (hot days) correction factor, the precipitation correction factor, and the groundwater correction factor. Using the calculations made by the PAI the map of the spatial distribution of the different arid zones of Hungary could be drawn as it is presented in the Appendix 1.

*Agro-Hydro Potential (AHP)* is used mainly by agronomists. This index gives the water demand satisfying ability of a certain area for a concrete plant stand existing there by the ratio of the effective water consumption and the water demand. In other words the AHP is the

actual evapotranspiration of the crop stand divided by the optimal evapotranspiration of the same. This index can show to what degree and how long a certain agricultural land is able to satisfy the water demand of the given crop stand living on it, and it is good for the expression of the occurrence of drought and of the different level of the water scarcity as well. For the expression of drought severity it seemed to be good to determine the number of days with water-stress, namely the number of days when the AHP-values are below 0.5. As many the number of water-stress days are, as strong the drought severity of the plant stand or the cultivated area is. The connection between the values of AHP and the potential yields of the given plant can be calculated either for each plot (area) or culture: by this result the strength of the drought effect could be expressed.

The above mentioned indicators constitute the basis of a *nation-wide monitoring system* for drought analysis and forecasting, which is under construction. Based on the use of the Palfai Aridity Index, a partial drought monitoring system is operating in water management and gives information first of all to the experts of the local water authorities interested in drought mitigation. According to our plans this system will be extended and together with the National Meteorological Service we would like to establish a general drought monitoring and forecasting system as well as to create a special data-base for drought analysis.

**(x) COUNTRY PROFILE****REPUBLIC OF HUNGARY**

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Biophysical indicators related to desertification and drought

**1. Climate**

- 1.1 Aridity index: 0.6 (ARI, calculated as the ratio of precipitation [P] and potential evapotranspiration [PET])  
 See also climatical zones of Hungary according to the Seljaninov hydrotermical index (Si) in Appendix 2.
- 1.2 Normal rainfall: 700 mm (yearly average)
- 1.3 Rainfall standard deviation: 500-900 mm

**2. Vegetation and land use**

- 2.1 NDVI (normalized difference vegetation index) → see Appendix 3.
- 2.2 Vegetation cover: 90 % of the total land area
- 2.3 Land use (according to the figures given by the National Statistical Office)

	1989		2003	
	km <sup>2</sup>	%	km <sup>2</sup>	%
Total area	93.030	100.0	93.030	100.0
Cultivated area	81.720	87.8	77.150	83.0
Irrigated:	300	0.3	130	0.1
Rainfed:	81.420	87.5	77.020	82.9
Arable crop land	47.126	50.6	45.000	48.4
Grassland (pasture and meadows)	11.972	12.8	14.150	15.2
Forest area	16.881	18.1	18.000	19.4
Uncultivated area (incl. fishponds and wetl.)	10.903	11.7	15.880	17.0

- 2.4 Surface albedo → see map in Appendix 4.

### 3. Water resources

3.1 Fresh water availability (million m <sup>3</sup> ):	5075.9	(100.0 %)
- groundwater	5070.5	(99.9 %)
in shallow layers:	70.5	( 1.3 %)
in deep layers:	5000.0	(98.6 %)
- surface waters:	5,4	( 0.1 %)
3.2 Fresh water resources per capita (m <sup>3</sup> ):	598.0	
3.3 Agricultural water use (million m <sup>3</sup> ):	0.6	
3.4 Industrial water use (million m <sup>3</sup> ):	4.5	
3.5 Communal water use (million m <sup>3</sup> ):	1.0	
3.6 Fresh water use per capita (m <sup>3</sup> ):	612.0	

### 4. Energy

#### Consumption

- 4.1 Energy use per capita (kg oil equivalent): 3.1 kg OE/capita/year (2004)  
 4.2 Agricultural energy use per hectare (kg oil equivalent): 306 kg OE/ha/year (2002)

#### Production

- 4.3 Energy from renewables excluding combustible  
 renewables and waste (% of total supply): 1.0 %  
 - planned production for 2010: 3.6 % of electric energy

#### Renewables – consumption by sector

- 4.4 Industry (% of total renewable consumption): 30 %  
 4.5 Residential (% of total renewable consumption): 40 %  
 4.6 Agricultural (% of total renewable consumption): 30 %

### 5. Types of land degradation

Soil degradation processes in Hungary are as follows:

- soil erosion – by water and by wind
- soil acidification
- salinization/alkalinization
- physical soil degradation: -- structural destruction
  - compaction
  - surface sealing
- extreme moisture regime: -- overmoistening, waterlogging
  - drought sensitivity
- biological degradation: -- decrease of organic matter content
  - deterioration of soil biota
- unfavourable changes in the nutrient regime
  - leaching
  - biotic and abiotic immobilization
- decrease of buffering capacity, soil pollution (toxicity)

Limiting factors of soil fertility in Hungary (1999):

	Area (1000 ha)	Percent (%) of total
- extremely coarse texture	746	8.0
- soil acidity	1200	12.8
- combined by erosion	348	3.7
- combined by shallow depth	67	0.7
- salinity/alkalinity	757	8.1
- salinity/alkalinity in the deeper layers	245	2.6
- extremely heavy texture	630	6.8
- peat formation (waterlogging)	161	1.7
- soil erosion	1455	15.6
- soil erosion combined with acidity	348	3.7
- shallow depth	217	2.3
- shallow depth combined with acidity	67	0.7

Note: In case of soil acidity combined with erosion or with shallow depth one factor was taken into account.

## 6. Rehabilitation

The necessity and rationality of the *reclamation of soils* with limited fertility depends on economic (cost-benefit) analysis and ecological considerations. The radical amelioration of salt-affected soil, sandy soils or peat-lands requires expensive complex measures, therefore it is not economic at present time. At the same time the saline lakes and soils, wetlands and sand regions are – in many cases – protected ecosystems, habitats of protected plants and/or animals, and they are kept for that reasons. *Rehabilitation of degraded soils* is estimated at and laid down in the National Agri-environmental Programme, and especially in the frame of the Environmentally Sensitive Areas (ESA) network.

### Socio-economic indicators related to desertification and drought

## 7. People and economy

- 7.1 Population (total): 10.090.330 (2005)
  - urban population (percent of total): 65 %
  - rural population (percent of total): 35 %
  - Population density: 108.5 capita/km<sup>2</sup> (2005)
- 7.2 Population growth (annual %): - 0.26 (2005)
- 7.3 Life expectancy (years): - females: 76.5 (2002)
  - males: 68.2 (2002)
- 7.4 Infant mortality rate (per 1000 live birth): 7.2 (2003)
- 7.5 GDP per capita value HUF 1.648.227 (2002)
  - EUR 6.748 (2002)
- 7.6 GNI per capita: -
- 7.7 National poverty rate (% of population): 7.3 (2000)
- 7.8 Crop production (metric tons): 18.858.000 (2002)
- 7.9 Livestock production (metric tons): 11.605.000 (2002)

**8. Human development**

- 8.1 Primary education completion rate (% age group): 72.8
- 8.2 Number of women in rural development (total number): 64.000 (2002)
- 8.3 Unemployment (% of total): 5.8 % (2002)
- 8.4 Youth unemployment rate: - age 15-19: 27.1 % (2002)  
- age 20-24: 11.1 % (2002)
- 8.5 Illiteracy total (% age 15 and above): -
- 8.6 Illiteracy male (% age 15 and above): -
- 8.7 Illiteracy female (% age 15 and above): -

**9. Science and technology**

- 9.1 Number of scientific and academic institutions engaged in desertification-related work (total number): 10

**10. Data sources**

- Statistical yearbooks of Hungary, Hungarian Central Statistical Office, different years
- Publications of the Ministry of Environment and Water, different years
- National Environmental Programme – I (1997-2002)
- National Environmental Programme – II (2003-2008)
- National Agri-environmental Programme (2000-2006)
- National Drought Strategy – draft (2006)
- National Meteorological Service (OMSz)

**APPENDICES**

Appendix 1: Aridity map of Hungary according to the PAI values

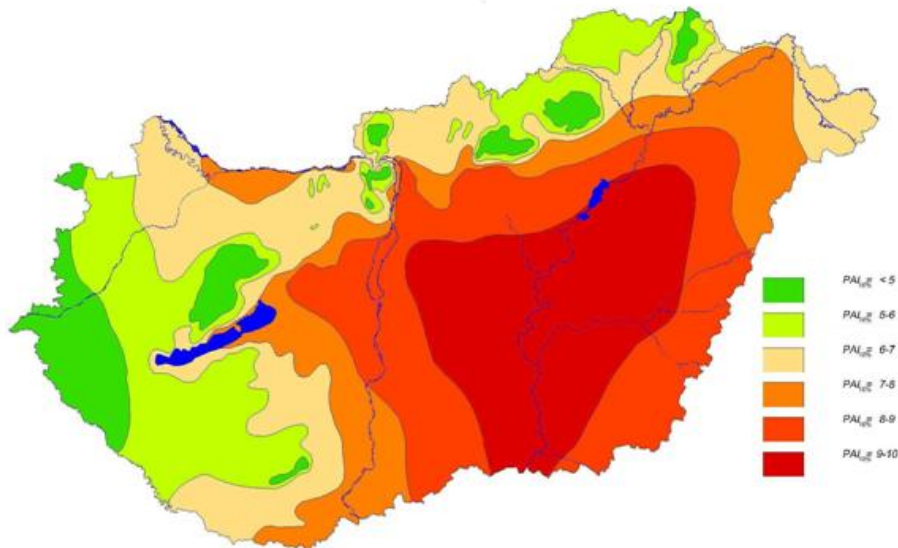
Appendix 2: Climatological zones of Hungary according to the Seljaninov hydrotermical index (SI)

Appendix 3: NDVI map of Hungary and the Carpathian Basin. 2<sup>nd</sup> decade of August, 2005

Appendix 4: Albedo map of Hungary and the Carpathian Basin. 2<sup>nd</sup> decade of August, 2005

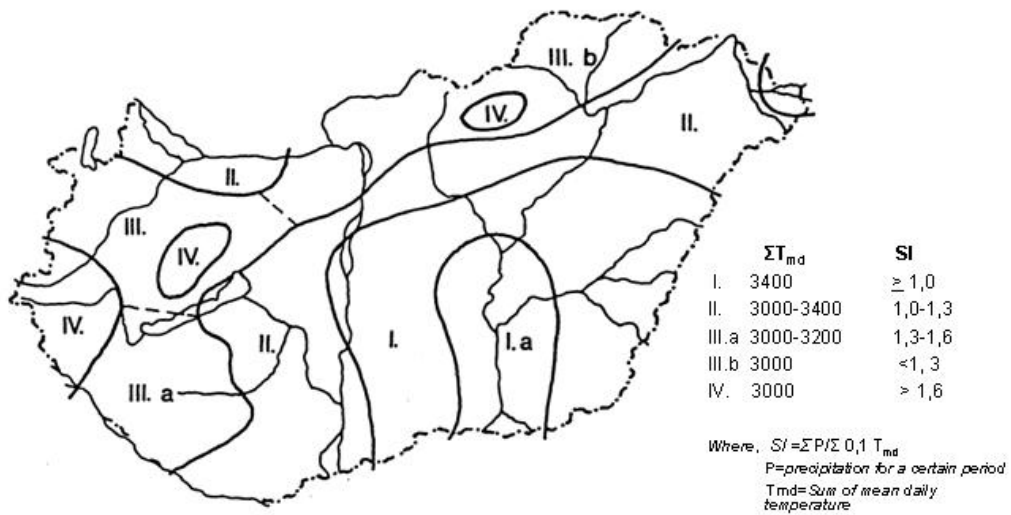


## Appendix 1.



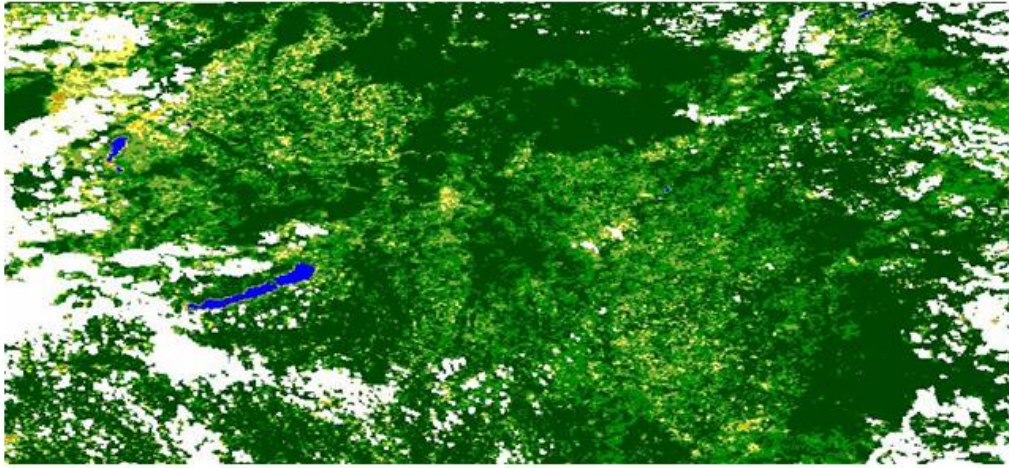
Aridity map of Hungary according to the PAI values

## Appendix 2.



Climatical zones of Hungary according to Seljaninov hydrotermical index (SI)

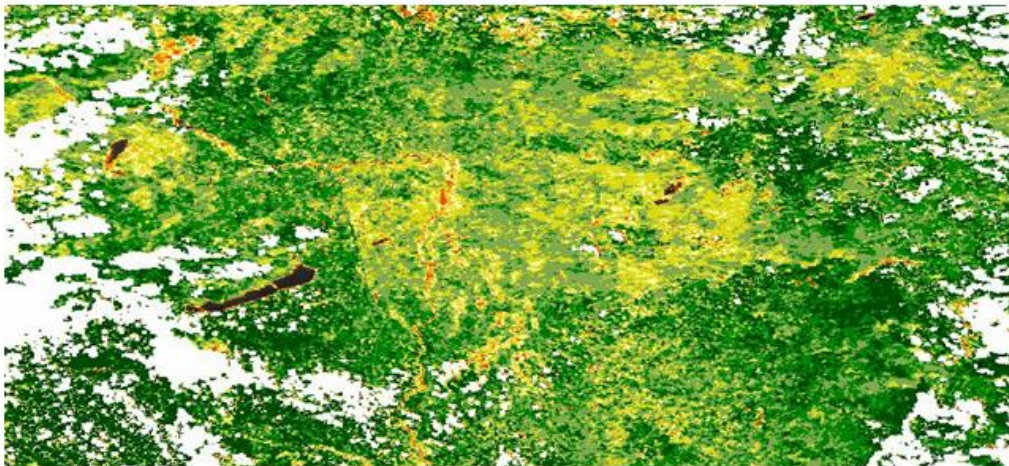
### Appendix 3.



**NDVI map of Hungary and the Carpathian Basin. 2nd decade of August, 2005**

*Note:* Regional albedo maps are archived in each decades in the National Meteorological Service (OMSZ)

### Appendix 4.



**Albedo map of Hungary and the Carpathian Basin. 2nd decade of August, 2005**

*Note:* Regional albedo maps are archived in each decades in the National Meteorological Service (OMSZ)