



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



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

**2002**



**(i) Contents**

<b>(II) SUMMARY .....</b>	<b>3</b>
BACKGROUND .....	3
(I) PARTICIPATORY PROCESSES INVOLVING CIVIL SOCIETY, NON-GOVERNMENTAL ORGANISATIONS AND COMMUNITY-BASED ORGANISATIONS .....	3
(II) LEGISLATIVE AND INSTITUTIONAL FRAMEWORKS OR ARRANGEMENTS .....	4
(III) RESOURCE MOBILISATION AND CO-ORDINATION, BOTH DOMESTIC AND INTERNATIONAL, INCLUDING CONCLUSIONS OF PARTNERSHIP AGREEMENTS.....	5
(IV) LINKAGES AND SYNERGIES WITH OTHER ENVIRONMENTAL CONVENTIONS AND, AS APPROPRIATE, WITH NATIONAL DEVELOPMENT STRATEGIES.....	5
(V) MEASURES FOR THE REHABILITATION OF DEGRADED LAND AND FOR EARLY WARNING SYSTEMS FOR MITIGATING THE EFFECTS OF DROUGHT .....	6
(VI) DROUGHT AND DESERTIFICATION MONITORING AND ASSESSMENT.....	8
(VII) ACCESS BY AFFECTED COUNTRY PARTIES, PARTICULARLY AFFECTED DEVELOPING COUNTRY PARTIES, TO APPROPRIATE TECHNOLOGY, KNOWLEDGE AND KNOW-HOW .....	8
<b>INTRODUCTION .....</b>	<b>10</b>
<b>(III) THE STRATEGIES AND PRIORITIES ESTABLISHED WITHIN THE FRAMEWORK OF SUSTAINABLE DEVELOPMENT PLANS AND/OR POLICIES .....</b>	<b>11</b>
<b>(IV) THE INSTITUTIONAL MEASURES TAKEN TO IMPLEMENT THE CONVENTION.....</b>	<b>13</b>
<b>(V) THE PARTICIPATORY PROCESS IN SUPPORT OF THE PREPARATION AND IMPLEMENTATION OF THE ACTION PROGRAMME .....</b>	<b>15</b>
<b>(VI) THE CONSULTATIVE PROCESS IN SUPPORT OF THE PREPARATION AND IMPLEMENTATION OF THE NATIONAL ACTION PROGRAMME AND THE PARTNERSHIP AGREEMENT WITH DEVELOPED COUNTRY PARTIES AND OTHER INTERESTED ENTITIES... </b>	<b>17</b>
<b>(VII) THE MEASURES TAKEN OR PLANNED WITHIN THE FRAMEWORK OF THE NATIONAL ACTION PROGRAMME, INCLUDING MEASURES TO IMPROVE THE ECONOMIC ENVIRONMENT, TO CONSERVE NATURAL RESOURCES, TO IMPROVE INSTITUTIONAL ORGANISATION, TO IMPROVE KNOWLEDGE OF DESERTIFICATION AND TO MONITOR AND ACCESS THE EFFECTS OF DROUGHT.....</b>	<b>26</b>
<b>(VIII) FINANCIAL ALLOCATIONS FROM NATIONAL BUDGETS IN SUPPORT OF IMPLEMENTATION AS WELL AS FINANCIAL ASSISTANCE AND TECHNICAL CO-OPERATION RECEIVED AND NEEDED, IDENTIFYING AND PRIORITISING REQUIREMENTS.....</b>	<b>31</b>
<b>(IX) REVIEW OF THE BENCHMARKS AND INDICATORS UTILISED TO MEASURE PROGRESS AND AN ASSESSMENT THEREOF .....</b>	<b>32</b>

## **(ii) Summary<sup>1</sup>**

### **Background**

Hungary, situated in Central Europe, belongs to the continental climatic zone. However, the country's weather conditions are influenced by Atlantic and Mediterranean streams. Despite the fact that natural-geographic conditions are favourable for agricultural production and that around 70 per cent of the total area of the country is cultivated, drought is a serious risk factor, especially on the Great Plain. The biggest and most significant area for agriculture is the Great Plain in Hungary, an area which can be declared as dry sub-humid under the terms of the United Nations Convention to Combat Desertification (UNCCD). The Great Plain has been hit by severe drought events.

Moreover, large parts of Hungary belong to the sub-humid and semi-arid climatic belt. The country suffered serious droughts, and drought events have become more intensive and more frequent during the past decades. As far as drought damage is concerned, the agricultural sector is the most directly exposed to the harmful impacts of extremely dry conditions. Besides, natural habitats and all sectors of the economy and a significant part of the society suffer from the effects of drought.

The epistemic community described that the years between 1984 and 1993 constituted the driest period in Hungary since 1881. There is a dangerous decrease identified in the series of the ratio of annual precipitation to potential evapotranspiration (P/PE), according to which Hungary can be identified as an “affected country” under the terms of the UNCCD.

As far as future tendencies are concerned, analyses of climatic data on long-term observations in Hungary demonstrate that a significant decreasing tendency in precipitation and average soil moisture content is anticipated.

### **(i) Participatory processes involving civil society, non-governmental organisations and community-based organisations**

The draft version of the National Drought Strategy provides for the establishment of the National Drought Commission which should serve as an interdisciplinary and inter-ministerial organisation for coordinating the implementation of the Strategy. The Commission should operate in tight co-operation with the National Focal Point, and should include representatives of different research institutions and agencies, corresponding to the complex and interdisciplinary nature of drought and its diverse impacts.

---

<sup>1</sup> The summary is structured in accordance with the Key Thematic Topics for the CRIC review process.

In line with the provisions of the Aarhus Convention, of which Hungary became a Party in 2001, Hungary promotes public involvement and access to information also in connection with the UNCCD.

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

## **(ii) Legislative and institutional frameworks or arrangements**

Taking into account that drought impacts not only agriculture and plant production, but also all living organisms, including human beings, and that damage can occur not only in cultivated fields but also in non-cultivated and nature protected areas as well as in the human society, there is a global need to search for policies and measures to prevent and mitigate the harmful effects of drought, and to improve the preparedness of the whole society. Therefore, Hungary is interested in taking national and international drought mitigation actions. Consequently, the Hungarian Parliament decided upon Hungary's accession to the UNCCD in 1999 (Parliamentary Resolution No. 47/1999 (VI. 3.)). The country's accession to the Convention entered into force on 11 October 1999.

In Hungary, the responsible national co-ordinating body for the implementation of the UNCCD is the Ministry of Environment and Water, and the national focal point is a representative of the Ministry. One of the leading Hungarian experts was nominated and accepted to the UNCCD Roster of Independent Experts. The Act on Environmental Protection, and the Act on Nature Conservation address the objectives of the Convention.

The establishment of the National Drought Commission is underway which should serve as an interdisciplinary and inter-ministerial organisation for co-ordinating the implementation of the forthcoming National Drought Strategy in Hungary. The Commission should include representatives of the most relevant research institutions and agencies, in line with the complex and interdisciplinary nature of drought and its diverse impacts. It is desirable that within the framework of the Commission, at least three Sub-Committees are created, each focusing on the primary needs as follows: a) monitoring, b) impact and vulnerability assessment, and c) mitigation and response.

During the initial phase, the Commission should make an inventory of all forms of assistance that are available from local, state and/or regional authorities in the time of severe drought, and evaluate drought mitigation programmes for their ability to address short-term

emergency situations and long-term mitigation actions. Assistance should be defined in a broad sense in order to include all forms of available technical and relief programmes. The Commission could act based on information and recommendations provided by the Sub-Committees, and response options must be determined for each of the principal impact sectors identified by Sub-Committees; and evaluate programmes at the national and regional levels to assist agricultural producers, municipalities and other stakeholders during the event of emergency.

Hungary has been in contact with the International Drought Information Center of the University of Nebraska (Lincoln, USA). Hungarian scientists and experts have participated in several international organisations aiming at mitigating the effects of drought, most actively in the working groups of the International Commission on Irrigation and Drainage (ICID), where a Hungarian expert functions as the chairman of the European Regional Work Team on Drought. This particular international Work Team prepared and organised several workshops and conferences on drought mitigation, and compiled a Guide for the member countries of ICID entitled *How to Work Out a Drought Mitigation Strategy* (1998). When preparing the National Drought Strategy of Hungary, these guidelines are given full consideration.

**(iii) Resource mobilisation and co-ordination, both domestic and international, including conclusions of partnership agreements**

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. Additional financial resources are needed from different sources to work out the National Action Programme for Drought Mitigation and to operate the National Drought Committee.

**(iv) Linkages and synergies with other environmental conventions and, as appropriate, with national development strategies**

In the international context, the UNCCD can be declared as one of the 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 co-ordinating bodies for the national level implementation of all the three above conventions is the Ministry of Environment and Water, and therefore the national focal points of the conventions can work in tight co-operation 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.

Hungary is committed to fulfil its obligations under the UNCCD, and certain provisions of the Convention are specifically important for the country. Hungary promotes the adoption of an integrated approach when addressing the different aspects of the process of desertification and drought. Besides, within the framework of sustainable development policy, the country has incorporated drought mitigation concerns into national policies and measures. At the national level, the National Environmental Programme for 1997-2002 and the concept of that for 2003-2008 incorporate drought mitigation issues to handle and tasks to fulfil as long-term objectives. Furthermore, land degradation and drought are identified as issues of cornerstone importance that require different measures for mitigation in the National Agri-environmental Programme. Hungary as an Accession Country to the European Union is preparing its National Development Plan within the framework of the accession process, 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.

**(v) Measures for the rehabilitation of degraded land and for early warning systems for mitigating the effects of drought**

The National Drought Strategy, which builds upon national results and international experiences, is in the final stage of preparation as of June 2002, under the guidance of the Ministry of Agriculture and Rural Development. The Strategy will summarise the underlying concepts, methods, steps and sources for preventing and mitigating drought damage in the country, and provide a basis for further actions in this field. The Strategy is being elaborated taking into account the relevant national development strategies, policies and environmental programmes. National Action Programmes on Drought Mitigation will be prepared and elaborated on the basis of the National Drought Strategy, following its future approval by the Hungarian Government.

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 sporadic and 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.

There are several indices used for drought estimation and forecasting in Hungary, serving the primary purpose of early warning. The most widely used indices are the following in Hungary.

At the Hungarian Meteorological Service, an operational statistical (analogue) technique for long-range forecasting was developed and has been used for 20 years. Programmes are under preparation targeting automatic data-reading from the forecasted fields, and automatic data processing and verification.

As for drought severity, the Palmer Drought Severity Index (PDSI) is applied. On a country-wide scale both the index values and their spatial extent are important. In certain cases, the Standardised Precipitation Index (SPI) series of 3-, 6-, 9-, and 18-month time scales are calculated. The shorter time scales of SPI can characterise water supply changes in short time periods in the year.

Hydrologists and water authorities prefer to use the Palfai Aridity Index (PAI) for drought prediction and evaluation. The main aim of this method, which has been designed for the specific features and conditions of the country, is to calculate the possible situation until the end of the year in case of the given spring conditions. The index can be used for making comparison between the wet and/or dry situations of different periods as well as of different areas, and it is also appropriate for some predicting purposes if calculation of PAI values are made continuously.

Agro-Hydro Potential (AHP) is used mainly by agronomists. This index describes 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. This index can show to what extent and how long a certain agricultural land is able to satisfy the water demand of a given crop stand living on it, and it is appropriate for expressing drought occurrence and the different levels of water scarcity.

Although a separate drought early warning system has not been established yet in Hungary, early warning activities are based on the above 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 Central and Eastern Europe is initiated, in which Hungary would be ready to take a co-ordinating role.

**(vi) Drought and desertification monitoring and assessment**

The above mentioned indicators constitute a solid base not only for establishing an early-warning system, but also for constructing a nation-wide monitoring system for drought analysis and forecasting. Based on the use of the Palfai Aridity Index, a partial drought monitoring system is operating in water management and provides information first of all to the experts of the local water authorities dealing with drought mitigation. It is planned that this system will be extended, and a general drought monitoring and forecasting system is planned to be established in co-operation with the Hungarian Meteorological Service, and a special data-base for drought analysis is ahead to be created.

One of the main tasks is to find out common methods and indices for expressing the severity of drought events, and for forecasting more precisely the occurrence of drought not only at the national, but also at the international level. Another important task is to draw a national and a European drought severity map to show the spatial distribution of drought in the countries of the region and in whole Europe. In order to be able to make these plans a reality, concerted actions and tight international co-operation among the countries involved are necessary. Therefore, a project proposal is under elaboration aiming at the creation of an international (European) research team or consortium dealing with the above mentioned problems methodologically and technically. This proposal will be submitted to the European Union's Sixth Framework Program for Research, Technological Development and Demonstration for financial support with the help of which these problems could be solved. Hungary is one of the proposing country of these initiatives and ready to take a leading role in such an international co-operation.

**(vii) Access by affected country Parties, particularly affected developing country Parties, to appropriate technology, knowledge and know-how**

In Hungary, most of the advanced technologies both in agricultural and industrial processing, in the different services, and in the research and development activities are well-known and used. Although cleaner technologies are used in certain areas of production, their utilisation is not widespread. Capital- and investment possibilities of farmers and industrial



producers are limited, therefore they tend to use conventional methods and technologies. The agricultural sector is still in transition, export markets have been re-orientated, the qualitative dimension of agricultural production has been coming in the foreground as opposed to the quantitative emphasis of the past. Therefore, greater dissemination of best available techniques in the drought mitigation practices is a major task for the future in Hungary.

## **Introduction**

Hungary, situated in Central Europe, belongs to the continental climatic zone. However, the country's weather conditions are influenced by Atlantic and Mediterranean streams. Despite the fact that natural-geographic conditions are favourable for agricultural production and that around 70 per cent of the total area of the country is cultivated, drought is a serious risk factor, especially on the Great Plain. The biggest and most significant area for agriculture is the Great Plain in Hungary, an area which can be declared as dry sub-humid under the terms of the United Nations Convention to Combat Desertification (UNCCD). The Great Plain has been hit by severe drought events.

Moreover, large parts of Hungary belong to the sub-humid and semi-arid climatic belt. The country suffered serious droughts, and drought events have become more intensive and more frequent during the past decades. As far as drought damage is concerned, the agricultural sector is the most directly exposed to the harmful impacts of extremely dry conditions. Besides, natural habitats and all sectors of the economy and a significant part of the society suffer from the effects of drought.

The epistemic community described that the years between 1984 and 1993 constituted the driest period in Hungary since 1881. There is a dangerous decrease identified in the series of the ratio of annual precipitation to potential evapotranspiration (P/PE), according to which Hungary can be identified as an “affected country” under the terms of the UNCCD.

As far as future tendencies are concerned, analyses of climatic data on long-term observations in Hungary demonstrate that a significant decreasing tendency in precipitation and average soil moisture content is anticipated.

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

Sustainable development is one of the basic concepts of the Hungarian economy and it has a dominant role in all policies and regulations concerning future actions. This is enforced in the relevant laws and in all national plans, especially in the *National Development Plan*, which summarises the required tendencies and necessary actions for the long-term development of our country.

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 our special 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.

Hungary's accession to the European Union (EU) is of strategic importance for political, economic and social reasons alike. Signing the Europe Agreement, Hungary declared that it will do all in its power to accept and apply the community legislation, the so-called *Acquis Communautaire*, the prerequisite of the accession. The process of the accession to the European Union has arrived to an important phase in Hungary. The legal harmonisation work and the adoption of the *Acquis Communautaire* is well on the way, and negotiations are well

developing. Therefore it is necessary to make steps towards the implementation of the Community legislation.

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.– Under the guidance of the Ministry of Agriculture and Rural development, the *National Soil Conservation Strategy* and the *National Drought Strategy* are in the process of preparation. These address the danger and risk of the threats of these natural disasters, and summarise the necessary steps to be done for the mitigation of their harmful effects.

Being convinced that drought is influencing not only agriculture and plant production, but at the same time all living organisms including domesticated and wild species of plants and animals, and also human beings, and damages can occur not only in cultivated fields but also in non-cultivated and nature protected areas as well as in the human society, there is a global need to find out the means and measures against harmful effects of drought, and to create some variables in space and time due to influence the preparedness of the whole society. Consequently the Hungarian Government decided to accede to the UNCCD, and this was approved by the Parliament with the Resolution No. 47/1999 [VI.3.] in 1999. Our experts took part in several international organisations aiming at mitigating drought damages, most actively in the working groups of International Commission on Irrigation and Drainage (ICID), where we are chairing the European Regional Work Team on Drought. This international work team prepared and organised several workshops and conferences on drought mitigation, and compiled a Guide for the member countries of ICID with the title *How to work out a Drought Mitigation Strategy* (1998).

#### **(iv) The institutional measures taken to implement the Convention**

In Hungary, the responsible *national co-ordinating 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 was nominated and accepted to the UNCCD Roster of Independent Experts on mitigation of drought and desertification. We 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 co-ordinating 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 co-operation 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 the concept of that for 2003-2008 incorporate drought mitigation issues to handle and task 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 an Accession Country to the European Union is preparing its National Development Plan within the framework of the accession process, 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 co-ordinator of UNCCD – is working with close connection with the *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 for example the *National Hydrological Programme*, which was developed on the International Hydrological Programme of the UNESCO, and the requirements of the new *Water Framework Directive of the EU* are also taken into account.

Based on our own results and the international experiences – the *National Drought Strategy* (NDS) is in the final stage of preparation in 2002, under the guidance of the Ministry

of Agriculture and Rural Development. This Strategy will summarise the necessary concepts, methods, steps and sources of prevention and drought mitigation in the country, and provide a basis for further detailed and short-term actions in this field. The Strategy is taking into account the other relevant national development strategies. According to the existing plans, the National Drought Strategy will be finalised in the next few months and introduced to the Government of Hungary for acceptance during the autumn of 2002.

The draft version of the NDS contains, inter alia, the establishment of the *National Drought Commission* (NDC) as an interdisciplinary and inter-ministerial organisation for co-ordinating all the works and activities against drought and for the implementation of the National Drought Strategy in Hungary. This Commission can act on the information and recommendation of the impact assessment sub-committee, and evaluate the state and regional programs available to assist agricultural producers, municipalities and others during the time of emergency. The NDC should include representatives of the most relevant mission agencies, recognising the complex and interdisciplinary nature of drought and its diverse impacts. It is most desirable that in the frame of the Commission at least *three sub-commissions* be created, each focusing on the primary needs as follows: a) monitoring, b) impact and vulnerability assessment, and c) mitigation and response.

During the initial phase, the NDC should make an inventory of all forms of assistance available from local, state and/or regional authorities in the time of severe drought, and evaluate these programs for their ability to address short-term emergency situations and long-term mitigation programs. Assistance should be defined in a very broad way to include all forms of technical and relief programs available. Rational response options must be determined for each of the principal impact sectors identified by the impact assessment sub-committee. A *National Action Programme (NAP)* on drought mitigation will be prepared and worked out on the basis of the NDS, following its approval by the Government.

### **(v) The participatory process in support of the preparation and implementation of the action programme**

The draft version of the National Drought Strategy provides for the establishment of the National Drought Commission which should serve as an interdisciplinary and inter-ministerial organisation for co-ordinating the implementation of the Strategy. The Commission should operate in tight co-operation with the National Focal Point, and should include representatives of different research institutions and agencies, corresponding to the complex and interdisciplinary nature of drought and its diverse impacts.

In line with the provisions of the Aarhus Convention, of which Hungary became a Party in 2001, Hungary promotes public involvement and access to information also in connection with the UNCCD.

The UNCCD was translated into Hungarian and made available to the public, and on the recent occasion of the World Day to Combat Desertification and Drought, research institutions organised an expert meeting 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 programs, 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 members can jointly develop common or minority opinion. So far, no similar institution operates in the country, and even in the neighbouring countries no environmental and nature conservation advisory body with similar authorisation exists. 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:

- To promote and stimulate harmony among the medium-term strategies of the ministries having been drafted so far, taking into account the international – first of all the European – requirements.
- To draw up a report on “Hungary’s Environmental Vision”, outlining a future concept, analysing the relationship and problems between sustainability and economic-social development.
- To aim at constructive co-operation with the ministries involved, therefore initiating consultations on their legislation and development programs that in accordance with its social advisory role could express opinion already on concepts.

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) The consultative process in support of the preparation and implementation of the national action programme and the partnership agreement with developed country parties and other interested entities**

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 from 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 organizations, 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 (ERWTD), the latter operating in the frame of the European Regional Working Group (ERWG). Hungary is represented in both, but we are more active in the ERWTD, which was established on a Hungarian proposal. This is a task force of the ERWG to assist and coordinate member countries interested in drought mitigation.

One of the main task of the ERWTD 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 ERWTD and other organisations. The different parts of the guide is summarised as follows.

The *introductory part* determines clear definitions of the relevant concepts concerning drought. There should be distinguished the differences between e.g. dryness and drought, and here should be formulated the aim of the strategy as well.

In the *second chapter* some drought occurrences are quoted from different parts and countries of the World. The ICID Guide gives examples from recent drought events from Hungary, Yugoslavia, Romania and Croatia.

The *third chapter* deals with the drought analysis, examining first the climatic conditions and hydrological factors causing drought, secondly quoting the human made effects, especially the agronomic circumstances, and thirdly analysing the role of soil types and soil conditions in drought occurrence.

The *fourth part* gives the inventory of the harmful impacts and damages of drought, specifically in the given country or region. Among these in first case the directly effected water users should be introduced and analysed, namely the different branches of agricultural production, the different branches of industry, especially food industry, and the different services, which mostly suffer from drought. Also the environmental impacts on natural resources, habitats and ecosystems, natural protected areas, national parks should be determined, and combined environmental effects studied in this part of the Strategy.

Among indirect effects of the trade conditions, especially the import-export relations, financial affairs and social impacts on public health, on employment/unemployment, on politics and foreign affairs, and on tourism should be evaluated. Some beneficial effects of drought should be examined, too, e.g. mosquito reduction, reduced cost for clearance of snow during winter drought, improvement efficiency in water use and water quality control, and the control of overproduction in agriculture. It have to be strongly point out that intensive research work is urgently needed in the field of further beneficial effects of drought.

In the *chapter five* the measures taken so far against harmful impacts of drought damages should be taken into account. In most cases unfounded, not quite well consolidated, highly improvised measures have been taken during – or even after – recent drought events. The steps were mainly succeeding and not preventing the damages, the actions were mainly stop-gap type actions with partial effects. Also the attitude and reaction of the society on drought should be analysed, which is in most cases strange and not understandable. In this respect the role of the media have to be pointed out as well.

*Chapter six* is the most important part for a strategy, giving the means and methods of the complex fight against drought damages. First the assessment and forecast of drought events should be studied, determining the calculation methods and indices used in the forecasting process. Establishment of a monitoring system in meteorology and in water management as well as in other branches of the economy is an important step. To draw up management plans in agriculture and forestry can help to mitigate drought damages in these sectors. Extension

services and media programs should be used for increasing awareness of farmers and other professionals on potential drought events. Key question is the determination of prevention methods, damage reduction instruments and toleration of drought damages. Among prevention methods supply-oriented and demand-oriented measures, and impact- and losses minimisation methods can be distinguished.

The instruments of *damage reduction* are manifold. There are agricultural methods, like optimum land use, better crop pattern, changes in the elements of agro-technology, complex land reclamation methods, improving plant breeding for better drought tolerant crop varieties, elaborating of authority system for control, regulation and support of drought damaged farmers, determining the sources and means of compensation or disaster aid for those who suffer from great income losses caused by drought, developing special insurance system for drought damages, establishing relief funds and/or guarantee funds for those who lost their yields or properties because of drought, etc.

*Toleration* means consciously counting on some risk, limitation or losses of yield or income. Therefore it is important to determine the tolerable level of losses by risk assessment, to set up priority lists for toleration of deficiencies caused by drought, and to draw up case studies on farm and/or company level for determining toleration, prevention and reduction measures for damage minimisation.

Key questions are the *organisation and co-ordination* questions, too, among which first of all the followings should be answered:

- How to organise the formulation and interpretation of the national drought strategy?
- How to organise the determination of the tasks of the different participants?
- How to organise the compilation of the action program on the systems of measures?
- How to establish the National Drought Commission for the realisation of the strategy?

Especially the latest has of great importance, the detailed explanation of which should be included in a strategy.

As far as *international co-operation* is concerned, the role of the neighbouring countries have to be clarified, where the potential collaboration of the countries concerned should be organised. The contact with international organisations such as the UNCCD, ICID, or others should be determined as well.

Also the needs for *research and development* as well as *education and training* should be analysed in a strategy. In most cases new types of research work are needed for summarising and synthesising the results gained so far, for systematisation of the results and

experiences according to a new classification of the themes: ecological, technological, economical and sociological questions of drought should be differentiated. It is important to find out new sources and funds for financing drought research.

Educational and training programs should be started for better understanding of drought problems among the public, to increase public awareness and preparedness for the coming drought events. Special media awareness program is necessary to convince journalists about drought problems and mitigation possibilities, and long-term educational programs should be established for all groups and economic sectors.

A glossary of terms and indices, and a collection of recommendations for potential risk reduction actions are advised to attach in appendices to the Strategy.

One of the major *future task* of the co-operation under the guidance of the ERWTD of ICID could be the preparation of a Regional Network for Central and Eastern European Countries, and to draw up the European drought sensitivity map which can be a good basis of any further actions against harmful drought effects.

Furthermore, Hungary has played an active role in organising *conferences and workshops on drought mitigation*. Budapest was the host and Hungarian National Committee of ICID was the main organiser of the *16<sup>th</sup> European Regional Conference of ICID*, in 1992, one special topic of which was devoted to drought problems. Following the recommendations of this Conference, the next ICID *International Workshop on Drought in the Carpathians' Region* was organised in 1995, Budapest-Alsógöd, Hungary, with the participation of most Central and Eastern European countries. The Proceedings of the Workshop contains introductory and national papers as well as the 32 scientific papers presented in the Workshop. The **Declaration** adopted by the participants of the Workshop was as follows:

„Participants of the Workshop coming from the countries of the Carpathian Region (Austria, Bulgaria, Croatia, Hungary, Poland, Romania, Slovenia, Ukraina, Yugoslavia) are convinced that people in Europe - especially in the Central, Eastern and Southern part of the continent, including the Carpathian Basin - are facing with increasing impacts of drought on the natural environment and socio-economic activities. National papers as well as individual contributions having been presented in the Workshop show that drought occurred more frequently in the last decades than earlier, and caused greater damages in several parts of life, but the most severe effects of drought could have been realised in agriculture, first of all in plant production. Therefore the attention of people, specialists and politician should be drawn more often and more accurately on the dangers concerning drought, and at the same time

efforts should be made for the forecasting, prevention, elimination, and in some respect for reduction and tolerance of drought effects in each countries concerned.

Because of the natural, ecological, and environment conditional unity of the Carpathian Basin, the countries of this region are linked together by interest in a common cause to develop and establish a more conscious, more substantial, better organised Cupertino in environmental management in general, both in governmental and non-governmental fields, among institutions of research, education, management, administration, and politics. The first stimulator and executor of this kind of co-operation could be the *water*, which does not recognise political boundaries, but consider natural conditions and ecological units only, and which can be either too much or too scarce, or sometimes too polluted.

*Drought*, as one of the main form of water scarcity, can be the most important "co-operator", with whom the Cupertino is a common interest for all parties concerned. Recognising this common interest the participants of the Workshop express their intention of co-operation by the adoption of the following tasks and recommendations.

1. A permanent *Working Group for Drought in the Carpathians' Region should be established* in the frame of ICID and by the promotion of the National Committees of ICID in the countries concerned. Each National Committee joined voluntarily to the Working Group has the right to delegate two permanent representatives and necessary number of experts into the Group.

The Working Group will be open to every European countries, but first of all the participation of the representatives of the countries of the Carpathians' Region are expected. Sessions of the Group will be held yearly (once a year) always in a different participating country on a rotation basis, for discussion of the actual problems and elaboration of common tasks concerning the fight against drought...

...2. For laying the foundation of the mutual information a *common data-base should be established*, practically at the co-ordination centre of the Working Group. This *data-bank* on necessary data for evaluating drought situations could be set up by the co-operation of the participants and it would be open to all participating countries. Details of the setting up of the data-base will be discussed and formulated later in the program of the Working Group.

3. A European - or a Carpathian - *drought sensitivity map should be drawn* by the co-operation among the researchers and/or institutions of the countries concerned, using as a first step the Pálfai-Petrasovits method proposed...

...4. Based on the data-bank, the drought sensitivity map, the results of research work, and the practical experience *national and even international drought strategies* could be elaborated, in which all the steps, methods, and sources of the fight against drought should be summarised. Formulation of the first draft of such a regional (or European) drought strategy, with special regard to the Carpathian Basin, could be a common task of the experts of the European countries gathered round into the ICID Working Group for Drought in the Carpathians' Region.

5. Integrated handling of drought problems needs an effective *summary and systematisation of the results of different fields of drought research*. Sub-systems of such a classification could be *drought ecology, drought technology* (concerning plant production and animal husbandry), *drought economy*, and *drought sociology*. This kind of categorisation needs also new approach and new type of co-operation among the persons and institutions concerned. Laying the foundation of this kind of co-operation will be one of the important task of the Working Group to be established.

6. It is necessary to find out and *create new national and international sources* for increasing the financial background of research and development work for drought prevention, and for increasing the public information about drought. All efforts should be done to gain the favour and support of potential governmental and private sponsors for that activity. Also the international organisations, like FAO, WMO, ECE, and others are asked to support this work.

7. It is necessary to carry out same or similar field experiments using the same methods, soil type, and crops for study the effect and intensity of drought. Formulation of the unified method, circumstances, and evaluation of results of these type of common field experiments could be an important task of the Working Group...

... Participants of the Workshop are convinced that concrete and practical steps should be done for a better and common preparedness against drought. Therefore they ask the responsible leaders of governmental institutions and non-governmental organisations to help with all possible means their efforts in realisation of the above-mentioned goals for a better life of the people in the Carpathians' Region.”

The *Central and Eastern European Workshop on Drought Mitigation* was the next meeting, organised by several Hungarian organisations in 2000, Budapest-Felsögöd, with the active support of UNCCD and FAO. ***Conclusions and recommendations*** of the Workshop have been formulated as follows:

“1. Participants of the Workshop - after discussing the papers and propositions presented - agreed in that an effective drought mitigation should be based on a comprehensive view of drought, because drought is not simply a deficiency of precipitation, but a more complex phenomenon which influences the whole society.

2. Recognising the significant economic, social and environmental impacts of drought in the CEE countries, as well as in other drought-prone European regions, the participants of the Workshop recommend that each country develop national strategies and national action programmes to mitigate drought, and establish international co-operation for solving related common problems as follows:

2.1 Encourage and help non-member countries to join the United Nations Convention to Combat Desertification, recognise the important role of UNCCD in combating desertification and land degradation, and support each other in drought mitigation.

2.2 Establish a common methodology for drought preparedness and mitigation programs and policies including forecasting, early warning system, risk assessment, characterisation of drought severity through common indicators and maps, etc., using the SPI index for international comparison. Any other indices are appropriate at national level. To facilitate the establishment of this common methodology, the Workshop participants recommend the creation of a regional network of scientists, policy makers, and other experts.

2.3 Request authorities, scientific institutions and people organisations involved in combating land degradation to link their activities with efforts aimed to monitor and mitigate drought effects in order to promote sustainable development and nature conservation in drought-prone regions.

3. Taking into account the importance of US practice and experience in drought mitigation and planning, the Workshop participants recommend the continued involvement of the US National Drought Mitigation Center in future European co-operation/collaboration, and the participation of US experts in the proposed regional drought mitigation projects.

4. Drought mitigation experts and institutions from any other countries are invited to participate.

5. Italy, on behalf of the Northern Mediterranean Annex of UNCCD, expressed the intention to foster collaboration between the Mediterranean and CEE regions. Participants of the Workshop accept this proposal and express their gratitude for that, and welcome coming opportunities for collaboration under the provision of Annex V to the UNCCD.

6. The participants of the Workshop ask the Hungarian authorities responsible for drought management to create an international interim task force with the participation of the

representatives of countries concerned, and co-ordinate the next steps to realise the above mentioned proposals, and to find out and identify relevant international bodies for the necessary participation and financial support.

This document, accepted by the participants, and the subsequent more detailed proposals will be sent as soon as possible to the principal national authorities of the CEE countries independently of the fact that they are members or non-members of the UN Convention to Combat Desertification and Drought.”

Hungary took part also in the *First Balkan Drought Workshop*, in 1998, Zajecar, Yugoslavia, and a Hungarian representative is the member of the Balkan Work Team on Drought established on the mentioned Workshop.

We have active contact with the *International and National Drought Mitigation Center* at the Nebraska University (Lincoln, USA). Their actions and results achieved give an excellent example on the successful drought mitigation practice and policy in the United States. The Director of the Center recently announced a proposition to establish a Global Drought Preparedness Network. In the frame of this Network – among the 5 or 6 regional networks – a *Central and Eastern European Regional Network* has been suggested to organise helping the countries involved in their better and more effective fight against drought damages. Hungary is ready to play an active role in this Network.

It is worthwhile to mention that Hungary took active part in the *Consultation Meeting to Prepare and Implement UNCCD in the Central and Eastern European Countries*, held in Prague, Czech Republic, 3-4 September 2001. In our country report and presentations there we explained our efforts and plans for drought mitigation, and expressed our willingness to take part actively in the implementation of UNCCD not only in our country, but also in the region.

Finally the last event concerning the topic was the *International Conference on Drought Mitigation and Land Desertification*, organised in Bled, Slovenia, 21-25 April, 2002. Hungarian experts took part both in the preparation and in the arrangement of the conference, on which further co-operation actions have been decided for drought mitigation. Based on the 5 key-note speeches and the lectures performed and discussed during the 4 main sessions and 2 sub-topic sessions of the Conference as well as the resolution of the parallel Work Team meetings of the European Regional Working Group of ICID the following ***conclusions and general recommendations*** have been formulated.

1. “However drought is occurring time-to-time in our life and its returning is unforeseeable, the *fight and preparedness against drought damages should be continuous*.”



2. All countries facing with frequent occurrence of severe droughts should have a definite *drought mitigation policy*, on the basis of which a *National Drought Strategy* should be worked out and drought mitigation short term *action programs* should be developed and implemented.

3. International – bi- or multilateral – *co-operation among countries involved* in drought mitigation is advisable for solving common problems, developing common methods, and performing common actions against harmful impacts of drought, and to prevent desertification in their territories.

4. Best way to co-ordinate the necessary actions for drought mitigation is to establish a *National Drought Commission* in each country involved, in which all representatives of the responsible agencies are involved.

5. Further *active research work and plant breeding activity* is necessary to find out new species and varieties of plants with good or even excellent drought tolerance, but usable for advanced production for fodder and food crops in drought prone areas.

6. *New methods of water saving techniques*, best agricultural management practices and soil cultivation methods for dry and irrigation farming should be developed and put into the practice.

7. *Research work for evaluation and comparison of different indices* used parallel in drought estimation/characterisation should be made widely and intensively to show the validity and usability of these indices in certain area.

8. *Commonly used method* should be worked out *for the interested European countries* for drought characterisation using parallel the Standardised Precipitation Index (SPI) and a combination of local indices.

9. Participants of the Conference are ready to establish the *Regional Network of Drought Mitigation/Preparedness in the Central and Eastern European region* to help each other in the fight against drought damages.

10. Participants of the Conference expressed the necessity of organising an expert team or consortium for the elaboration of the methodology and *drawing the European Drought Sensitivity Map* with the participation of the representatives of the European countries interested.”

**(vii) The measures taken or planned within the framework of the national action programme, including measures to improve the economic environment, to conserve natural resources, to improve institutional organisation, to improve knowledge of desertification and to monitor and access the effects of drought**

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 sporadic and 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 the frequent drought events in the country, Hungarian specialists in water management, in agriculture and in agro-meteorology have been deeply involved in drought investigation. *Intensive research work* has been extended to the following main topics:

- evaluation of the effects of drought events;
- determination of the reasons and circumstances in which severe 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 explained and discussed, but after some serious drought events the experts evaluated the situation within the framework of *consultations and symposia*. One of the most important evaluation 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 in that time had arisen the *strategy of drought mitigation in agriculture* 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 co-ordination of these kinds of research activities.

A serious 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 a more effective *international co-operation* has been urged, first of all among the countries of the Carpathian Basin.

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 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 in similar technologies, even some new research work is necessary. However it is imperative that in the national drought strategy 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 task is the *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 forthcoming Sixth Framework Programme for Research, Technological Development and Demonstration (FP6).

For an 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 – or at least part of it. 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. Therefore a special research team or consortium should be established and maintained directly to this particular task in the frame of a Network of Excellence offered by the European Commission as a new form of organisation especially for common activities and common research works in different tasks. The topic of the project fits into the priorities of the thematic areas of the research in FP6, namely into the Theme entitled 1.6 Sustainable Development, Global Change and Ecosystems.

As it was shortly mentioned above the *main aim* of the project is to *construct and draw a drought severity map for Europe*. This should be based on the hydro-meteorological data collected and the internationally used indices constructed for expressing drought sensitivity in a certain area.

One of the most important general preventive actions is the *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.

The major objectives of the project *can be summarised as follows*:

- to organise a research team or consortium of experts (representatives of research institutions) which is ready to work together for solving the methodological problems of a drought severity map;
- to determine the detailed and common methodology of the work and indices on calculating/constructing drought sensitivity in different areas of Europe;
- to make the necessary calculations of drought sensitivity using the relevant hydro-meteorological data collected in the different countries;
- to draw the drought sensitivity map in the participating countries;
- based on the different country maps to draw the European Drought Sensitivity Map and to distribute it in Europe (and world-wide).

*Main tasks* of the research project – or better to say the major questions to be answered – are the followings:

- What kind of time-intervals should be used for the basic calculations?
- What kind of hydro-meteorological indices should be used in the calculations? (SPI, PAI, or others?)
- What will be the best scale of the maps on which drought sensitive areas are shown?
- How the soil conditions and existing soil maps could be taken into consideration?
- How the crop cover could be taken into account?
- How can be combined the maps showing the different ecological effects?
- What is the role and usability of GIS in the mapping process?
- Only one map or a series of maps are necessary to show the different severity areas?

- According to which aspects could be the final series chosen?

These main questions – and of course other more – should be answered step by step during the development process of the project.

The *implementation period* of the project is 36-40 months that should be divided into several – shorter or longer – phases. The result of the project will be a map and some description either on the methodology used or on the usage of the map.

The European Drought Sensitivity Map – including the separate country maps – could be used widely in implementing the national drought strategies and action planes, and also in the implementation of international efforts to combat desertification and land degradation, and it serves to help in the shaping of sustainable development in Europe.

Participants of the research team or consortium will join on a voluntary basis from the European countries involved in drought mitigation, especially from the Southern, Central and Eastern European countries, preferably the active members of the European Regional Working Group of ICID. Each country is obliged to nominate one institute and one expert from this institute as responsible representative (contact person) of the participating country. During the implementation of the project the participating countries should include as many collaborating institutions and/or experts as they feel necessary.

The Szent Istvan University (Hungary), and the proposer, who is a University Professor there and also the Chairman of the European Regional Work Team on Drought of ICID, is ready to play a co-ordinating role in the organisation and establishment of the research team in the frame of a Network of Excellence.

**(viii) Financial allocations from national budgets in support of implementation as well as financial assistance and technical co-operation received and needed, identifying and prioritising requirements**

Financing of drought mitigation actions from national budget has not been adequately managed, it has been in numerous cases inadequately founded, not quite well consolidated and co-ordinated among responsible authorities and organisations. The system of governmental and local authority control, regulation and support should be 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. Beside of 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, as it was mentioned above. Further financial resources are needed from different sources – national and/or international – to work out the National Action Programme for Drought Mitigation, and to operate the National Drought Committee.

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

Although a separate drought early warning system has not been established yet in Hungary, early warning activities are based on the above 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 Central and Eastern Europe is initiated, in which Hungary would be ready to take a co-ordinating role.

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. Programs 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. The following categories were applied to evaluate drought severity:

- drought is moderate if PDSI values  $<-2.0$  extend over more than 50% of Hungary,
- drought is severe if PDSI values  $<-3.0$  extend over 33% of the country,
- drought is extreme if PDSI values  $<-4.0$  covering at least 20% on the nation's territory.

These categories, while somewhat arbitrary, were selected because more severe droughts have occurred almost continuously during the period 1983-1995.

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.

*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.

Investigations and measurements of droughts in Hungary show that the climate in this country is determined mainly by the large-scale circulation patterns of maritime, continental and Mediterranean air masses, modified by the topography of the basin. This results in

increased sunshine, less precipitation, weaker wind, greater amplitude of daily and yearly temperature variation range and great spatial variability of precipitation (annual mean maximum is 879 mm, while minimum is only 453 mm). The mean annual temperature is about 10°C and exhibits a zonal pattern modified by the altitude. The distribution of precipitation over Hungary is uneven as it is apparent from Figure 1. The most humid parts of the country in the West receive somewhat less than 900 mm of rain per year, about twice the precipitation of the driest areas in the Hungarian Plain, which is the most important agricultural area of the country. In the Hungarian Plain climate is characterised by a tendency for dryness and often insufficient rain for agriculture during summer months. The highest monthly precipitation values are measured in June (60-90 mm), and February was the driest month. While, on the one hand side, monthly precipitation can exceed 100 mm or sometimes even 200 mm in any month, on the other hand side months without any rainfall may occur any time of the year. The growing season (April-September) exhibits even larger variations regarding monthly precipitation sums.

Historical records of extreme meteorological events were collected for the Carpathian Basin. The occurrence and characteristics of historic droughts in Hungary have been analysed. It was found that droughts have been recurring in the past century. Historic references suggest that although extremely dry periods occurred already before the beginning of regular meteorological observations, e.g. between 1779 and 1794, the series of severe droughts from 1983 to 1995 is rather exceptional. PDSI series between 1881 and 1995 were analysed statistically at 15 locations in Hungary. Both linear regression and the Mann-Kendall test resulted in a significant decrease of the PDSI at most of the stations. Analyses of drought occurrence suggested an increase in the frequency of droughts in different severity classes.

At first, the two tests have been applied to the PDSI and SPI index series ending in 1995, then series ending in 1999 were used. Regarding PDSI, the tests indicated significant (1% to 5%) increasing drought frequency at a number of stations, mostly on the Hungarian Plains. The second test indicated that droughts tend to occur in spells of years even where the first test failed to indicate drying tendency. This result suggests that in successive years in which PDSI values under certain thresholds recur are more probable than individual occurrences. Tests 1 and 2 when applied to PDSI series until the end of 1999 resulted in similar outcome. In accordance with the expected behaviour, the test statistics are smaller and their significance is sometimes reduced than in the previous case due to the recent spell of wet years. However, the general characteristics remained the same.

SPI index series of 3, 6, 9 and 18-month time scales have been 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.

The 3-month SPI revealed different patterns than the PDSI discussed above. They also indicated existing drying tendencies, but at more defined periods of the year. According to these series, drying occur mostly in late spring – early summer months and during late autumn. Both periods play a very important role in agriculture, as the first is the time of germination and sprouting, while the second is after harvest, when soils should fill up with moisture for the next vegetative period. Therefore drying during these important phases can have crucial effects on agricultural production. Tests on longer SPI series also indicated that the recent period has been dryer, but, similar to the PDSI results, the significant results occurred in wider interval within the year.

Test 2 when applied to the SPI series resulted in much fewer significant test statistics than when applied to the PDSI series. This can suggest that the clustering feature found earlier could be associated to the PDSI characteristic, that it has a tendency to be stuck at negative or positive values.

In Hungary, the sequence of years has recent shifted from dry to wet period, this change is well represented in the drought index series, which have increased in value from moderately dry category to extremely wet, especially in the east and south-east Hungary. Despite the above sharp changes, statistical tests indicate significant drying tendency over the past hundred years. The statistical significance of the test statistics have been reduced, but the general picture remained the same, which is a sign of the stability and reliability of the tests as well as their output. Increased statistical significance occurred at some stations and months, which may be explained by shift of the precipitation maximum from one month to an other. These differences can be connected with dry and wet years and may be the result of climate variability. Results from the periodicity test suggested differed for PDSI and SPI series. This behaviour may be the result of the PDSI tendency to be stuck to large negative or positive values.

In Hungary, most of the advanced technologies both in agricultural and industrial processing, in the different services, and in the research and development activities are well-known and used. Although cleaner technologies are used in certain areas of production, their utilisation is not widespread. Capital- and investment possibilities of farmers and industrial producers are limited, therefore they tend to use conventional methods and technologies. The agricultural sector is still in transition, export markets have been re-orientated, the qualitative

dimension of agricultural production has been coming in the foreground as opposed to the quantitative emphasis of the past. Therefore, greater dissemination of best available techniques in the drought mitigation practices is a major task for the future in Hungary.