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Country reports

Austria.....	3
Czech Republic	7
France.....	18
Poland	25
Romania	33
Spain	38

Austria

EUROPEAN FORESTRY COMMISSION
WORKING PARTY ON THE MANAGEMENT OF MOUNTAIN WATERSHEDS
TWENTY-FIFTH SESSION

NATIONAL REPORT AUSTRIA

Modern natural hazard management can best be explained by means of the principle of the **risk cycle**, which begins with the event (disaster) and comprises disaster intervention, repair, reconstruction, prevention, and measures of disaster preparedness. The objective is to improve and enhance society's preparedness for future natural disasters. Provision of these security services requires the cooperation of experts of numerous technical disciplines and many public and private organisations. A task of natural hazard management is also to harmonise all relevant technical plans to serve the goal of protecting against natural hazards.

The protection against natural hazards has thus become a comprehensive task which cannot be managed by the state with its agencies and authorities alone. Also stakeholders – communities, carriers and utilities, the economy and, in particular, the individual citizen – must participate intensively in the precautionary measures and make an appropriate contribution thereto.

The management of disaster events (like the flood of the year 2002) requires the coordinated action of all players. Right after the event local or regional crisis management committees guide the intervention of the disaster relief team and the execution of the necessary immediate measures such as the closing of roads, the evacuation of areas subject to acute risk or the leading back of rivers and torrents which overflowed their banks to their beds. The crisis management committees bring together the experts and decision-makers needed from the different fields of competence. However, in order to reach the protection targets all plans and measures must also in the subsequent phases of reconstruction and development of precautionary measures (preventive protection) be coordinated between territorial authorities, public and private bodies.

Communicating the risk associated with the natural hazards of alpine areas is an essential contribution towards improved hazard awareness of the population. The goal pursued is first to create social acceptance of the impending hazards and the necessary preventive measures and, in a second step, to make citizens participants in the process of preparing for cases of natural hazards.

Key tasks with respect to the communication on natural hazards are to provide information and to impart knowledge on the subject. In the age of electronic media the continuous provision of information material (brochures, films), targeted public relations work (television, newspapers), but increasingly also “events” (presentations at fairs, exhibitions) are playing a vital role.

However, communication about the protection against natural hazards goes far beyond the simple provision of information. Modern hazard control plans require space (land) on the one hand and infringe upon individual rights on the other hand; for this reason they conflict with competing land-use interests (agriculture, protection of nature, residential settlement, infrastructure, tourism). As a result, there are necessarily two essential level of communication for the planning of active and passive measures of protection:

1. Communication with the persons affected by the plans (beneficiaries, adjoining owners, holders of rights, citizens' initiatives).
2. Communication in the framework of various technical plans of relevance to specific areas.

Managing such communication processes requires tools which ensure the participation of all those affected by the planning. The following examples for successful natural hazard communication in Austria can be mentioned:

- Intensive hazard mapping and implementation of web-based public hazard information systems (eg. HORA)
- Public information for citizens and education even for children on the topic natural hazards (generation blue, Biber Berti, hazard mapping at school)
- Intensified citizen participation (Kamp river)
- Tran competent expert platforms (annual meeting of flood and torrent controllers in Austria)

- Strategic steering platforms (strategic business field “natural hazard protection” established since 2001 in the federal ministry for agriculture, forestry, environment and water management)

The impact of global warming on natural hazards was a major topic in media and press recently in Austria according to an apparent increase in the number and intensity of disastrous events. Although within the last years enormous damage due to floods and avalanches has occurred, no distinct development towards more natural catastrophes in large river basins could be proved by scientific means. Hydrologic data for precipitation or run-off do not show a significant trend in this direction. On the other hand there is evidence that the catastrophic flood events in small catchment areas due to intensive rain showers increases significantly. This phenomenon; as well as others – e.g. the impact of the rise of the snow-line or the retreat of glaciers on the hydrology of alpine catchment areas – has to be subject to intensive research in the near future.

Experiences that can be gained from coping with natural disasters constitute an important basis for a better preparation of the society for future events. The following **future objectives and tasks** could be derived from the analysis of the flood 2002 in Austria (study “FLOOD RISK, 2004”):

- Demonstrating the limits of protection and the responsibility of those involved
- Promoting hazards knowledge and hazards awareness.
- Ensuring a site-adapted land-use planning
- Incentive systems for prevention at one’s own initiative
- Harmonisation of all planning activities in the public sector
- Control measures, where necessary, permanent maintenance
- Emergency planning and disaster control measures
- Financial provisions, insurances and claim settlement

Czech Republic

Czech Republic National Report on the Watershed Management (- an Integrated Approach to Environment Protection)

The 25th Session of the EFC Working Party on the Management of Mountain Watersheds

Karel Vancura
Forest Management Institute
UHUL, Nábřezní 1326
250 01 Brandys n. L.
Czech Republic
Vancura.Karel@uhul.cz

General information

The Czech Republic is a country located in the Temperate Zone of the Northern Hemisphere in the central part of Europe. Its climate is characterised by a western circulation with a prevailing occurrence of a western wind. An intensive cyclonal activity is caused by a frequent change of air mass with a relatively frequent precipitation. Nevertheless, this territory is experienced with significant change in the last years re. to the occurrence of weather extremes as tornado, downpour rains with following floods and landslides.

The area of the Czech Republic is 78,866 km², of which 52,817 km² (67 %) is located at the altitude up to 500 m. Together 25,222 km² (32 %) is located at the altitude from 500 m to 1,000 m and only 827 km² (1%) at the altitude above 1,000 m. The highest-located point of the country territory is Snezka (1,602 m above the sea) in the Krkonose Mountains and the lowest-located point represents the outflow of the Labe River at Hrensko in the Northern Bohemia. The forest land area is 26,370 km² which represents 33.4 %.

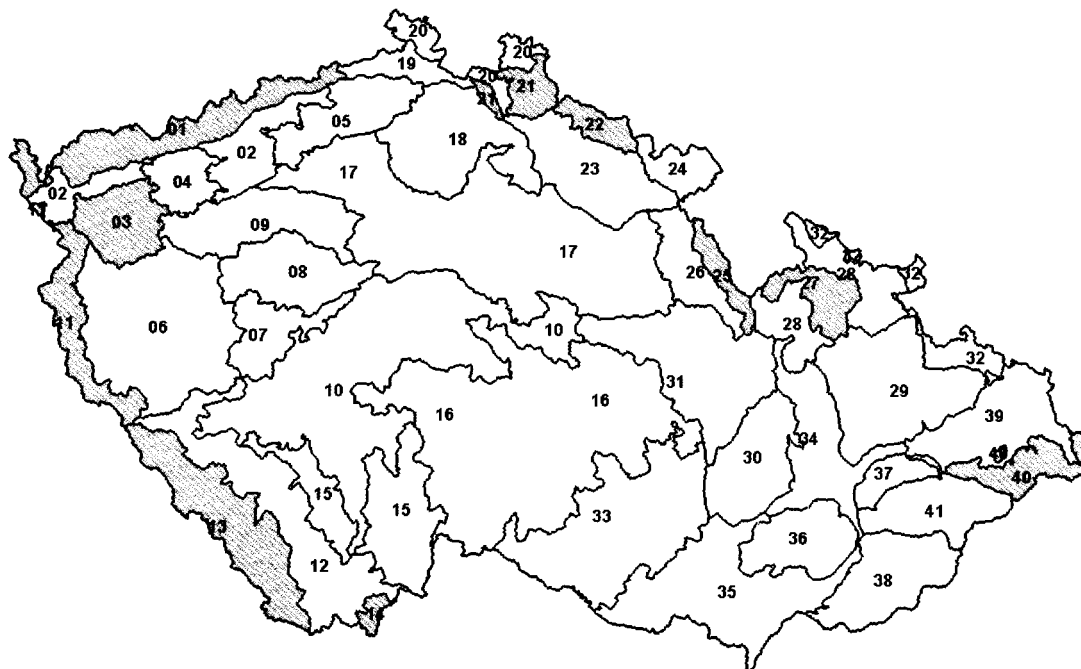
Mountain forests are an important landscape component of this country. Speaking about watersheds management we have to take into account above all mountain forests. These forests represent an object of specific importance from the aspect of natural environment conservation, and stabilisation of natural processes. In addition, they fulfil a number of production and non-production functions. They involve not only the production of wood, game, forest fruit, etc. but also socially important functions in the sphere of hydrology, soil conservation, climate protection, recreation, nature conservation, biodiversity, etc. The objective of sustainable management of these forests is to create a forest characterised by ecological stability, high quality, and species, genetic, spatial and age differentiation.

Characteristics of FOREST VEGETATION (altitudinal) ZONES in mountain forests

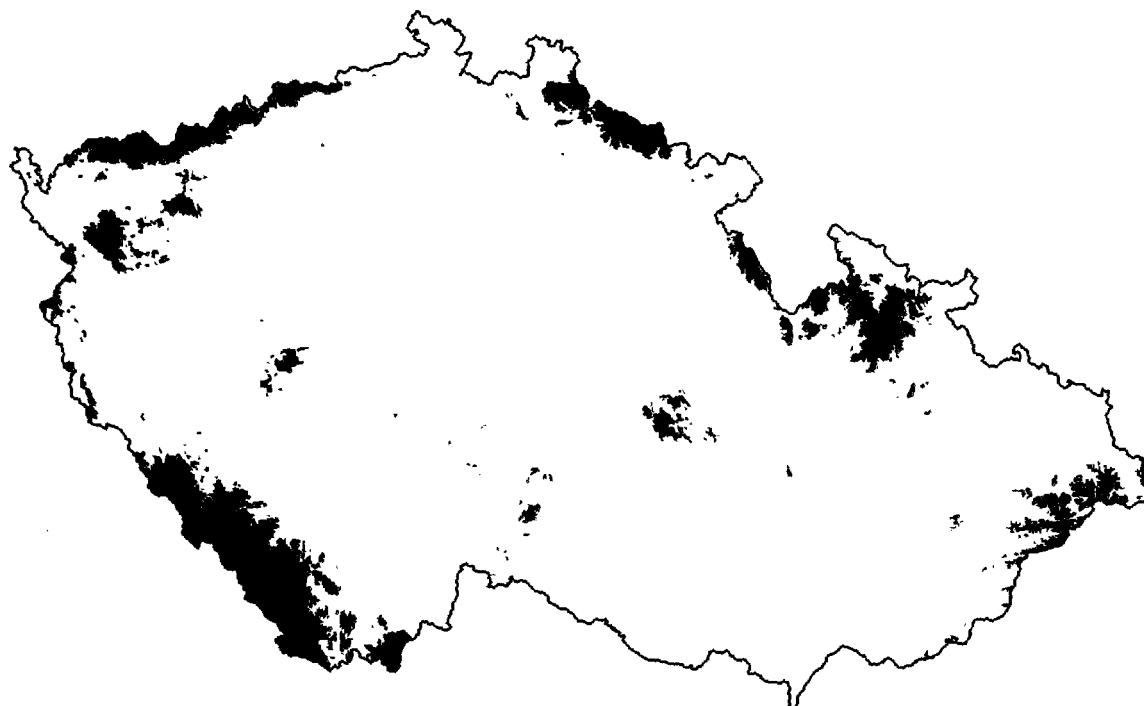
Forest altitudinal zone	Forest land area	Proportion of		Altitude	Average temperature	Annual precipitation	Vegetation period	Forest percentage	
		FAZ 6-9	FAZ 0-9						
		ha	%						m
6	Beech with spruce	309 367	67.32	11.75	700 - 900	4.5 – 5.5	900 – 1 050	115 - 130	49.1
7	Spruce with beech	99 824	21.72	3.79	900 - 1 050	4.0 - 4.5	1 050 - 1 200	100 - 115	51.6
8	Spruce	44 522	9.69	1.69	1 050 - 1 350	2.5 - 4.0	1 200 - 1 500	60 - 100	91.6
9	Dwarf pine	5 857	1.27	0.22	>1 350	<2.5	>1500	< 60	99.3

Total forest area in the CR is 2 632 000 ha, of it the area of mountain forests (6th – 9th FAZ) amounts to 459 570 ha, i.e. 17.45% (data of Forest Management Institute at Brandys n. L.).

Natural forest areas (NFA) of the Czech Republic. Areas with a significant proportion of mountain forests (hatched) are as follows: 01 – Krušné hory Mts., 03 – Karlovy Vary Hills, 11 – Bohemian Forest, 13 – Šumava Mts., 14 – Novohradské hory Mts., 21 – Jizerské hory Mts. and Ještěd Mt., 22 – Krkonoše Mts., 25 – Orlické hory Mts., 27 – Hrubý Jeseník Mts., 40 – Moravian Silesian Beskids.



Localisation of mountain regions of the CR from the 6th FAZ (from 700 m above sea level.) to higher altitudes is shown in following figure:



Mountains and forests

Mountainous forests are mostly located in border areas of the country. Since the Middle Ages the usage of these forests has its typical development. Originally it was the game management interests, then pasture and production of grass as a supplementary activities to the developing farming. In the areas below the tree line, the originally small clearings started to expand while pasture and production of grass only accelerated this process. And finally the aimed interests started in relation with the production of wood for needs of mining, iron industry, glass industry or as a firewood. The beginnings of the intentional management in these areas could have been seen only since the 19th century.

Fir-beech forests prevailed in the mountainous forests of the 17th century and spruce started spreading in the 18th century. Norway spruce became a prevailing tree species on the turn of 19th and 20th centuries and was continuing to get even larger area on the account of beech and fir in the 20th century. Vast spruce plantations are, however, endangered by wind, snow, insect pests and, after the World War II in a visible manner, also by the air pollution even if this problem began much sooner. Fatefully is known "Black Triangle" - the most damaged Krusne hory (Ore Mts.) forest region, but also Jizerske hory, Krkonose, Orlicke hory etc. Norway spruce stands disrupted by the calamities were, beginning 70th and 80th, replaced by the so-called substitute tree species. There is assumed a gradual restoration of so called "transitory stands of substitute species", when spruce is the main tree species of the natural species composition of the mountainous forests at its 60 % target share.

A change in the forestry management in the mountainous forests occurred only by publishing of the Forest Act in the year 1852 that regulated the procedures for harvesting and reforestation of forests at the high altitudes and on the steep slopes. Consequently, there appeared also the first determination of forest stands as a forest with a special purpose, by the way of its management and rotation period – a protected forest. These principles had a positive impact on keeping the upper tree line of forests. Together with the increasing of artificial afforestation this line was going up. The afforestation was successful on the majority of areas, although there were occurred damages in some plantations, caused by the plants getting dry, particularly from the reason of a non-suitable genetic origin of seedlings.

Afforestation was performed also from the reason of erosion-control protection of soil on the turn of 19th and 20th centuries. The flooding-control protection represents another reason after a disaster precipitation at the end of 19th century in the central part of Bohemia where, however, it does not mean mountainous forests, and in the Krkonose Mts. and in the Beskydy Mts. This afforestation was performed in the public interest and was significantly supported by the state.

Importance of mountain forests

Mountain forests are definitely very important part of forest ecosystems as such. They serve as an important moderator of climate, regulator of landscape hydrology, resource of timber, refuge of biological diversity, friendly area of human recreation and source of spiritual values. Within the forest-depleted Central Europe, the mountain forests create much appreciated landscape scenery - they are one of the most important landscape components of the country. They have specific importance from the aspect of natural environment conservation, stabilisation of natural processes and general landscape formation. In addition, they fulfil a number of production and non-production functions. They involve not only the production of wood, game, forest fruit, etc. but also socially important functions in the sphere of hydrology, soil conservation, climate protection, recreation, nature conservation, biodiversity, etc. The objective

of sustainable management of these forests is to create a forest characterised by ecological stability, high quality, and species, genetic, spatial and age differentiation. Mountain forests usually represent an important natural boundary and barrier, possibly a source of cultural and spiritual traditions and populations from lowlands enjoy considerable benefits from them.

Besides the wood-producing function, mountain forests fulfil important ecological and environmental functions. These mountain regions are very important for the conservation of biological diversity of thousands of species of the plant and animal kingdom, their communities and relations between the ecosystems. It is the conservation of not only genetic resources of tree species but also of herbs, bryophytes, lichens, fungi, animals, microorganisms, etc. (many gene pools of autochthonous ecotypes of tree species occur in these areas).

Mountain forests have positive soil-conservation and hydrological functions. Forests in mountain locations do not influence only the environment of the site where they grow; they also produce remote effects. They fulfil erosion and partly also flood control functions and ensure water supplies in the production landscape at lower altitudes. Mountain forests are specific areas with increased interest in the soil-protection function of forests and they are classified as hydrologically important forests. The hydrological importance of mountains is documented by declaration of so called Natural Water Accumulation Protected Areas (CHOPAV / NWAPA) and also by their participation in protective zones of water resources, mainly in the perimeters of water-supply reservoirs and streams.

Currently there is about 76,000 km of water-courses in the country, of which app. 15,300 km are important from the water management point of view and about 60,700 km of other small water courses. All those watercourses have, defined by the Water Act, a professional administration with the defined obligations. "Lesy České republiky" (LCR s. p. - Forests of the Czech Republic, State Enterprise) is one of the three important administrators. It manages approximately 20,000 km of small watercourses – torrents, catchment of that are located mostly in the mountainous areas and predominantly forested. Thus forestry activities are considered as very important.

Sustainable forest management is considered a key to water resources management in particular and to upland resources development in general. It is tightly linked to watershed development. Forested catchments supply water for domestic, agricultural, industrial and other needs in downstream areas. Forests and forested watersheds play essential roles in sustaining and protecting of supplies fresh water, which is increasingly in demand.

A growing numbers of factors influence forest and water resources, including: Climatic variability, local- or larger-scale pollution and fires, deforestation and changes in land use, lack of water, too much water, demographic trends, conflicts, market and short-term economic factors, the development of infrastructure and tourism, insufficient participation of local actors, lack of political vision, and shifts in societal expectations. It seems that "forest and water" deserve to be an issue of the next MCPFE.

Problems and threats

Economic situation - It is connected a lot with problem of nature conservation and with allot regime of management. Also with an objective necessity to prevent a displacement of men from these regions because of lack of jobs. Conservation is a public interest (or state policy), and that is why the state would actively assist to the resident inhabitants (e.g. at the development of tourism etc.), to the development of services, processing of local products (e.g. wooden made ones). Also in the specially forest protected areas must exist a life, by analogy like in parts of the ancient monument towns.

High costs for forest management and timber production - Personal subsidies on management measurements in forests is useful to restrict to specific cases, when demanding management is not possible to cover from forestry income and at the most efficient and economic approach. It is important to complete tools implementing the sustainable forest management in cases when the forest estate cannot demonstrably create a sufficient amount of resources needed.

Ownership structure - The crushing prevalence of state ownership exists in mountain regions of the Czech Republic. State Enterprise Forests of the Czech Republic (LCR, s. p.) is often only one employer for local inhabitants in these regions - particularly it is due to the inhibition of agriculture in marginal agricultural lots or in the case of bankruptcy of some major industrial company in the region. It is a question, whether the major variety forms of ownership would contribute to resurgence of mountain region, namely not only from managed forest point of view, but also from the view of recreation and other suited activities.

There is a need of the improvement of detail quantification for the economic consequences of optimizing the network of small-area specially protected areas, national parks and protected landscape areas and the creation of the NATURA 2000 system. For the NATURA 2000 system, including proposal for dealing with any compensation of harm to owners.

Ecological situation - Mostly mountain regions on northern borders are affected by air pollution in the country. It must be underlined a legal responsibility and liability of all subjects e.g. in connection with damages of forest stands by air pollution, of waters and soil, particularly in harmony with existing or prepared legislative of the EC. There is not solved the system of damages compensations to forest owners caused by pollution, which stayed quite without response at past period. To this item is only possible to mention that energy production "power" lobby is a very special interest group in the Czech Republic and it is definitely much stronger than forest owners...

Game damage - Damages by hoofed high deer (mostly of the red deer *Cervus*) are not solved on principle all the time. Mr. Deer made enormous problems particularly in the high mountains (Ore Mts., Giant Mts.). But it is sure that also hunting lobby is more powerful than foresters are. A success of forest regeneration, including the achievement of higher biodiversity without spending not necessary over expenses, is directly linked with the game stock that forest owner having not the personal hunting district (at least 500 ha according the law) can influence only hardly.

Climate change - Impacts of global climate changes on the stability of forest ecosystems and sustainable management in mountain forests is an open question. The knowledge of responses of different ecosystems to progressive civilisation pressures is currently poor. Changes in air-pollution ecological conditions will likely bring about changes in the structure of these ecosystems, in their function and production. Bio-climatic conditions of forest altitudinal zones will certainly change to some extent, but no greater shift is likely to be expected. It is to note that forest ecosystems are relatively conservative objects. Particularly changes in the soil are very slow, especially in comparison with climate changes. Climate change is already long time considered in connection with biodiversity, but not only species level has to be kept in mind but also forest genetic diversity.

Important elements of research

Research of climatic elements, particularly of precipitation is being performed with the aim to get a deeper knowledge of the hydrologic function of forests. In particular its relation to the runoffs in the small mountainous catchment areas with the forest stands restoration and influenced by the air pollution is of interest as well as the water amplexness and the quality of

water sources and flood-control protection. A forestry-hydrologic monitoring of forest environment has been taking place since 1928 on two localities in the Northern Moravia aimed at the precipitation-runoff course.

The importance of forests for water conservation, water regimen and environment of cultural landscape has been understood by the forestry sciences in the territory of what is known as the Czech Republic already in the first third of 20th century. (Long-term - several decades - measurements of forest-hydrological research on mountain catchments in the Javorniky Mts. since 1928, further research on experimental watersheds in Beskydy Mts. running already a half of the century etc.). There was created a base for practical silvicultural "non-productive" activities having the character of services in relation of forests and water with utilisation of results and records gained on the experimental plots of joint research projects of bioclimatologic, hydrogeologic and silvicultural character.

Groundwork for real silvicultural activities, which have a character of silvicultural services in the water (water sources) and landscape conservation against the water was since the 70s of the last century intensely studying in a big projects (state research projects) by forest research in uplands and hilly regions. After the 15 years of systematic work there were obtained the following principle findings:

- Characteristics of the fundamental types of forest functions in conservation of water regimen and cultural landscape: Hydric functions (spontaneous forest effects) and water management functions (aimed effects, called by introduction of work and capital) as different policy-economic components of forestry sector activities - joint effect of forest production and silvicultural services;
- Characteristics of the fundamental types of water management functions (qualitative, quantitative and complex functions),
- Characteristics of the fundamental types of forest stand important from the water management point of view and their dislocation in the Czech Republic. Particularly of forests in the protective zones of water sources (surface basins) for water supply with complex water function (10 %) and important mountain forests (16 % of total forest area);
- Technologies of multipurpose forest management in protective zones of water sources (screening of quality and quantity of dispensable water), according to several functional groups of forest stands (water protection function, antierosive, infiltration, or related to creation of precipitations);
- Item for important mountain forests (protection of cultural landscape against water);
- Expenses on covering of the forest functions mentioned in forests important from the standpoint of water management of the country, it means a sufficient protection of water sources and adequate protection of cultural landscape in foothills against the erosion and floods.

Forest represents a natural environment with the impact on the creation of runoff from the mountainous catchment areas, however, the precipitations, that are the most important factor of the runoff regime, are influenced by the forest stands minimally concerning the volume of water. Spring areas of the mountains are sloppy terrains that support a faster runoff. Here, forest is a factor that helps to prolong the length of time of water flow into the network of concentrated runoff. Forestry-hydrologic research has, up to date, provided background materials, that there is not taking place any provable change in the runoff despite the situation when reforestation is speeded-up. It means when felled mature stands are replaced by the cultures and young stands of the first age class in comparison with catchments where a high share of the higher age classes stands is maintained and only a sanitary cutting is performed.

In general, forest soils of the mountainous catchment areas delay runoffs in a limited scope only, their retention capacity ranges from 50 to 100 mm of precipitation depending on concrete site conditions. It is in accordance with the saturation of forest ecosystem with water and in accordance with the thickness of such soil layer. From the point of view of the accessibility of forest stands, it is important to perform a correct marking of forest transportation network and safe drainage of the concentrated precipitation water from its objects and facilities.

Forestry-hydrologic research gradually documents that a favourable flood-control performance of forest is limited. If there is created a critically intensive rain, in addition, covering a large area, then the consequences are a result of nature. However, this must not be a reason for not taking care of flood-control measures in the mountainous-forested areas, rich for precipitation. Erosion-control measures and importance of forest for the protection of soil on the mountainous slopes are historically verified and justified.

Legislation related to forest, water and silvicultural services

A protection of citizens and territory endangered by the torrents has, in the Czech Lands, more than 120 years tradition. As a historical remainder of silvicultural services from previous times so called Forestry Amelioration Service with the Torrent Control Service (LTM-HB) survives in the Czech Republic. It was originally assumed from France in the time of Austro-Hungarian Empire in eighties of 19th century (Austro-Hungarian Imperial Code No. 117/1884). This service was considered as a public beneficial service of state administration to protect the cultural landscape against the water. As a care of torrent catchment areas it has since 1960 the exact, rationally formed tasks mentioned in the legislation (Forest Act No. 166/1960 Coll.). Unfortunately, the policy-economical idea of forestry (forestry only as a production sector) led to the fact, that the Forest Act No. 61/1977 Coll. did not include the torrent service tasks and thereby this service lost a legal rule. Since that time its gradual inhibition occurred in terms of lack of interest to cover activities of such services in forestry practice. The generally binding legal rule (the "Instruction to the management of forested land in protective zones of water sources" No. 13/1982) was processed in 1979 and then published as a publication of the Ministry of Forest and Water Management in 1982.

After the changes in 1989, with shifting to market economy system and also with changes of legislative system the above mentioned instruction No. 13/1982 lost its liability as an assignment standard. The conception of forestry as production sector goes on also in so called liberal democratic system. National Forestry Programme (NFP) as intended basis to the new amendment of policy and legislation in the Czech Republic has been proposed already in the beginning of the 90s (Sept. 1993). Originally prepared by NGO (National Forestry Committee - this organisation has been merged with the Czech Forestry Association in the end of August 2005) and then passed by Departments of Agriculture and Environment. However in the concurrence of ecological ideas and real economic calculations the former results of research was not taken into account and current NFP does not include the idea of transformation of forestry as the integral sector of forest production and forest environmental services.

Currently two acts regulate flood-control protection of the mountainous catchment areas of the torrents: A new Water Act took effect in the year 2002, while the Forest Act is valid since 1996.

Forest legislation of the Czech Republic is covering the services only marginally. Valid Forest Act No. 289/1995 Coll. knows "non-productive functions" (§ 2b), knows also forests of special categories, however in § 38 on purpose-made forests it considers a duty to "suffer

limitation at management of such forest stands". It covers only title of financial burden rising to proprietors from "limitation of forests management".

It means, that "forest management" is considered only as a production of marketed goods or substances, not as a silvicultural service. Law is then far away from the conception of services like components of forest estates economic exploitation in public interest. Services are, in fact, considered according to the classical approach as a "limitation of management". Similarly, the paragraph § 35 can be mentioned ("soil improvement, amelioration and torrent control in forests"), where to question-mark of forest policy character comes up also an uneasy in-expertness in conception of torrents control (they can be carried out exclusively "in forests"). Forestry failed to care for run on services in the area of forest - water relation. There were not created appropriate political and legislative conditions of existence for such services. Unfortunately, nor tragic events - floods of 1997 and 2002 (a critical regional precipitation with consequent floods occurred in Moravia in July 1997 and in South/Central/North Bohemia in August 2002) - were not utilised to improve this situation. On the contrary, forestry got onto the pressure of militant conservationist, arguing by current forest management like causes of big waters and floods. So called ecologists usually being adversely obstruct against restoration of arrangements on torrent streams of mountain areas in spite of the fact that it is an inevitable component of cultural landscape protection in foothills.

Besides the legal changes regarding torrent and ravine control and for the protection of their catchment areas there was issued a Czech Technical Standard CSN 75 2106 "Torrent and ravine control" in 1998, which was completed by recommendation making some of its provisions more detailed (2002). This standard includes biological and technical measures against flooding damages and fast erosion, for taking care of their natural parts or maintenance works for their regulated parts. In the year 2001, there was issued a Decree of the Ministry of Agriculture that defines basic technical requirements for such constructions.

Land use and tasks to be solved

Land uses practices, and forestry practices as well, have a high potential in influencing natural hazards. Forests can influence rockfalls and avalanches, with a stabilising effect of trees on snow cover. There is a difference between the direct influence that trees for example have on slowing down rockfall, while an indirect influence comes from soil properties.

Well-managed forests have a direct impact not only on the quality of water yields from watersheds and on the regulation of flows. They also mitigate the effects of soil mass movements, rockfalls and avalanches and contribute to soil erosion control and consequently to reducing downstream sediment transfers. Even if these hazards are not so frequent in our country they occur in the last years particularly in connection with various meteorological extremes. All above-mentioned forest services related to water may be better identified within a watershed framework, linking upstream and downstream areas. Although forest and water resources are inextricably linked, they are rarely managed in an integrated way.

A body of the state for flood-control protection of the mountainous catchment areas of watercourses has been already for 120 years the Torrent Control Service. In these areas, the state is mostly the owner of forestland. But state influences by the direct relations of the forest management (in accordance with forest management documents – forest management plans), also the other forms of ownership. It is done, in particular, for the maintenance of quality of forests through the sustainable forest management and consequently also for the maintenance of water quality in the Czech Republic.

Prevention and measures in the upper parts of the catchment areas were not performed. In the year 1992, there was made a change and an organisational stabilisation: The activities of torrent control were included into the new Act on Forests in the year 1996, however, financing of these measures stayed completely dependent on the possibilities of the state and budget for this purpose is downsized regularly. Thus prevention from damages and erosion, maintenance works for ensuring performed works functional is insufficient yet.

The problems, i. e. organisation stability and procurement of the torrent control service, a precise definition of its tasks and obligations, shared financing measures, are in the interest of the state when ensuring flood-control protection of citizens and territory. It is necessary to reach again the level that was proved to be efficient in the past in the Czech Lands in the time of Torrent Control Service creation.

Disadvantages regarding land use and rural development are well known. There could be of assistance measures listed in the EAFRD – it concerns problem of support in relation of rural development generally.

The regional plans of forest development should be more enforced to the landscape planning of regions (so called *OPRL* in the Czech Republic - and in our nomenclature it means to the "higher territorial units" – *VUC*). The aim is to minimise conflicts of concerns over the territory touched upon and to think about forests at the regional development, at utilising of their potential. Forests should be mentioned in all important regional plans and programmes of rural development and of course a special regional part related to the mountain forests and their relationship to water has to be included into the National Forest Programme.

Also improvement of awareness on general forestry issues, including forests important role in watershed management, and stressing the cross-sectoral responsibility for forests should be taken into account. Last but not the least, it will be necessary to take notice of the landscape and to respect nature laws and phenomenon, as flooding are a natural part of it.

Forest, water and environmental services

Essential features, that would make easier position of the environmental services in the Czech forestry are known already long time – they in fact lead to the Torrent Control Service creation already 122 years ago.

- Densely populated cultural landscape with very rich infrastructure under the border mountain range with torrent watercourses, currently highly sensitive to the water element;
- Big share of fresh, potable water, coming from surface waters (more than 50 %), from water basins) with extraordinary emphasis on protection of raw-water quality (washing in drainage area; price of potable water as a consequence of processing technologies); also dispensable water quantity plays a role (losses by evapotranspiration in watersheds).
- Relatively high forest coverage of mountainous watersheds important from the water management point of view, often also in areas of lower mountains; and consequent responsibility of forestry in retention and retardation of precipitations runoff;
- Relatively high usage of techniques in managed forest, particularly in cutting and timber transport operations impending harmful influence over the soil, runoff mode of catchments and water quality (tractors in skidding, density and character of transport lines and forest roads of all types).

It is necessary to start generally but in the concrete with ruminating over the internalisation of selected externalities (it means on market applying of some environmental

services). They can include e.g. the sale of fresh water of springs by forest owner, with a target to diversify revenues from forest management on forest possessions. After all, for water management companies it must be all the time more preferable to receive a clean water than water of lower quality, which requires high spending on cleaning and further adjustment.

Last but not the least - mountain forest is important part of an attractive landscape for tourism. It is quite essentially to advertise more so-called forest tourism and everything what is connected with. This point is related also to the education and P.R. Such activities as forest pedagogical education "*School in forest - forest in school*", known as PAWS (Pedagogische Arbeit im Wald) should be considered as very important. They improve relation between forest and human beings and also assist to improve the image of forestry.

In closing

Solutions of many forest-related problems, and maybe not only in the Czech Republic, lie outside the forestry sector. Consequently there is the need to stress the cross-sectoral, shared responsibility for our forests and forestry issues (Vienna Declaration of the 4th MCPFE). There is a need to participate in international processes dealing with forests (also in relation with mountains even if we have not so high mountains, also in relation with desertification even if we have to count "only" with erosion...).

The mountain ecosystems, under appropriate management, provide a large set of benefits to lowland regions and many socio-economic sectors are both benefiting from, as well as influencing these resources. This is a reason for various alliances, coalitions, partnerships, agreements and contracts on forest conservation and management between local and non-local actors, which could and should help in sharing benefits at all levels.

However, such participation would have the desired effect only if there is a real political will to solve related problems on a conceptual basis and if it is based on and respects all other related agreements it means *i. a.* if there are convenient conditions created for e. g.:

- overcoming of gaps in collaboration between and among those involved with forestry science, research and practice as well as insufficient communication at various levels;
- improvement of general public involvement in forestry issues and awareness on forestry as such including improvement of up to date bad medial presentation of forestry;
- improvement in overall education and public relations, capacity building;
- and responsible and respectable behaviour of all stakeholders including policymakers.

These conclusions should lead *i. a.* to the following suggested actions:

- Actions to improve visibility of forestry as such.
- Actions supporting education.
- Solving such issues as e. g. character of work of respective state administration bodies, which deals with forests; forest categories; public relations; improvement of awareness (particularly also with people responsible for macro-economy, policy-makers and NGOs) also in connection with real introduction of payments for ecosystems services particularly in mountainous regions.

There is a hope that Forest Action Plan just prepared in Community should help to solve some of problems mentioned including better image of forestry. Czech Republic appreciate very much activities done by Austria in preparation of Forest Action Plan of the EU trying to include also mountain forests as a special item into this document.

France

**25^{ème} session du groupe de travail
de la Commission Européenne des Forêts
sur l'aménagement des bassins versants de montagne**

SALZBOURG (Autriche)

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RAPPORT NATIONAL FRANCE

Auteur :

Délégation Nationale aux Actions RTM
Office National des Forêts
9, Quai Créqui
38000 GRENOBLE

En France, les actions d'aménagement des bassins versants de montagne visant à lutter contre l'érosion et les risques naturels sont menés depuis plus d'un siècle dans le cadre de la Restauration des Terrains en Montagne (RTM).

Les actions publiques de prévention des risques naturels en montagne dépassent cependant largement le cadre strict de la RTM pour trois raisons :

- l'approche française d'aménagement des bassins versants est celle de la multifonctionnalité, dans une optique de gestion durable ; dont le contrôle de l'érosion et la prévention des risques ne constituent qu'une des composantes,*
- la nécessité de décliner l'aménagement des hauts bassins en actions opérationnelles répondant aux divers services environnementaux et de développement conduit à une grande diversité des situations ; si la forêt de montagne y joue un rôle clé, la gestion des bassins versants dépasse largement le cadre forestier,,*
- la prévention des risques naturels implique différents départements ministériels de l'Etat et les collectivités territoriales, dans un dispositif législatif et un contexte de décentralisation et de recherche de responsabilité qui ont beaucoup évolués au cours des vingt dernières années.*

Le présent rapport est structuré conformément aux directives de la FAO, en se focalisant sur les évolutions survenues dans la montagne française depuis la 24^e session du groupe de travail ; il s'appuie largement sur les actions conduites dans le cadre de la RTM.

I - DEVELOPPEMENTS DEPUIS LA XXIV^e SESSION

Evénements naturels

La montagne française n'a pas été touchée ces deux dernières années par des épisodes majeurs par leur ampleur et le nombre de victimes, comme cela avait été le cas en 1999 avant la 21^e session.

Cette absence de catastrophes ne signifie pas que la montagne soit restée inactive, puisque plusieurs centaines d'événements aux conséquences notables, souvent localisés, sont répertoriés chaque année. Nombre d'entre eux (une quarantaine par an) ont occasionné des dégâts importants mais ponctuels, conduisant dans le système d'assurances français à une déclaration de l'état de catastrophe naturelle permettant l'indemnisation des victimes.

L'épisode torrentiel le plus important aura été celui d'août 2005 en Isère et Haute Savoie, sans victimes mais avec destruction de bâtiments et infrastructures coupées ; l'hiver 2005 / 2006 avec un fort enneigement dans les Alpes a conduit à de nombreux dépassements des avalanches connues, mais sans dégâts importants ; le nombre de victimes d'avalanche, hors des zones sécurisées, a été le double (près de 60) d'une année moyenne.

Connaissance des phénomènes naturels et leur prise en compte dans l'aménagement de la montagne

La connaissance des sites et des phénomènes, engagée de longue date, s'enrichit de l'observation permanente de ceux-ci. Elle permet toutes les expertises nécessaires à l'exercice des responsabilités publiques, et débouche sur les actions d'information préventive des populations et de cartographie réglementaire des risques spécifiques à la montagne.

Dans les départements de montagne des Alpes et des Pyrénées, ceci s'est plus particulièrement traduit par :

- l'accent mis sur la consignation des données événementielles (enquête permanente des avalanches, événements sur les risques montagne avec un objectif de dépouillement des sources diverses d'archives) dans des bases de données nationales,
- la mise en œuvre d'un programme de rénovation des cartes d'avalanches (CLPA), couvrant maintenant de l'ordre de 800 000 ha,
- une montée en puissance de la réalisation des Plans de Prévention des Risques (entrés en vigueur dans 48 nouvelles communes de montagne en 2004 et 29 en 2005).

La gestion patrimoniale des territoires de montagne

La sécurité des personnes et des biens dépend en grande partie de la qualité d'entretien du milieu ; c'est particulièrement le cas des forêts de montagne, dont 3 millions d'hectares sont publiques et gérées par l'Office National des Forêts.

Parmi ceux-ci, les terrains domaniaux RTM où le budget de l'Etat a consacré 10 M€ par an pour des travaux spécialisés, principalement des ouvrages de correction (entretien et ouvrages nouveaux) et dont les 2/3 environ concernent les torrents ; l'accent a été mis sur l'entretien des ouvrages existants, souvent très anciens.

A ce montant s'est ajouté 2 M€/an d'opérations d'entretien et de renouvellement des peuplements domaniaux jouant un rôle marqué de protection (190 000 ha), provenant du budget de l'ONF.

Malgré une conjoncture financière difficile, l'effort conjoint de l'Etat et de l'ONF pour les actions forestières de protection a pu se maintenir au niveau de la période antérieure.

Les travaux de protection menés par les collectivités locales

Qu'ils soient actifs (correction à la source) ou dans la majorité des cas passifs (protection rapprochée des enjeux sensibles), ces travaux spécialisés sont destinés à améliorer la sécurité des personnes et des biens à l'aval.

Dans le domaine de la RTM, les collectivités ont financé 14 M€ par an de travaux en 2004 et 2005. Ils se répartissent en travaux torrentiels (59 %), paravalanches (9 %) et contre les instabilités de versant (32 %) ; des aides financières aux communes maîtres d'ouvrages sont apportées par l'Etat (qui ont globalement représenté 12 % du coût pendant la période), les Régions (22%) et des Départements (10 %).

Les aides du Ministère chargé des forêts se sont recentrés sur les actions spécifiques à la gestion des bassins versants par régulation ou correction des phénomènes naturels (protection active), les autres partenaires financiers intervenant davantage sur les travaux de protection rapprochée.

II - STRATEGIES DE PREVENTION : QUELLES EVOLUTIONS ?

On ne développera pas ici les principales dispositions législatives servant de cadre à l'action publique : loi créant la Restauration des Terrains en Montagne (1882), loi sur l'indemnisation des victimes des catastrophes naturelles (1982), loi "montagne" (1985), loi sur la sécurité civile (1987), loi sur l'environnement (1995) instituant les Plans de Prévention des Risques naturels prévisibles (PPR) et instaurant l'expropriation des biens menacés par un risque majeur imminent, loi

d'orientation forestière (2001) s'appuyant sur la notion de gestion durable avec des aspects relatifs aux risques naturels pour les forêts de montagne.

Evolution du cadre législatif

L'évolution depuis la précédente session consiste en la mise en œuvre de la nouvelle loi de 2003 sur les risques (naturels et technologiques), qui n'est pas spécifique à la montagne mais qui, pour ce qui concerne les risques naturels, renforce les dispositions en vigueur en mettant l'accent sur :

- l'information et la participation des populations, avec notamment l'information des acquéreurs et locataires,
- la gestion des territoires (par exemple les zones d'expansion des crues),
- une meilleure définition des responsabilités des acteurs et favorisant l'implication des collectivités territoriales.

Parallèlement, la nouvelle loi de 2005 sur les territoires ruraux s'inscrit dans la continuité du cadre législatif existant, mettant l'accent sur le rôle des acteurs locaux dans le développement durable des territoires, et l'intégration des différents services qu'ils rendent ; on ne peut donc parler dans la période qui nous intéresse d'évolution marquée des stratégies de gestion des bassins versants, mais il faut souligner une volonté de meilleure implication des différents partenaires.

Mise en œuvre des stratégies

Au niveau de l'Etat, la période a été marquée par la mise en œuvre d'une gestion budgétaire par grands objectifs (Loi de Finance), introduisant souplesse d'action et responsabilisation de ses représentants locaux sur ces programmes.

Deux évolutions sont par ailleurs à noter :

- le développement d'outils à destination des acteurs techniques (préparation de guides avalanche et torrentiel pour la réalisation de PPR, organisation de la concertation, suivi de la jurisprudence...)
- l'amélioration de la mise à disposition de données (sites Internet...) pour l'information du public.

III – LA RECHERCHE ET SES IMPACTS

En France, l'organisme de recherche le plus impliqué dans le domaine de la gestion des risques naturels par le biais de l'aménagement des bassins versants de montagne est le CEMAGREF.

Ses activités dans ce domaine concernent d'une part la gestion des forêts de montagne, d'autre part la dynamique des écoulements gravitaires et l'ingénierie des dispositifs de protection.

Parmi les résultats des travaux de recherche réalisés ou en cours ayant eu des retombées directes pour les gestionnaires des actions de prévention et de protection, depuis la précédente session, on peut relever :

- le développement de logiciels permettant une appréciation des aléas, par exemple les laves torrentielles, et le dimensionnement des ouvrages de protection,
- l'étude sur site expérimental des interactions forêt et chutes de blocs,
- la rédaction de guides pratiques de soins minimaux aux forêts, notamment pour les risques naturels,

IV – PRINCIPAUX PROBLEMES RENCONTRES

La gestion des bassins versants de montagne repose sur l'intégration de diverses composantes. Le fait que les politiques publiques soient souvent conçues à partir d'approches sectorielles (notamment l'eau, la forêt, l'urbanisme, les risques naturels) constitue de ce fait un handicap pour la gestion de situations locales demandant une approche multifonctionnelle. Cependant un dialogue existe entre les partenaires forestiers et de la politique de l'eau, visant une approche par bassin versant.

La dimension sécuritaire, avec ses conséquences en terme de responsabilité, implique également une vigilance particulière et une association étroite entre acteurs.

On peut aussi relever la difficulté d'identifier une politique spécifique pour la montagne au sein d'un dispositif conçu pour gérer chacune des politiques sectorielles au plan national.

Cependant, les difficultés qui peuvent être rencontrées sont davantage liées à la mise en œuvre de ces politiques qu'à leur contenu, leur intérêt étant très largement perçu et admis par tous les acteurs ; ces difficultés concernent par exemple :

- la multiplicité des acteurs, à chacun des différents niveaux de compétence (Etat avec ses différents Ministères, Régions, Départements, Communes, Citoyens), demandant une meilleure définition du rôle de chacun,
- la nécessité d'une continuité des actions,
- le manque d'outils d'évaluation,
- le besoin de renouvellement de peuplements instables à rôle protecteur,
- les difficultés de mobilisation et de mise en œuvre des financements nécessaires.

Poland

**Twenty-fifth Session of the FAO/European Forestry Commission's
Working Party on the Management of Mountain Watersheds,
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NATIONAL REPORT POLAND

MOUNTAIN FOREST WATERSHED MANAGEMENT

Lenart E.¹⁾, Pierzgalski E.²⁾, Niemtur S.³⁾

1) Ministry of Environmental, 2), 3) Forest Research Institute

1. Introduction

In the period since Twenty- fourth Session in Cracow there has not been in Poland a major natural catastrophe or natural disaster. Local floods were in each year in some region but there were relatively small with comparison of flood in 1997. Due to this facts report presents basic problems connected with forest and water as well actions associated with the protection of environment undertaken in recently years.

2. Basic data of polish forests

The overall national territory amounting to 312,6 thousand km² includes 58,7 percent of agricultural land (including 76 percent of arable land and 22 percent of grasslands). Forests occupy about 29% of the national territory, with the acreage approaching 9,2 million ha. They vary considerably in their structure and natural values. A particularly pronounced feature of Poland's vegetation cover is that changes occur along two gradients, i.e. from the west - eastwards, and from the north - southwards. This is reflected in the increased share in the potential natural vegetation of the sub-continental and sub-boreal elements (i.e. mixed coniferous forests and lowland spruce stands), that gain special importance in the north-eastern parts of the country. At the same time, the sub-oceanic elements gradually disappear, i.e. lowland beech woods, acidophilous oak woods that predominate in western and south-western Poland, and are virtually non-existent in the east of the country.

Poland lies in the centre of European Plains with average altitude 173 m, in the climatic zone wherein forest communities could potentially cover almost 90% of the country area. Forest communities are therefore most natural vegetation types which provide shelter for natural richness of living organisms. Within the area of Poland, there are more than 60 thousand species registered including about 35 thousands animal species, more than 12 thousand plant species (in 485 types of plant associations), and about 13 thousand fungi species.

Approximately 80% of the forest area is State owned and about 76% is managed by the Polish State Forest Enterprises in an uniform way regulated by the Forest Law and strictly prescribed management procedures. The State Forest Enterprise manages about 26000 of forest complexes of various sizes from small, less than 1 ha, to large as the Białowieża Forest of about 56000 ha. The private forest ownership is largely fragmented since 1.5 million ha of private woodland is owned by more than 1 million proprietors.

In Poland area with altitude above 300 m and classified as a mountains occupy about 8,9 % area of country. It was one of the reasons undervalue of importance of Polish mountain forests in the past, which despite of small area perform unusually significant functions for all country.

Mountain forests in Poland occupied the northern part of the Carpathian and Sudeten Mountains, extending about 700 km along the southern Polish border. They cover about 950 000 ha in five Polish voivodships. They have maximum elevation timber line about 1650 m. a.s.l. and have diversified climate, soil, vegetation and antropogenic impacts. The proportion of mountain forests in total forest areas in Poland, total volume over 7 cm and stand volume in 1ha is shown on Fig. 1.

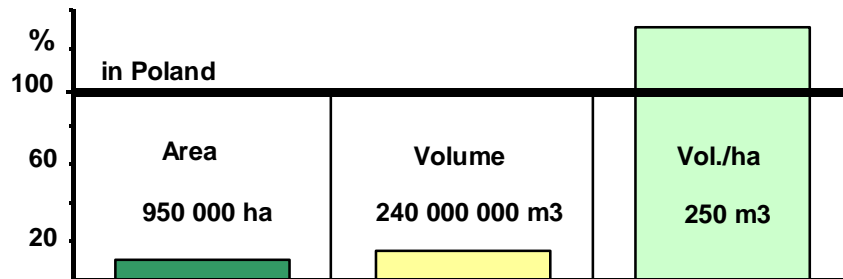


Fig.1 Mountain forests against background of forests in Poland

The forest vegetation form the following elevation zones:

- foothills, up to an altitude of 500 -600 m, vegetation mainly: Galio-Carpinetum and Pino-Quercetum,
- lower mountain zone at an altitude 500-1000 in Sudeten, and up to 1200 m in Carpathians, vegetation mainly: Dentario enneaphylidis - Fagetum (Sudeten), Dentario glandulosae - Fagetum (Carpathians) Luzulo nemorosae - Fagetum and Abieteti - Picetum montanum,
- upper mountain zone at an elevation of 1000-1250 m in Sudeten, and 1200 - 1650 in Carpathians, vegetation: Plagiothecio - Piceetum hercynicum (Sudeten), Plagiothecio - Piceetum tatricum (Carpathians)
- dwarf pine zone at an elevation of 1250-1450 m in Sudeten and above 1500 - 1800 m in Carpathians.

The present species composition of the forests significantly differs from the primeval (natural) because of centuries of improper management (monoculture plantations, lack of natural tree regeneration, and the type of cutting system). In the Sudeten the coniferous sites occupy 46% of forest area and the current percentage of spruce stands area is about 72% but fir stands only 0.3%. In the Carpathians the coniferous sites occupy only about 3% and the average percentage of spruce and fir stands reaches almost 50% (23 and 27 respectively).

3. Water problems

Water resources in Poland are relatively small. On over one third of the country area there a deficit of water occurs, especially in the vegetation period. Due to the high variability of annual rainfall (from 400 to 800 mm) only every 4 out of 10 years are suitable for agricultural production. In the remaining 6 years the rainfall is not sufficient or too abundant for optimal production. Summer rains frequently result in flooding and/or crop damage, while at the same time almost every year, there are some periods of drought. The soils in Poland are mainly of glacier origin and show a significant special variability. Approximately 50% of soils can be classified as sandy with low water holding capacity. The plants grown on these soils are the most sensitive to short periods of drought. Under these climatic and soil conditions the intensive and stable agricultural production requires supplemental irrigation. Only in south of territories of Poland the water balance in this period is positive. The trends of decreasing of water resources are observed in some regions and periods mainly due to increase of air temperature and relatively low precipitation during last 20 years. It has been

stated that the central territories of Poland are especially deficit in water and most threatened with becoming a steppe. Rational water management in forests is important for water relations in all the country.

The water-retaining properties of forests play a great role in shaping water resources and in combating phenomena, such as draughts and floods. Interception, retentive properties of forest litter and relatively high forest soil permeability make it possible to retain part of precipitation and to replace surface runoffs with groundwater runoff. As a result, forests make the underground water resources grow and, at the same time, they reduce the flood wave peak in rivers, thus reducing flood hazards. The significance of forest effect on water circulation in lowlands is slightly different than in mountain forests which, in addition to reducing flood waves, protect very well soil against erosion. The supplying of watercourses with underflow waters during climatic draughts is also considered an important role of forests. Discharges in watercourses outgoing from forests are then much higher than those in watercourses passing through agricultural catchment areas. The role of forests in shaping water quality increases with the growth of environment contamination.

Good example of the influence of forest on hydrology of torrents is the change of outflow in Sudeten due to ecological catastrophe. During On years 1977 – 1981, a gradual increase in the water outflow induced by the poor condition of stands as a result of insect attacks. In the years 1982 – 1984 amount of the water outflow increased in the as compared with the previous years caused by intensive dying of trees and their removal from the watershed. The runoff coefficient value for the small catchments up to 10 km² increased by 10 to 30%. In greater catchments the amount of the outflow was estimated at 10 to 30% depending upon deforestation rate and initial forest cover of the watershed. In period 1985 – 1989 outflow was stabilised as a result of stopping the deforestation process and intensive reforestation management. After 1990 up to now slow decrease in water outflow and intensified after the flood of 1997 was observed.

The trends of decreasing of water resources is also observed in forests. It should be prevented by control of outflow, increasing number of small surface reservoirs and improvement of soils properties with use of right silvicultural treatments. To stop depletion of water resources and to restrain the more and more frequent overdrying of habitats, the surface water retention in forest areas should be increased. The programme of retention increase is being implemented in Poland on the basis of agreements made in 1995 and again in 2003 between the Minister of Environmental Protection, Natural Resources and Forestry on the one hand and the Minister of Agriculture and Rural Development on the other hand. Implementation of Programme of Small Scale Retention in Poland (up to 2015) should crucial improve water balance and water condition of natural environment. Commonly, the term “small-scale retention” means different activities aimed increased water resources, but the major role of the small-scale retention measures is to positive influence on the moisture content of habitats by raising the groundwater level, increasing the water content in soils, as well as influence on the microclimate. Small-scale water retention is understood as the ability of plants, forest litter, soil and morphology of a terrain to retain water. Retention ability could be increase through various ways:

- landscape planning,
- technical measures,
- agro- and forestry management.

The increase of retention can be done through the augmentation of forest cover. Afforestation of upper parts of catchments, watershed areas and areas exposed to wet winds is most effective. Afforestations of farmlands should be in line with the spatial management of a given region and environmental conditions. The increase of retentive capacity can be attained by change of surface downflow into subsurface flow into groundwater-bearing layers. The retention measures include small natural reservoirs (water bodies, old riverbeds, lakes), artificial reservoirs

(ponds, excavation pits, impounding reservoirs, dammed lakes), rivers and network of water collecting ditches which delay the water runoff from the catchments area. According to the Programme of Small Scale Retention capacity of reservoirs which can be include to small-scale retention measures should be less than 5 millions m³ on agricultural area and 1 millions m³ in forests. The implementation of signed by two Ministers document was planned up to 2015. Total volume of water increase planned up to 2015 is 965 million m³. Most of this volume was projected in reservoirs (75 %) and lakes (23,3 %). Others measures (1,7%) were: channels retention, soil retention and afforestation.

Presently the major task in the area of water management is implementation of The Water Frame Directive of European Union which should be done up to 2015.

One of the most important priorities of the mountain forest watersheds management in Poland is an inclusion of private forests into the ecologization process and afforestation of a part of post-agricultural areas, specified in the National Programme for the the Expansion of Forest Cover.

4. Forests and protection of environment

In Poland various regimes of nature conservation were extended to protect the most valuable natural or close to natural types of vegetation, such as 23 national parks (315,000 ha), more than 1000 nature reserves, 7 biosphere reserves, 120 landscape parks (about 2.5 million ha) and in more than 350 areas of protected landscape (about 5 million ha).

Forest areas are protected as integral parts of the above forms of nature conservation. Almost 50 percent of the State-owned forests (about 3.5 million hectares) have been included as protective forests: i.e. forests protecting soil and water, constituting valuable resources of indigenous nature, sites of scientific importance, and forests making up protective zones around large towns, and health and recreation resorts (Fig. 2).

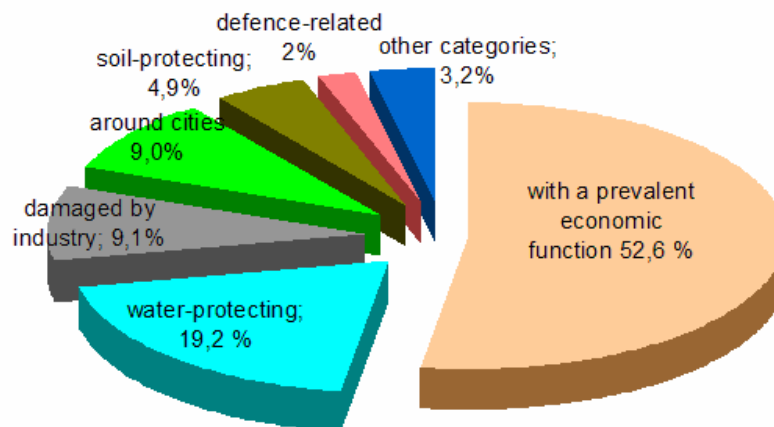


Fig. 2 Protective forest in Poland

Within the State Forest Enterprise a special form of management for protection with the emphasis on the preservation of forest multifunctionality (protection for the physical environment, social functions and economic functions) has been introduced in the form of Forest Promotional Complex. First ten of FPC were established between 1995-1996 and now there is 19 FPC on about million hectares, and six Forest Promotional Complexes have been established by last two years. The FPCs have been implementing programmes within which forest functions may be differently prioritized. In all instances, however, the priority task is to be compatible with the need to protect natural biodiversity what means that certain forest practices will be limited or even abandoned. These forest areas have specific ecological,

educational and social importance in Poland.

In addition, 1880 thousand hectares of forests or about one fifth of the Polish forest surface will be protected within the planned Natura 2000 sites. Special Areas of Conservation in Poland cover the following forest Natura 2000 habitats:

- 9110 acidic beech forests;
- 9130 nutrient rich beech forests;
- 9140 mountain maple forests with high herbs;
- 9150 xerophilous beech forests with orchids;
- 9160 subatlantic hornbeam-oak forests;
- 9170 central European hornbeam-oak forests; 9180 mountain maple forests on slopes and screes;
- 9190 acidic oak forests;
- 91E0 floodplain forest and riparian willow shrub; 91F0 oak-elm-ash floodplain forests; 91I0 subcontinental oak forests;
- 9410 mountain spruce forests.

In line with the Habitat Directive the forest management within these sites shall take into account the maintenance or restoration of the proper protection status of a given natural habitat. At the moment, only overall principles exist concerning the management of the forest natural habitats within Natura 2000 sites but in general there is no essential contradiction between the multifunctional forestry model of management which prevails in the Polish forestry and the concept of protection provided for by the Natura 2000 network.

Protected areas in mountains occupy 47.4% of their surface area (for comparison on a national basis they represent 32.5% of Poland's territory).

5. Review of legislation acts

The protection of forests areas, so important for mountain watersheds, is subject to several recent legal acts including:

- **Constitution of the Republic of Poland, as adopted on 2 April 1997**, includes *inter alia* the provisions on nature conservation and environmental protection to be conducted pursuant to the principle of sustainable development. The Act sets out policies that provide for ecological security for the present and future generations. It imposes on each citizen a general obligation to take care of the environment, as well as the liability for the deterioration thereof.
- **Act of 2003 on the Protection of the Environment** includes *inter alia* general provisions on nature conservation, including the principle of the protection of wildlife and landscape. It includes also essential provisions concerning genetically modified organisms. For nature conservation, particularly important are the provisions that refer to the protection of waters and marine environment as well as to the protection of air in the course of investment activity, and aim at the preservation of natural balance and biological diversity.
- **Act of 2004 on Nature Conservation** is the basic legal act in this field, and its provisions are consistent with the European Union law. According to the Act, nature conservation means preservation, appropriate use and restoration of natural resources and elements. Under the Act, nature conservation has the following aims: to sustain ecological processes and stability of ecosystems, to preserve biological diversity and geological heritage and to safeguard the continuous existence of plant and animal species as well as of their biotopes, by means of maintaining natural habitats and other natural elements in adequate conditions or by restoring them to the original state. Another important goal is to develop appropriate human attitudes towards nature. The Act laid down: nature conservation authorities, nature conservation forms, application of nature conservation, management of natural resources and elements, rights vested to public organisations and to citizens, legal implications of the protection and penal provisions.

- **Act of 1991 on Forests** with later amendments lays out rules for sustainable forest management. Over the last decade several important documents concerning forest management and protection have been elaborated and adopted in Poland. Most of them were prepared before 2003 within the framework of the accession procedures.

In addition to the above mentioned legal acts other political documents have been adopted including:

- **Program of Conservation of Forest Gene Resources and Selection Breeding of Forest Trees (1993)**. The program defines the basis for the conservation of forest gene resources, improvement of the seed base and selection of forest trees. The Bank of Genes in Kostrzyca (Sudety Mts) was established for all Polish forests;

- **Guidelines on the improvement of forest management based on sustainability principles (1995)**. The document lays rules for the introduction of Forest Promotional Complexes and promotes sustainable forest management in the commercial forestry obliging to implement such activities as: protection and restoration of water regime, water and wetland biotopes and biocenoses, and cooperation with land planning in this respect; development of enriched forest ecotones; limitation of clear-cut size; enrichment of species, age, and spatial structure of forest stands; priority for natural methods of forest protection. The Guidelines specify detailed principles regarding the protection of forest genetic resources, silviculture, forest protection and management;

- **National Programme for the Expansion of Forest Cover (1995)**. The country's forest cover increased from 20.8% in 1945 to 28.2% in 1995. According to the abovementioned document the forest cover in Poland shall increase to about 30% by 2000 and to about 33% by 2050;

- **National Policy on Forests (1997)** A document adopted by the Polish Government and highlighting the aims and trends of forestry development in the XXI century. The document calls for the establishment of Forest Regional Operational Programmes and emphasises the need to observe a sustainable development strategy and the importance of forest ecological, economic and social functions. The Policy provides for forest management methods which take account of the specific natural, economic and social conditions. Nature (biodiversity) protection in forest management shall be gradually enhanced by implementing nature conservation plans in individual Forestry Inspectorates (main management units). These plans have already been prepared in the majority of forestry units in Poland. Guidance provided by the new forest policy requires that both public and private forests are subject to similar management methods. Thus, every forest owner and manager is obliged to manage forests following such basic rules as sustainability, responsibility for forest protection and enrichment of forest resources. According to the Policy the permanence of forests and their multifunctionality, will best be achieved by: increasing the country's forest resources, improving the state of forest resources and their protection, introduction of a pro-ecological and economically balanced model of multifunctional forest management, participation of Poland in the international dialogue on global principles of sustainable forestry management.

- **National Forest Program (2002)** - the Program covering among other things the protection of forest areas which play an important role in all activities involved in planning and implementation of sustainable forestry.

6. Main problem that must be solved

Mountains often constitute geopolitical borders and can be sites of potential/current tensions or even conflicts owing to their rich natural resources and strategic relevance. Within countries too, mountain areas can be places of tension and conflict: because of their inaccessibility and remoteness, mountain regions sometimes harbour opposition groups.

However, mountains also offer opportunities for transborder cooperation and promoting peace.

To the main threats of mountain forests still belongs air pollution, change of water condition as well as extreme weather events like floods and droughts, the changes in use of agricultural lands due to economy reasons, the growth of tourism and its concentration in attractive mountain regions.

There are still needs for research on regional level on pollution of air and water, soil erosion, flood protection and the quality of the environment. Major difficulties are connected with the anthropogenic pressure, especially related to water pollution and the prevention against floods. Mountain watershed management requires an interdisciplinary approach. Integrated water management should include hydrology, ecology, forestry, infrastructure, as well as social and a range of other problems.

One of the most important priorities of the mountain forest watersheds management in Poland is an inclusion of private forests into the ecologization process and afforestation of a part of post-agricultural areas.

Long-term tasks are connected with implementation of Water Frame Directive of European Union, National Programme for the Expansion of Forest Cover, Programme of Small Scale Retention and National Program of Municipal Sewage Treatment.

Romania

FAO
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

EUROPEAN FORESTRY COMMISSION
WORKING PARTY ON THE MANAGEMENT OF THE WATERSHEDS

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NATIONAL REPORT

ROMANIA

Ciprian Pahontu*)

Nicolae Oprisa**)

Ionut Zlota***)

**) Ministry of Agriculture, Forests and Rural Development, Director of Forestry Development and Property Consolidation department*

****) Ministry of Agriculture, Forests and Rural Development, Forestry Development and Property Consolidation department*

*****) Ministry of Agriculture, Forests and Rural Development, National Forest Administration – ROMSILVA, Afforestation – Development department*

1. General information

Natural conditions of relief, lithological substratum and climate from Romania, corroborated with inadequate management of land resources and pollution from the last decades, has led to different levels of degradation for 7.1 million hectares of land, produced by erosion, landslides etc. Due to this situation, over two thirds of hydrographical network has an increased torrential rate, producing over 175 million euro damages.

The Danube is carrying yearly, from Romanian territory, around 17-20 million mc sludge resulted from land's degrading processes (depth erosions, surface erosions, landslides), as well as from hydrographic network.

Torrentiality and land degrading are exerting their effects on large areas, causing wastages for the national economy, especially through:

reducing or even entirely wasting the soil fertility;

altering hydrological regime of the rivers, with all its negative consequences, such as: predisposition for catastrophic flooding (1970...

damaging or destroying objectives situated in the way of flash floodings (factories, hydro-electric plant, roads, cities)

clogging of the barrier lakes;

elevating bed of rivers and narrowing their courses.

Land degrading processes and torrentiality are concentrated over the mountainous and hilly areas, where the reception area for the rivers with excessive torrentiality totalizing over 1,9 million hectares, and the length of the torrential hydrographic network is 29 000 km, in this area.

The data we have until now, indicate that the first torrents correction works in Romania were carried out by the National Railway Administration, that performed the first works in 1905 and 1912, in Sinaia – Posada – Comarnic area.

During 1920 – 1950, as a result to the obligations undertaken by Romania under the Treaty of Trianon, there were executed consolidation works for a hydro graphic network of 140 km, with a special intensification process on Someș, Criș, Mureș, Timiș (Banat) rivers that flow into Tisa.

In 1930, the "Law on amelioration of degraded lands" was promulgated which would set up the legal frame for: the constitution of the amelioration perimeters, the planning, financing and execution of works necessary for the amelioration of degraded lands and for torrents correction. The Law required that the "Amelioration Project" should be elaborated by the representatives of the Amelioration of Degraded Lands Service within the "Forest Regime Department" which actually caused for the torrents correction works to become a forest sector responsibility.

The period during 1950 – 1992 was outstanding, on the overall of the operations, from the objectives protection point of view, objectives that were executed within the social-economical development program of the country and habitat. Among these programs, we mention the following:

- the hydro-energetic program;
- the national program for the hydro graphic basins complex management plan;
- the program for the update of the communication means;
- the program for the accessibility of forest through forest roads development;
- the valuing program by the afforestation of degraded lands on the agricultural sector.

There should also be mentioned the fact that within the national program for the hydrographic basins complex management plan, a component regarding the torrents correction was also included, meant for protecting the objectives developed through these programs against torrential phenomena.

In 1996, the Forest Research and Management Institute developed a study that proved that during 1950 and 1992, in the forest sector and with state financing, there were successfully executed torrents correction works in 3.166 basins and amelioration perimeters, in a total surface of 983.745 ha, out of which 668.930 ha were inside the state forests. The hydrographic network consolidated through torrents correction works (during the period and on the geographic area mentioned above) measured a total of 1.856 km. At the end of 1992, within the basins mentioned

before, there also existed an undeveloped torrential hydrographic network in a total length of 2.150 km.

Regarding the actions taken on this particular phase, we should bring the following explanations:

- the forest sector founded its own school (recognized by FAO) of complex and integrated management of the torrential watersheds, using the hydro energetic constructions like: ditches, sills, rails, small dams made of: wood, metal, dry stone masonry, concrete, concrete steel, masonry with cement mortar.

- the national program on hydro graphic basins management plan, set up by law, offered the possibility for parallel planning and execution, on large geographic areas, of the works required by the water management sector, of the works against soil erosion, in the agricultural sector and of the hydro graphic basins management, in the forest sector.

The correlation of the above mentioned sectors was set up by an institution founded at the national level, under the name of National Water Board, especially on the reception basins of the accumulation lakes. This correlation had very good results, but its period of existence was rather short. We still think that, for this activity, the correlation of works within the hydro graphic basins complex management plan is extremely important.

- the state financing made possible the creation of the legal frame and of the institutions to implement those programs (research, planning, approval, authorization, execution). The result was mostly felt during 1988 and 1989 when, there were consolidated each year about 120 km of torrential hydro graphic network, recognized to be the peak phase of the operations carried out over one century.

After 1992, the consolidation of torrential hydro graphic basins operation reached a deadlock, due to the reorientation of state funds towards the safety works for the existing correcting systems as well as towards works for forest road protection, so that, during 1992 – 2005 there was made functional a surface of 431.6 km of torrents correction works.

In the last 2 years, in Romania, the torrential rains with high intensity has repeatedly generated catastrophical floods.

In December 2005 the government has approved the “National strategy for floods risk management”. According to this strategy, the Ministry of Agriculture, Forests and Rural Development has to identify high risk areas for erosion and soil degrading and classify them in order to promote new works. Although it will ensures watershed management based on plans accorded with the big hydrographic basins plans for flooding risk management.

II. Information on the present situation

1. Related to the new objectives situation within the period after 1992:

- the central authority responsible with forestry, in its quality of main credit officer, drastically reduced the state budget financing;
- after 1998, the main financing sources were represented by CEDB and EIB
- in 2005, the funds allocated from the state budget, for torrent correction works, were around 8 million euro; this year the amount was tripled.
- currently we trying to access 20 million euro loan from Council of Europe Development Bank.

2. Related to the status of the constituted fund:

- the existent constituted fund, in which most of the works have a common surpassed functionality period, has not beneficiated from maintenance and repairing works and some of these works are really in an advanced degradation stage;
- there have not been elaborated technical norms on the maintenance and repairing operations; they are only now in course of receiving the final approval.

III. Appraisal of the works to be done

It is necessary for the obtained results to be completed by the continuation with new works required for the finalization of the initialised systems and by putting into safety the existent works. Any other delay may lead to the collapse of the existing constructions and to the release of violent torrential phenomena of unbelievable proportions, due to the fact that upstream every dam there are

important quantities of alluviums, which may be moved by the water, transported and laid down on the social-economical objectives downstream.

In order to prevent and mitigate the torrential phenomena, as well as to reduce the intensity of the lands degradation process, we estimate that for the execution of these works there shall be needed funds in a total amount of 180 millions Euro, specifically for:

- putting into safety the existent torrents correction works, as well as for the continuation of the works begun in the period 1950 – 1992, in the torrential watersheds, with the objective of developing a 350 km of hydro graphic network;

- starting new works of torrents correction inside the watersheds damaged by natural disasters which affected objectives of general interest: inhabited areas, accumulations, etc, with the objective of developing a 250 km of hydrographic network;

In order to mitigate the torrential phenomena up to an acceptable degree for the social safety, as well as to regain the ecologic equilibrium within the areas damaged by the degradation process, it is required, on short and medium term, a minimum annual execution rhythm of 200 km of corrected torrential bed.

The “Law on the improvement of land resources” states that: “The National Administration for the Improvement of Land Resources manages the infrastructure of land resources improvement belonging to the public and private sector, *except the lands include in state forest areas managed by National Forest Administration.*”

Because of the reducing process related to the areas managed by the National Forest Administration, it is required for a torrents correction department to be founded within the National Administration for the Improvement of Land Resources. The department shall deal with the financing, through state budget funds and external loans, of the execution of works, as well as of the maintenance operations for the existent works, on the lands that are not managed by the National Forest Administration.

Spain

25th Meeting of the Working Party of the CFE for Mountain Watershed Management

**Salzburg, Austria
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**NATIONAL REPORT 2004-2005
SPAIN**

**Dr. Eng. Leopoldo Rojo Serrano
Ministry of Environment
Spain**

1. Forest and hydrological restoration activities

Central Government and Autonomous Regions work together to carry out forest and hydrological restoration actions in watersheds in order to control hydrological erosion processes.

The following activities were undertaken along the years 2004-2005:

Reforestations

Financed by the Ministry of Environment and achieved by the Autonomous Region Technical Services an area of 4.217 ha has been reforested with species of the most ecological value according to the climate, topography and land conditions.



Fig.1. Reforestation with *Populus alba*, 11 years old. Pais Vasco.



Fig.2. Reforestation with *Prunus avium*, 9 years old. La Rioja.

Correction works

They have been carried out in torrents as preventive and active measures against bedload transport to avoid its accumulation in water courses and reservoirs. Correction works have consisted on the construction of 24.205 m³ of terraces and check dams of hydraulic and gavion masonries.

Forest areas improvement treatments

In order to preserve and to improve the state of the forest areas and their protective functions, these treatments have been applied in a 4.452 ha area.

The main part of the mentioned interventions have been co-financed by common funds, in compliance to the forestry articles of the Regulation 1257/99 (CE) in force in 2004-2005, from the FEOGA Guidance Section, within the framework of the corresponding Guarantee Section Programs.

The table below shows the distribution by Autonomous Region of the described investments:

INVESTMENTS 2004-2005	
AUTONOMOUS REGION	INVESTMENT AMOUNT€
Andalucía	6.858.727
Aragón	1.912.970
Asturias	1.484.313
Baleares	869.396
Canarias	481.342
Cantabria	612.613
Castilla-La Mancha	3.477.704
Castilla y León	5.035.006
Cataluña	4.778.801
Extremadura	1.908.918
Galicia	2.281.716
Madrid	746.696
Murcia	2.206.014
La Rioja	514.914
Valencia	2.758.085
TOTAL.....	35.927.215

These investments have been differently assigned to the three kinds of intervention mentioned depending on the necessities of each Autonomous Region:

INTERVENTIONS 2004-2005			
AUTONOMOUS REGION	REFORESTATIONS (ha.)	FOREST AREA TREATMENTS (ha.)	HYDRAULIC WORKS (m³)
Andalucía	540	1.019	9250
Aragón	403	0	0
Asturias	286	55	0
Baleares	0	3	3200
Canarias	19	0	666
Cantabria	113	0	0
Castilla-La Mancha	524	1.036	1415
Castilla y León	747	686	0
Cataluña	0	1.038	0
Extremadura	605	0	33
Galicia	455	128	0
Madrid	0	165	0
Murcia	0	153	6842
La Rioja	0	157	0
Valencia	525	12	2799
TOTAL	4.217	4.452	24205

Most of the investment of the years 2004-2005 has been co-financed by the FEOGA Guidance Section, with reinburshements between 50% and 75%, depending on the regions, within the framework of the Guarantee Section Programs corresponding to the period 2000-2006 (Chapter VIII of the Regulation 1257/99 CE).



Fig 3. Gavion masonry stabilisation dam.

Besides these ordinary investments, special legislation was approved in 2005 (RDL 11/2005, RD 949/2005 and RD 1123/2005) to allow emergency actions to prevent and to restore damages caused by forest fires.

The investments for the emergency actions were geographically distributed as shown in the table below:

LOCATION	EMERGENCY ACTIONS	INVESTMENT (€)
Guadalajara	Fire damages restoration	3.980.000
Gerona	id	309.000
Cáceres	id	3.980.000
Orense	id	560.000
Pontevedra	id	950.000
TOTAL Ecological and environmental restoration of fire damaged areas		9.779.000
Murcia	Biomass use cancellation	500.000
Madrid	id	500.000
TOTAL Wood fuel elimination		1.000.000
Confederación Hidrográfica Norte	Forest Fires Prevention	904.800
Confederación Hidrográfica Guadalquivir	id	1.175.955
TOTAL		2.080.755
TOTAL EMERGENCY INTERVENTIONS		12.859.755

Economical Assistance for Public Forest Areas

Funds have been set aside as economical assistance for the sustainable management of forest areas, setting mountain areas and the high part of watersheds as priority areas with the aim of preserving and strengthening the protective, social and ecological functions these zones fulfil.

The total amount of the economical assistance reached 18.922.040 € in the years 2004-2005 and was distributed in the different Autonomous Regions as shows the table below:

ECONOMICAL ASSISTANCE FOR PUBLIC FOREST AREAS MANAGEMENT 2004-2005	
AUTONOMOUS REGION	EXPENSE €
Andalucía	2.035.620
Aragón	1.420.000
Asturias	1.043.860
Baleares	247.940
Canarias	810.360
Cantabria	1.033.380
Castilla-La Mancha	2.723.960
Castilla y León	3.768.980
Cataluña	1.166.560
Extremadura	2.067.300
Galicia	232.140
Madrid	701.260
Murcia	0
La Rioja	1.341.420
Valencia	329.260
TOTAL.....	18.922.040

2. Cartography, Monitoring and Planning works

During the 2004-2005 period the following initiatives were undertaken:

Digital Soil Map

The production of the Digital Soil Map started in 2005, within the framework of the project LUCDEME, attaching high importance to a thorough knowledge of the main natural resource implicated in desertification processes.

29 cartographic sheets have been digitalised, at scale 1: 100.000, out of the 142 edited in graphic format since 1981 (14% of the national territory), covering so the whole region of Almeria.

The digital map of every sheet has been published in a CD containing, besides, the vectorial layers files allowing to be used in a GIS, a report with the description of every cartographic unit, complete data about a selection of the edaphic profiles sampled for the production of the map and pictures of the profiles and of the unit.

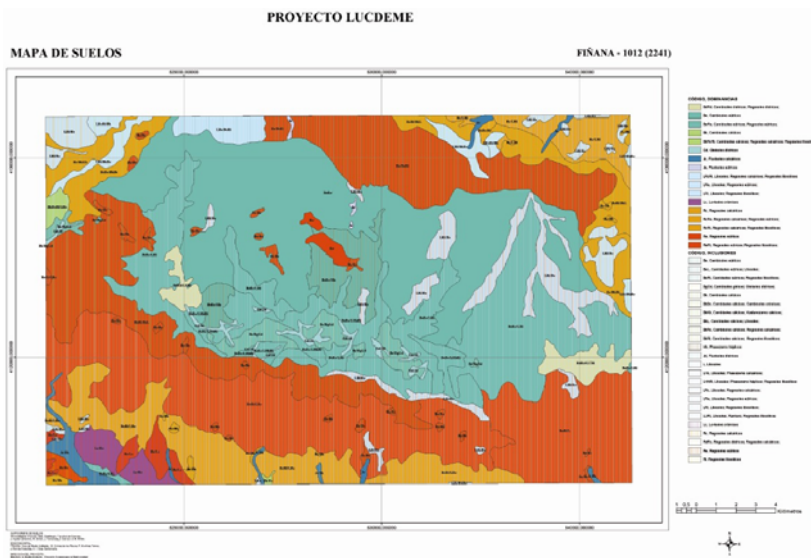


Fig.4. Digital Soil Map Cartographic sheet.



Fig. 5. Edaphic profile

Furthermore, the different cartographic sheets have been assembled in order to obtain the representation of the whole region as well as a general report about land in Almeria.

The Annex IV of the United Nations Convention to Combat the Desertification, specific for the North Mediterranean Area, together with the development of the European Strategy for Land Protection, reinforce the importance of this cartography. Therefore, the publication in digital format of all the existent sheets is planned with their corresponding regional map which, in turn, will be assembled to obtain a continuous digital cartography of land.

Soil Erosion National Inventory

Completing the previous Soil Erosion State Maps, the inventory intends to detect, quantify and represent cartographically, in digital and graphic format, the main erosion processes of land in our country as well as their evolution along the years. These objectives require three kinds of cartography activities: a representation of land segmentation in homogeneous systems, a compilation of field measurements and a subsequent processing and integration of both informations.

In accordance with the schedule planned, field works of 17 regions are already finished and 13 out of them have been published: Madrid, Murcia and Lugo in 2003; Asturias, Baleares, La Coruña, La Rioja and Navarra in 2004 and Cantabria, Gerona, Orense, Pontevedra and Tarragona in 2005.

Works corresponding to the whole country will be carried out continuously and periodically every 10 years at a scale of 1: 50.000 which will allow the constant updating of the cartography as well as of the field data. Besides, it will make possible comparison along the years.

This purpose has led to the achievement in 2005 of the works corresponding to Badajoz, Barcelona, Cáceres and Lérida, the publication of which is planned for 2006.
National Action Program to Combat Desertification (NAPD)

In compliance with the article 5 of the United Nations Convention to Combat the Desertification, the Work Program Document of the National Action Program to Combat Desertification was concluded in October 2004. The Document was submitted to the Secretariat of the UNCCD for its analysis and elaboration of remarks concerning, specially, the respect of the principles and contents of the Convention. The result of the revision of the Document by the Executive Secretary of the UNCCD was "once the NPCD analysed, he declares with pleasure there is nothing to add to this integrated and complete tool to combat desertification in Spain".

Monitoring and Assessment Erosion Experimental Stations Network



Fig.4. Flow gage in Morille Experimental Station (Salamanca)

The aim of the network is to coordinate and improve the use of the results obtained by the different research teams who work on the experimental study of this phenomenon since the 80's and who nowadays have 20 associated centres and more than 40 experimental stations.

The network started working in 1996 and has provided data until 2005 to create a data base about the erosion cycle, the hydrologic cycle and water quality that can be looked up at real time by any researcher or environmental manager making easier the development of preventive and management actions in areas vulnerable to desertification according to reliable information.

Plan for Priority Interventions in Forest and Hydrological Restoration, Erosion Control and Combat against Desertification

This plan, the elaboration of which concluded in 2003, has been updated in 2005 with the purpose of setting the priority watersheds to act, considering the interventions to be carried out in medium-term and establishing a hierarchy and a schedule for their execution.

The aim of the Plan is to promote, to focus and to set a hierarchy for the actions of implementation, conservation and improvement of the protective vegetal cover in areas strongly affected by erosion-desertification problems.

3. Institutional and Coordination Actions

XIII International Course for Forest and Hydrological Restoration and Erosion Control.

This course was celebrated in Spain in September 2005 together with the Ministry of Foreign Affairs. The assistants were university graduated from South America with experience or working in activities related to the combat against desertification and as managers of watershed forest and hydrological restoration and watershed management activities.

The course included theoretical classes given by specialists from Public Administration, University and Private Companies, and practical experiences in the Spanish Pirynees (Huesca), paying special attention to the International Agreement to Combat Desertification and its specific annexes for South America and Caribbean and North Mediterranean Areas.

*V Interactive High Course about Combat against Desertification and Defence against Drought and Floods
and
II International Seminar about Forest as Biodiversity Reserve and Defence against Desertification and Climate Change.*

These interactive courses, developed within the framework of the activities included in the Araucaria Program of the Spanish Agency for International Cooperation, have been celebrated in Cartagena de Indias (Colombia) in July and October 2005 with the main goal of providing South American technical experts the necessary knowledge and information to achieve a correct management of the desertification issue and the erosion control.

4. Torrent Arás: Sentence for the catastrophe of 1996, ten years later.

Almost ten years later, the Spanish Government must pay 11 million euros to the victims of the flood of the torrent Arás (Huesca Pirynees) that took place on the 7th august 1996.

The storm registered let 185 l/m^2 in 24 hours what involved, for a 1.850 ha watershed, an estimated flow of 300-520 m^3/s of torrential lava.

The flow destroyed all the check dams and unleashed the flooding of the entire camping of Biescas situated in the alluvial fan of the torrent, causing the death of 87 people.

The court passed sentence on the 22th December 2005 and, considering that the danger involved by the location of the camping in the fan of the torrent was clearly documented and predictable, the Government is condemned to indemnify the victims.

This accident represents one more example of the high importance of the preventive measures and more specifically of the zonification and establishment of danger areas with their associated limitation of uses.

The following diagram represents the swollen of the torrent the day of the accident in the Camping of Biescas:

LA TORMENTA Y LA RIADA

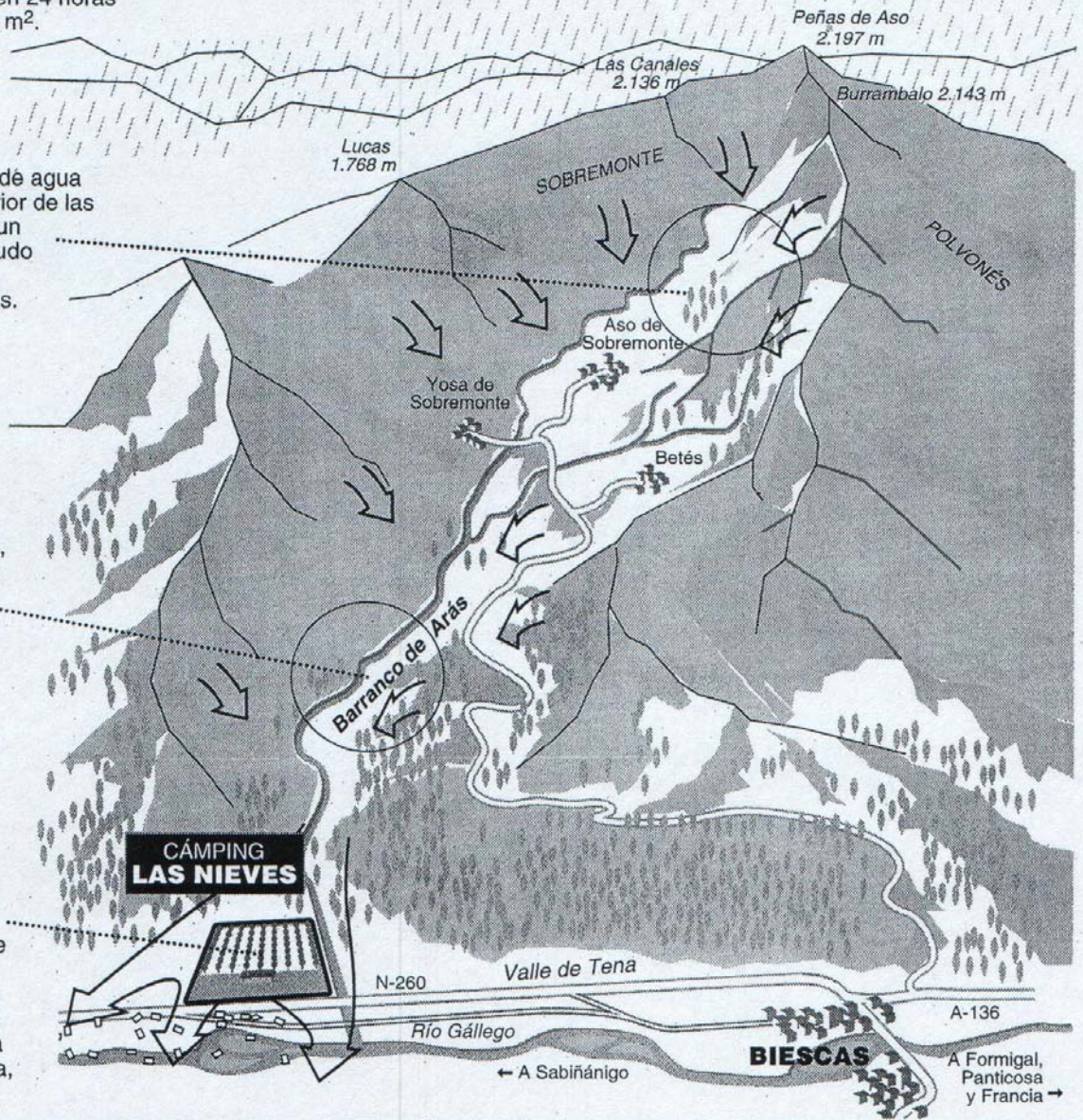
Tuvo su comienzo en un frente frío sobre los Pirineos y una masa fría de -12° a más de 5.500 metros de altura. Las temperaturas en superficie oscilaban entre 24° y 31° . La lluvia caída en 24 horas fue de 185 litros m^2 .

A las 19.30 la enorme riada desbordaba el barranco de Arás y anegaba el camping Las Nieves. Fueron movilizadas todas las ambulancias de la Comunidad de Aragón, policía, Guardia Civil, Protección Civil, bomberos y una compañía militar de Jaca.

La acumulación de agua en la zona superior de las laderas produjo un caudal que no pudo ser sujetado por diques y represas.

El puente de Yosa, que resultó destruido, hizo de tapón de las aguas y favoreció el flujo de la riada.

El camping Las Nieves, en el que se encontraban alojadas 600 personas, quedó arrasado por una corriente de agua, piedras y lodo.



Fuente: Instituto Nacional de Meteorología, elaboración propia.

EL PAÍS

Finally, we include five photographs of the same stretch of the torrent along the last century to illustrate its historic evolution:



Photo 1: Early 20th century



Photo 2: Mid 20th century



Photo 3: Between 1970 and 1980.



Photo 4: Image of the torrent after the swollen on august 1996.



Photo 5: Correction work achieved in the last years (picture from 2001)