EUROPEAN FORESTRY COMMISSION

Final Report of the

ELEVENTH SESSION OF THE WORKING PARTY ON THE MANAGEMENT OF MOUNTAIN WATERSHEDS

Held in Ankara, Turkey
3 - 14 June 1974

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

EUROPEAN FORESTRY COMMISSION

WORKING PARTY ON THE MANAGEMENT OF MOUNTAIN WATERSHEDS

Eleventh Session

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FINAL REPORT

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Rome, 1975

ABSTRACT

The European Forestry Commission Working Party on the Management of Mountain Watersheds held its Eleventh Session in Ankara, Turkey from 3-14 June 1974.

There were 36 participants from 11 European member countries plus observers from Unesco and FAO and an IUFRO representative. About 20 observers were present.

During 3-8 June, papers were presented and discussed on the topics of watershed management, torrent control, avalanche control, erosion, environmental protection, forest hydrology, mountain land use planning, flooding, snow management, mountain tourism and related topics. There were 74 reports submitted in English, French or Spanish.

The group decided to complete a terminology in five languages (in 1975) to begin a manual on torrent control and to publish a manual of avalanche control (1975/76).

A field study trip in watershed management went from Ankara to the Turkish south coast during 9-13 June.

This summary report is available from the Forest Resources Division, Forest Conservation and Wildlife Branch, FAO, Via delle Terme di Caracalla, Rome, Italy. The individual reports summarized here, however, are not available from FAO but should be requested directly from the individual authors (see address list).

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1. INTRODUCTION

The 11th Session of the Working Party on Mountain Watersheds was held in Ankara, Turkey, from 3 to 8 June 1974.

The working sessions in Ankara were followed by a study tour across Turkey from Ankara to Antalya, on the south coast.

The session was attended by 36 participants from the following 11 countries: Austria, Federal Republic of Germany, Spain, France, Italy, Norway, Poland, Romania, Switzerland, Turkey and Yugoslavia. The Austrian participant also represented IUFRO. Unesco and FAO were represented.

The discussions were chaired by Prof. S. Munteanu (Romania) with the assistance of Mr. Puglisi (Italy) and Mr. Lichtenhahn (Switzerland), as first and second vice-chairmen respectively. Mr. S.H. Kunkle (FAO) served as Technical Secretary for the group.

The opening ceremony took place in Ankara with the Turkish Minister of Forests welcoming the visitors. He underlined the importance of watershed management and water and pointed out the importance of collaboration among the specialists in these topics. Mr. Munteanu expressed appreciation to the Turkish authorities for their hospitality. He emphasized the dual role of the forest, both for its productive function as well as the protection of mountain watersheds and as a source area for water supplies.

Mr. G. Kronfellner-Kraus, who also represented IUFRO, summarized the collaboration between the Working Party and IUFRO. Mr. B. von Droste, (Unesco) noted the interest of that Organization in the work of the group, as did Mr. L.S. Botero of the FAO Regional Office in Latin America, who reminded the group of the importance of close contacts between the European and South American specialists.

2. REPORTS BY AUSTRIA (A)

2.1 National Report of Austria (abstract) 74/A.1 (Austria)

(G. Kronfellner-Kraus)

From the middle of the year 1972 until May 1974 less floods, mud flows and avalanches occurred than during the years before. Because of the lack of such events, operations progressed on schedule in the areas of torrent control, avalanche protection and reforestation. Most control works were built in the districts of past catastrophies.

Through the so-called "special programme for avalanches" (Lawinensonderprogramm) considerable additional resources have been provided for avalanche control and reforestation in avalanche districts. Forestry agency reforestation activity in torrential and avalanche catchments was also increased by the revision of law mentioned at the 10th Session. In 1972, reforestation operations were carried out on 370 ha of alpine land, and 270 ha of destroyed or old protection forest were re-established. The total outlay for torrent control, reforestation and the re-establishment of protection forests in 1972 was 360 million schillings.

New points of main effort: the preparation of maps of endangered areas was accelerated; a working group on the cost-benefit question; a full-time professor of torrent and avalanche control at the "Hochschule für Bodenkultur"; the ongoing research programmes of the Federal Forestry Research Institute; the "Colloquium on Torrent Dams", which was published. (Original: English)

2.2 Torrent Control - Problems on Channel Stabilization (abstract) 74/A.2 (Austria)

(G. Kronfellner-Kraus)

Channel stabilization is one of the most important problems of torrent control and on this occasion the topic can scarcely be dealt with as fully as it deserves to be. Therefore more general questions, and general proposals for answering them should be put forward here.

The most important question, which is raised time and again, is how to find an optimum solution, and the following aspects must be considered in the search for it:

Technical requirements: The choice of methods and types of construction.

Environmental requirements: Especially the use of natural materials.

Economic aspects: Including construction cost and benefits.

Social aspects: Labour and seasonal employment.

Under these aspects the problem of channel stabilization should be tackled through an international survey of methods and construction types, which can be equally important for both theory and practice.

A catalogue compiled on the basis of this questionnaire could provide not only general information but also a basis for general guidelines (by mathematical models). Such a catalogue could be a better basis for our planned handbook. (Original: English)

2.3 Preparation of a Handbook - Part II, Torrent Control (abstract) 74/A.3 (Austria)
(G. Kronfellner-Kraus)

In accordance with the results of the 10th Session of the Working Party, Mr. Kronfellner-Kraus prepared a preliminary draft outline for this part of the handbook in 1973. In June 1974, Messrs. Benini, Kunkle, Munteanu and Puglisi reviewed this draft and made revisions, emphasizing that every chapter should stand independent of the others, in order to allow better collaboration among a large number of specialists.

Mr. Kronfellner-Kraus and several Working Party members revised the outline in Ankara and proposed that the manual have the following format (only major headings given here; details have also been worked out):

0. Introduction, 1. Definition and classifications, 2. Torrential hydrology, 3. Basin degradation processes, 4. Stream bed and bank processes, 5. Watershed stabilization measures, 6. Principles and methods of torrential streambed control, 7. Construction methods, 8. Materials used, 9. Hydraulic calculations, 10. Static calculations, 11. Undertaking and maintaining works, Annex 1. Symbols. (Original: English)

2.4 Torrent Erosion in its Particular Forms (abstract) 74/A.4 (Austria)
(G. Kronfellner-Kraus)

The term 'torrent erosion' basically encompasses all denudation in torrent areas, mainly geological and streambed erosion, but also other natural as well as man-caused erosion, insofar as it may contribute to the torrent's transport of sediment. Soil erosion is a relatively slow process of destruction of the exposed soil surface. Torrent erosion, on the other hand, usually occurs suddenly in the form of breaks and often affects the soil profile as a whole, including the transportable subsoil. In its various forms torrent erosion may appear as vertical erosion, lateral erosion, landslides or mass creep in rock. The protective influence of the forests likewise varies. While soil erosion can be checked within tolerable limits solely by agricultural and silvicultural methods, the curbing of torrent erosion mostly calls for combined technical and silvicultural-biological measures.

Mass creep, a special kind of torrent erosion, causes deep deformation of mountain slopes, narrowing torrent valleys. Examples are given. Observations over a period of five years in a mass creep area of 2 sq km along the Gradenbach in the Möll valley (Carinthia) brought out the relationship between precipitation and movement of slopes as well as the kind and degree of stress on the check dams. The large degree of special stresses necessitates the use of a specific technique of defense works and custom-designed structures. This control has to include a strong raising and broadening of the torrent bed to control erosion and stabilize the convex toe of the moving mass by depositing the bed load. Mechanical and biological draining of the moving mass is necessary. Experience has shown that stabilization works are not always able to stop the movement of the slope. In such cases the bottom of the torrents will require repeated raisings and repeated deposition of the bed load. Therefore, when selecting the construction types, one must consider the possibility of more movement of the slope or stresses from the sides as well as the possible need to further raise the bottom of the torrent. Flexible building materials are required, which stay in working order when heavily stressed. Combined construction types may also be used, with single movable parts which are suited for later lifting. The adaption of the techniques for local conditions can be made more economical by starting the reconnaissance sufficiently early, for the whole area involved, and by continuous control of the works. The special importance of mass creep also needs consideration when classifying torrents, particularly in appraising the torrent potential. (Original: English)

2.5 Terminology of Torrents and Torrent Control (abstract) 74/A.5 (Austria)
(G. Kronfellner-Kraus)

A German/French glossary, with definitions in these two languages was presented which included 522 words or phrases. An English draft list of uncorrected terms was also added to 74/A.5; however, the latter should be replaced by the FAO English list (see 74/FOR. 1, Kunkle, under FAO). The word numbers correspond to items 74/A.5 and 74/FOR.1.

In 1975 Spanish and Italian words (no definitions) are to be added by Messrs. Benini, Botero and Cadenas. Kunkle, FAO, is coordinating the project. The complete five-language terminology and word list is planned for publication in 1975. (Original: German/French/English.)

2.6 Bibliography 1972 and 1973, Austria (abstract) 74/A.6 (Austria)
(G. Ruf)

About 140 references, primarily in German, are listed by author, title and place of publication. (Original: English)

3. REPORTS BY SWITZERLAND (CH)

3.1 General Report (abstract) 74/CH.1 (Switzerland)
(C. Lichtenhahn and J.P. Graf)

The centuries-old struggle against flood and avalanche in Switzerland is being waged as needed and financially possible.

Population growth, industrialization, the exodus of the mountain population, the need to help mountain regions, the cleaning of waste waters, the harm done by toxic gas emanations, protection of the landscape, integrated land use planning, and water resource management, are important current problems.

- The amended federal law against water pollution went into force on 1 July 1972.
- A law on the doctrine for mountain region development is under consideration.
- The federal decree instituting emergency land-use planning measures is being applied pending promulgation of the federal law.
- An article of the constitution relating to water resource development will make it possible to place these resources under effective overall management. (Original: French)

3.2 Statistical Analysis of Peak Discharges (Flood Frequency) in Swiss Water Courses up to 1969 (abstract) 74/CH.2 (Switzerland)
(C. Lichtenhahn)

A frequency analysis of the maximum discharges of Swiss water courses was performed using the peak discharges of the greatest flood in each year of observation (annual flood). The values in the series of measurements were fitted to several frequency distributions permitting extrapolation for low-frequency discharges. The distributions used were Galton's 2- and 3-parameter lognormal distributions, the exponential distributions of Goodrich and Fuller, the Gamma distribution and Pearson's type III distribution. Galton's 2- and 3-parameter distributions give a good estimate of 50 and 100-year floods. Pearson's type III distribution, recommended in 1967 by the Water Resources Council of the U.S.A., yields

results only negligibly divergent from those of the other two distributions. Fréchet's distribution is usable only for stations south of the Alps.

In applying these statistical methods, the following points must be borne in mind:

- all values relate to the history of the drainage basin;
- we pass from short series - of 25 to 50 years - to floods of very low frequency (100-year and 1 000-year floods);
- measurements of unusual floods, which are decisive for extrapolation purposes, particularly in short series, are also the least accurate;
- the distribution curve being asymptotic to infinity, discharge values will be extremely high at very low frequencies, while there will be very definite limits to the physical characteristics of atmosphere and watershed.

A total of 238 measurement series were processed; the results are given in the form of graphs for comparison among the different watersheds. (Original: French)

3.3 Determination of the Design Flood for Control Works: Consequences for the Design (abstract) 74/CH.3 (Switzerland)

(C. Lichtenhahn)

An economic analysis to determine a design flood that strikes a balance between the benefits and costs of a project is a very difficult undertaking; the design flood is therefore taken as the discharge corresponding to a 100-year return period (100-year flood). Nevertheless, account must also be taken

- of floods in neighbouring and similar catchments;
- of past and future influence of human activity on flood peaks.

The large installations must be located outside the threatened area or special protective measures must be taken to limit damage to their vital parts.

Though in the first construction phase a discharge lower than the 100-year flood may be expected, the design will take account of the following data:

- tracts susceptible to flooding, so that danger areas may be identified;
- structural configurations designed to permit subsequent raising of the design flood. The area needed for building the final-phase structures will be reserved in the first construction stage.

The related structures (bridges, vaultings) will generally be built at the outset for the 100-year flood plus a safety margin as follows:

- for large rivers	0.8 - 1.3 m
- for small streams	0.5 - 0.8
- for bridges	
- across large streams	1.1 - 1.5
- across small watercourses	0.7 - 1.0
- across torrents	2.5

- for vaultings and coverings
- with dump upstream 0.5 - 0.7
- without dump upstream 0.8 - 1.0 (Original: French)

3.4 Report on Guidelines to the Danger of Avalanche (Draft) (abstract) 74/CH.4 (Switzerland)

(J.P. Graf)

Twenty-two years ago the Federal Interior Ministry published guidelines to prevent abuses in the subsidizing of projects for avalanche protection works.

These guidelines were legalized by the implementary ordinance of the federal law on Federal High Superintendence of the Forest Police (of 1 October 1965).

Draft guidelines are under study in the framework of land-use planning to standardize the evaluation of the danger of avalanche everywhere in the country.

These guidelines provide, among others, four working instruments:

- the map of avalanche danger
- a cadastre of avalanches
- a map of regions where avalanches can occur
- a map of danger zones, and an organization at the cantonal level.

(Original: French)

3.5 Avalanche Protection Works in Progress in Truns Commune, the Graubunden (abstract) 74/CH.5 (Switzerland)

(J.P. Graf)

In March 1967, 3 people and 31 head of cattle were killed by an avalanche at Truns.

This was the tenth such disaster in five centuries. More than 500 persons are directly threatened at present, for extensive areas of protective forest have been destroyed.

Vast projects for avalanche protection works are in execution. One of them is a remarkable original idea that was adopted for a sector that would have been too expensive to protect in the conventional manner.

Instead and in place of avalanche barriers laid out in the breakaway zone, a retaining wall is being built to anchor the snow. This wall will be able to hold behind its crest an accumulation of 360 000 m^3 of snow.

The barrier is to be completed with avalanche breakers built higher up the slope.

(Original: French)

3.6 Bibliography (abstract) 74/CH.6 (Switzerland)

(C. Lichtenhahn and J.P. Graf)

About 80 articles are listed by title, author and place of publication.

(Original: French)

3.7 Preliminary Report on Education (abstract) 74/CH.7 (Switzerland)
(C. Lichtenhahn)

Switzerland is a small country and its institutions of higher learning turn out no real specialists in all the different tasks required for the management of mountain catchments, but engineers (civil, forest and agricultural) specializing in the different fields. The two federal university-level schools are:

- The Ecole polytechnique fédérale, of Zürich (ETHZ) and

- The Ecole polytechnique fédérale, of Lausanne (EPFL).

(There are also other cantonal technical schools of civil engineering).

a) ETHZ

Students of water economics may attend a course of 34 hours (plus 25 hours of practical work and excursions) on river and torrent control.

The Forest Economics Department

The biological part is particularly well developed in this department. A total of 50 hours of courses and 70 hours of practical work and excursions are provided on the subject of torrent control, slope stabilization and avalanche control.

The Agricultural Engineering Department

The course on river and torrent control in the Civil Engineering Department is open to students in this department.

b) EPFL

The instruction at Lausanne is roughly the same as at Zürich, but there is no forest economics department.

The Civil Engineering Department offers the broadest possible training in eight semesters.

The Department of Agricultural Engineering and Surveying offers training in the following fields: surveying techniques, cadastral surveying, photogrammetry, topography and geodesy, land improvements, consolidation of land holdings, rural engineering (farmland rehabilitation, rainwater drainage and collection, the removal of excess moisture and the improvement of soil structure). (Original: French)

4. REPORTS OF THE FEDERAL REPUBLIC OF GERMANY (D)

4.1 Regional Report of Bavaria (abstract) 74/D.1 (Germany)

(M. Seyberth)

4.1.1 Situation and Problems

Area of Bavarian Alps		4 747 km^2
Permanent resident population		337 300
Number of Alpine farmsteads	approx.	12 000
Decrease of persons employed in the sector of Agriculture and Forestry (1961 - 1970)		8.2 %
Tourism, overnight-lodgings of tourists	approx.	22 mill/year

The main problem in the Bavarian Alps is a decline of agriculture coinciding with increasing exploitation of the country. During a period in which the population was increasing at a rate of 0.75%, construction work (weekend houses, second residences) was rising 3% a year.

4.1.2 Construction Policy

It is not only necessary to give direction to the flows of land settlement; protection against destruction by torrents and avalanches must also be provided in settlement areas, along traffic routes and for systems of supply. Approximately, DM 21.7 million are spent yearly in Bavaria for torrent control and protection from avalanches which amounts to a yearly expenditure of about DM 4 600/km^2 in the Alpine region.

4.1.3 Steps Taken by the Administration

Since 1972 the Bavarian Ministry of the Interior - Construction Authority - has published two more studies in the "Schutz dem Bergland" (Protect the Alpine Region) series. These are:

"10-Jahres-Programm Wildbachverbauung" and

"Wasserwirtschaftliche Sanierung des Alpengebietes"
(Ten-Year Torrent Control Programme) and (The Rehabilitation of Alpine Catchments)

Further, two exhibitions on Alpine problems were arranged, one in Berlin and another in Munich.

4.1.4 Main Emphasis in Future Work

Future work will concentrate on the following:

- Intensified torrent control and avalanche protection;
- Subsidies to improve mountain agriculture;
- Establishment of an Alpine National Park;
- Rejuvenation of the Alpine forests by reducing the wildlife concentrations and separation of forest and pasture;
- Intensified international exchanges of ideas and experiences. (Original: English)

4.2 Integrated Water Planning in the Federal Republic of Germany (abstract)
74/D.2 Germany

(K. Zanker)

In the Federal Republic of Germany the necessity of effective water planning was recognized early, based on paragraph 36 of the Water Management Law of 27 July 1957. On the basis of this law, on 6 September 1966 the Government of the Federal Republic of Germany adopted the "Guidelines for the Preparation of Integrated Water Development Plans" for general administrative purposes. Integrated water development was to generate a body of experience for a future large-scale water management. The German "guidelines" cover:

a) The concept, purpose, content and principles of integrated water planning.

b) Water needs (for drinking purposes, industry and irrigation, for navigation, for power production and for ensuring the minimum requirements for purposes of fisheries, ameliorations, sports and recreation, nature and landscape conservation).

c) Available water resources (discharge of surface waters, groundwater resources and groundwater recharge, surface and sub-surface storage capacities, quality of surface waters and groundwater).

d) Usable water resources, flood control and prevention of water pollution.

e) Operating procedures.

f) Cooperation between the authorities and other offices.

g) Coordination of integrated water development plans.

h) Information of the Federal Government.

i) Checking the water development plans at certain intervals.

Details on integrated water development are provided in the "Technical Instructions" appended to the guidelines.

Hessen, a "Land" situated approximately in the centre of the Federal Republic of Germany, began very early its drafting of integrated water development plans for large and medium-size river basins. In a way, this land has done pioneer work in this field for the other German Lands.

To summarize, integrated water development planning is an effective tool in the broad field of water for adequate and efficient protection of the environment. The example of the Federal Republic of Germany could be a source of ideas and assistance to other countries that have not yet reached the same high degree of development in the water sector. (Original: English)

4.3 Forest Hydrology Research in the State of Hessen (abstract) 74/D.3.a (Germany)

(H.M. Brechtel)

Forest hydrology research is under way in four different experiment areas under a large scale programme of studies covering several watersheds throughout the State. The objective is to obtain reliable information about the possibilities of increasing water yields through forest management.

Krofdorf Experiment Area: Four small watersheds (10-20 ha) stocked with old stands of beech are in calibration since November 1971 in order to find out by planned cutting experiments how forest practices affect total amounts and rate of flow and water quality.

Frankfurt Experiment Area: Since November 1967 the influences of species and age of forest stands are being studied on 25 plots. Monthly measurements are made to determine interception loss, transpiration of the trees and finally on ground water recharge.

Schotten Experiment Area: Since spring 1968 efforts have been made to quantify the retention capacity of forest stands in comparison with agricultural plant covers by measuring interception loss, accumulation and melting of snow, infiltration rate and soil water storage capacity.

Reinhardswald Experiment Area: In November 1972 gauging of a 420 ha watershed stocked with stands of beech and Norway spruce was started to determine the influence of different forest practices on stream sedimentation and water chemistry. Experiments of fertilization, application of pesticides and utilization of forest sites for sewage disposal will be made.

Multiple Watershed Studies: About 700 snow courses were laid out at 100 metre elevation intervals on north and south slopes under beech and spruce stands and on open ground in 19 different mountain regions. Since the winter of 1971/72 weekly measurements of snow cover depth and water equivalent are taken and also observations on precipitation, air temperature, soil frost frequency and depth, amount of intercepted snow, snow type and surface soiling are being made. It is expected to obtain information for flood warning, land use planning and water yield control. (Original: English)

4.4 Annual Report 1973 of the Hessian Forest Research Organization (abstract)
74/D.3.b (Germany)

(H.M. Brechtel)

The Hessian Forest Research Station belongs to the Hessian Forest Service and was founded on 1 January 1971. The former Hessian Institute for Forest Tree Breeding became part of the new organization which is made up of institutes for forest tree breeding, forest production and forest hydrology.

Apart from the scientific work of the three institutes and transfer of knowledge, there is development of methods and techniques for solving forest management problems in private, communal and state forests. Research work started in 1972 at full scale.

Several large scale trials have been planted at the test locations. Various research projects have been evaluated and the facilities for data processing have been improved. The most important achievements during the review period may be summarized as follows:

- Establishment of 11 test areas of the International Douglas Fir Provenance Trial with 126 provenances and comparable plantations of 90 single tree progenies on a total area of 28 ha.

- Completion of the planting programmes for the testing of Balsam poplars by establishing test plantations of a total area of 39 ha on 17 localities with up to 49 clones.

- Completion of the inventory of prospective seed stands of Scotch Pine (Pinus silvestris) in Hessen by selecting 30 stands and 300 plus trees.

- Establishment of 11 ha of trial areas on 14 localities for testing the suitability of various types of containers for planting Douglas fir.

- Start of research on the possibilities of selective thinning within young Norway spruce stands opened up by tractors.

- Conclusion of the early tests on frost resistance of 126 provenances of Douglas fir.

- Interim evaluation of tests on the resistance against spreading of red root (Fomes annosus) or Norway spruce on 6 test localities.

- Establishing complementary facilities in the experimental areas for forest hydrology at Frankfurt, Krofdorf, Schotten, Reinhardswald and Bad Segeberg.

- Establishment of 3 new meteorological recording stations as well as setting up 40 rain gauges in forest areas and installing 700 frost measuring tubes at the test sites of the Snow Survey.

- Conducting 39 technical seminars, excursions and conferences with 1 400 participants, among them 136 guests from abroad. (Original: English)

4.5 Influence of Land Use, Particularly of Forestry, on Hydrologic Regime and on Water Quality - Methods and Results of Investigations in Europe (abstract)
74/D.3.c (Germany)

(H.M. Brechtel)

How land is used and managed has a very definite effect on total amount of flow, on stream flow timing and on water quality. This is due to the fact that vegetal cover and soil, which can be influenced by men, affect runoff. Important processes of the water cycle can be modified by watershed management, for example: interception storage and loss, accumulation and melting of snow frequency and depth of soil frost, infiltration-, retention- and detention-capacity of the soil, frequency and amount of surface flow, soil erosion and stream sedimentation, temperature and bacteria content of stream runoff. The report reviews the European literature about research on this subject, making an attempt to summarize the present knowledge about the influences of vegetation on water yield and methods used in the evaluations. Most European watershed research done so far has been on watershed conservation and restoration (soil erosion, torrential erosion, torrent control, avalanche protection, etc.). Much less information is available about the possibilities of water yield control, especially vis-à-vis vegetation as opposed to structural works only. Today many regions in Europe are experiencing serious deficiencies in water supplies, therefore a real need exists to initiate much more investigations on water yield as affected by the treatment of vegetation, especially by forest management. (Original: English)

4.6 Mapping, Collection and Registration of Torrent and Avalanche Data (abstract)
74/D.4 (Germany)

(M. Seyberth)

A number of reliable maps exist for the Bavarian Alpine region. These have been amended systematically during the last two decades by new data. These efforts were aimed at recording both natural and man-made causes of erosion in the Alpine region and in determining the ecological strain on the Alpine region. In Bavaria, the following supporting documents are available for planning activities in torrential watersheds:

4.6.1 Torrent Map, Scale 1:' 25 000

On this map soil erosion such as gullies and landslides (derived from aerial photographs, scale 1: 10 000) are marked. Furthermore, all surface waters, unconsolidated

alluvial deposits and debris cones and forests are shown. For construction design purposes in the Alpine region the following maps can be used: the topographic map of Bavaria (scale 1: 25 000), the geological maps in different scales and cadastral maps (scale 1: 5 000) with contours.

4.6.2 Forest Condition Map, Scale 1: 25 000

In this map showing forests in the Alpine region a classification into four categories is made according to the tree crown coverage, i.e., the projection of the crowns of trees on the ground:

Degree of tree crown coverage:	1 =	approx.	0.9 to 1.0	coverage	by	forest
	2 =	"	0.6 to 0.8	"	"	"
	3 =	"	0.3 to 0.5	"	"	"
	4 =	"	0.3	"	"	"

4.6.3 Data Collection for the Bavarian Alpine Region

On ascertaining additional parameters it has been found that the presentation in maps alone does not provide sufficient perspective and that the combination of these parameters is no longer possible. Therefore, the Alpine drainage area in Bavaria was subdivided into 1 km^2 large surface units (altogether about 5 200 km^2). On the basis of these units an initial attempt has been made to employ computer techniques for appraising the Alpine region's erodibility.

A detailed description is given on the parameters to be used. Certain findings for the Bavarian Alpine region are described. (Original: English)

4.7 Bibliography, August 1972 to June 1974 for Torrent and Avalanche Control and Watershed Management, Germany (abstract) 74/D.5 (Germany)

(M. Seyberth)

A list of about 30 articles is given by title, author and journal. (Original: English)

5. REPORTS BY SPAIN (E)

5.1 National Report, Spain (abstract) 74/E.1 (Spain)

Execution of Projects

The ICONA's reforestation activities during the Third 4-Year Development Plan 1972/75 were structured into three sub-programmes:

- Subgroup I. - For strictly production purposes: hydrology and recreation. Involved primarily the reforestation of 400 000 ha.

- Subgroup II. - Rural land-use planning, with differentiation between areas adjacent to urban and industrial growth centres, areas of balanced agriculture and areas critical and cash mountain crops. Carried out on 88 000 ha.

- Subgroup III. - Promotion of reforestation by private enterprise. A total of 60 000 ha were reforested during the 4-year period.

The three sub-programmes entailed an investment of Ptas. 6 128.09 million.

The return on this investment has been computed in indirect benefits, direct social benefits and recreational benefits, considered separately.

Research

The research has been conducted by the Section on Torrent Hydraulics, Soil Conservation and Forest Influences of the former Instituto Forestal de Investigaciones y Experiencias. The lines of research are (a) a study of the effects of alterations and transformations of the plant cover on the water budget and on the quality and control of the water in a catchment, (b) a study of the factors governing torrents with a view to quantification in individual cases and to the evolution of the phenomenon as a whole and (c) research and testing of new techniques for torrent control and mountain watershed management.

Institutional Framework

An Executive Decree of 28 October 1971 reorganized the institutional administration in the Ministry of Agriculture and in the process created the Instituto Nacional de Investigaciones Agrarias (INIA) to draw up and carry out the research plans and programmes of the Ministry of Agriculture and assume all appropriate functions in connection with research in the agrarian sector.

Also created was the Instituto Nacional para la Conservación de la Naturaleza (ICONA), which asumes the following functions:

a) The inventorying of renewable natural resources.

b) The establishment, conservation, improvement and management of forest stands on lands owned by the State and on those worked under cooperative management or contract.

c) The administration and management of the forests listed in the oatalogue of public utility forests and responsibility for protective forests and local communal forests.

d) The conservation and melioration of crop and forest soils and the agrohydrological management of catchments.

e) The maintenance and restoration of bioecological equilibria.

f) Landscape protection, the establishment and administration of national parks and natural locations of national interest, the protection, conservation, promotion and rational exploitation of inland fisheries and hunting resources.

g) The promotion and restructuring of economically depressed districts.

h) The management of livestock routes.

i) Supervision and control of inland waters in respect of fishery resources and the other concerns of the Institute.

j) Protection against forest fires.

k) The creation of areas of greenery located conveniently to urban centres in need of unpolluted air.

Instruction

On the subjects of torrent control, avalanche protection and watershed management, the Escuela Técnica Superior de Ingenieros de Montes offers the following specific courses: Meteorology and Ecology, Hydraulics, Surface Hydrology and Soil Conservation, and others such as Silviculture, Reforestation, Construction, etc.

The programme leading to the degree of Ingeniero Superior (Senior Engineer) is five years long. Another two years of study and a thesis are required for the doctorate. The Schools of Forest Engineering at Madrid and Huelva offer courses in Hydraulics, Soil Conservation and Hydrology.

The following courses have been offered for graduate students:

- General and Applied Hydrology (Centro de Estudios Hidrográficos).
- A course in Nature Conservation (Escuela de Montes).
- A course for Latin American graduate students with emphasis on reforestation (Escuela de Montes). (Original: Spanish)

5.2 Special Techniques and Sundry Procedures in Reforestation (abstract) 74/E.2 (Spain) (López-Cadenas)

This report refers to biological measures, the conservation of agricultural and marginal soils, and to reforestation methods and techniques, with special emphasis on the latter.

Current tendencies in reforestation are determined by the following circumstances and conditions:

a) Steadily rising costs, particularly in manpower.

b) The need of extensive brush-clearing and soil preparation work, which cannot be done without adequate means.

c) Completion of the work in the shortest possible time.

Accordingly it has been found necessary that:

a) All forest operations be mechanized that can be.

b) All operations be rationalized following thorough study.

c) The most suitable reforestation method be adapted to every particular circumstance.

d) A corollary of mechanization is that a larger area must be reforested to make it pay.

e) There is a tendency to drop the system of reforestation by seeding in favour of the faster, more reliable and less costly system of planting forest trees either by the bare roots or, in the more recent practice, in special receptacles; these developments are accompanied by the parallel development of nurseries in the country.

In this report, the operations are discussed under three headings:

1. Brush Clearing

Although there are places where this is still done by slash-and-burn methods, mechanization has become general and the brush is removed by special rollers, scrub-clearing machines, discs, etc., before the soil is upturned, or else the underbrush is uprooted with a tractor-drawn spade, which also prepares the soil, thus saving time and simplifying operations.

2. Preparation of the Ground

Surface Tillage	Tillage at Progressively Increasing Depths			Is the slope Altered?
	Slight Depth	Medium Depth	Great Depth	
	1 - Spots	7 - Holes	13 - Holes with backhoe	no
At points	2 -	8 - Terraces		
	2 -	8 - Terraces	14 -	yes
	3 - Strips, by hand	9 - Ploughed strips	15 - Subsoiled strips	no
In continuous lines	4 - Terraces	10 - Ridges	16 - Bulldozed terraces	yes
	5 -	11 - Continuous tillage	17 - Continuous subsoiling	no
	6 -	12 - Ploughing with shouldered ridges	18 - Subsoiling with shouldered ridges	yes

The report discusses reforestation methods and when and where they are applied.

3. Seeding and Planting

3.1 Seeding. - As reported above, the trend is to abandon this method owing to the high cost of subsequent silvicultural operations.

3.2 Planting. - We distinguish between:

Planting by hand - Continues to be used, though more sure to be for the advance preparation of the soil. Whether the plant is put in the ground in a plastic bag or with naked roots depends on the quality of the location. Also, root balls are used with one or two plants depending on whether there are freezing problems in the area and birds, rodents, etc.

Mechanical planting - This technique is on the rise, and we may distinguish two fields of operation.

a) Mechanization of conifer plantations. Simple or twin planters pulled by a light tractor, on which sits a worker who places the plant directly on the ground.

b) Mechanization of hardwood planting. The most widespread method is planting in open holes with a backhoe.

The plants are placed in CML, Jiffypot, cane or clay pots either with bare roots or with root balls. Satisfactory results are also obtained with more modern methods such as plastic bags and paper pots.

Seeding has been almost entirely abandoned to avoid future silvicultural costs, and mechanization has been extended to the production of plants in large and fully mechanized nurseries. (Original: Spanish)

5.3 Mathematical Model of Water Erosion (abstract) 74/E.3 (Spain)
(López-Cadenas)

Four erosion subprocesses are defined and each is evaluated with a mathematical model.

a) Disaggregation of soil particles by raindrop impact.

$D_R = S_{DR}. A I^2$, where

S_{DR} = coefficient of soil susceptibility to disaggregation by raindrop impact.

A = area of the test plot.

I = intensity of precipitation.

b) Transport of particles by splashing.

$T_E = S_{TR} IS$, where

T_R = transport by splashing.

T_{TR} = coefficient of soil transportability by splashing.

S = slope of the ground.

c) Disaggregation of soil particles by surface flow or runoff.

$D_F = S_{DF} A . Q^{2/3} S^{2/3}$

D_F = disaggregation because of runoff.

A = plot area.

S_{DF} = coefficient of soil susceptibility to disaggregation by runoff.

Q = discharge volume.

Now, let Q_i and S_i be the initial conditions, and Q_f and S_f the final conditions,

$D_F = S_{DF} A \frac{1}{2}(Q_i^{2/3} S_i^{2/3} + Q_f^{2/3} S_f^{2/3})$

d) Particle transport by runoff.

$$T_F = S_{TF} \; A^{5/3} \; S^{5/3}$$

T_F = transport by runoff.

S_{TF} = coefficient of soil susceptibility to transport by runoff.

S = slope of the ground.

Q = volume of runoff.

The model as a whole is applied to a slope to distinguish areas of erosion from areas of sedimentation. It has been applied to slopes of different configuration and under stated standard conditions, and the corresponding models have been processed by an IBM 1620 computer; the closeness of fit of the results has been confirmed by experimental data. (Original: Spanish)

5.4 Report on Floods in Southeastern Spain (abstract) 74/E.4 (Spain)
(López-Cadenas)

The first data in the history of flood disasters in southeastern Spain are for 1258. Statistically speaking, there has been a flood every ten years, but if we confine the analysis to data for the present century we find that floods causing loss of life, damage to agriculture and livestock and the destruction of homes and infrastructure works have occurred every six years. The latest floods happened in October of last year and affected almost the entire southeastern region of the country.

The general features of the biotope are: landscape of pronounced topographical irregularity with wide differences in level, and heavy drainage in steeply sloped stream channels resulting in a catchment morphology such that flows tend to be torrential. The geological context is of markedly disaggregated but unstable soils susceptible to erosion. Climates range from subhumid Mediterranean to arid Mediterranean. Plant communities exhibit little variety: at high elevations pinewoods and vestigial cork and holm-oak stands representative of the climax stage; a shrubby and herbaceous zone of regressive facies; vines, and carob and almond trees grown on slopes; and fertile vegas, whose lower areas in the southeast, cultivated by the "enarenado" technique, produce very high yields of garden crops for marketing well ahead of normal harvests. Suffice it to mention that up to three harvests are obtained. This ecosystem was acted upon by the weather, in which pronounced instability at high elevations combined with ground-level storms to give rise to great convection clouds. Rainfall attained intensities of more than 60 mm in 40 minutes. Torrential flows, resultant of the characteristics of the biotope, plant communities and precipitation, were extraordinarily great, which accounted for the severe damage caused in the immediate vicinity of rivers and watercourses in their lower reaches, where the mass of water and its entrained solid matter became so great that it could no longer be contained in the streambed and spilled over into the adjacent territory, where the towns, vegas and related infrastructure works were located.

Thus, in the October floods in the southeast, water erosion in catchment basins was most severe in the watercourses of Albuñol, where there are almost 12 000 ha of almond trees and vineyards. The downpours that caused the floods in the catchment are calculated to have washed an average of 3 cm of soil cover, or the equivalent of 540 m t/ha, off the lands under cultivation. Also substantial, though less extreme, were the losses of 100 to 250 m t/ha/downpour in other similarly afflicted catchments.

The balance sheet for losses of life and material damage from these floods is eloquent: 200 dead, more than 8 000 million farming losses and more than 1 000 million in infrastructure works.

To prevent recurrences of this havoc there is need of agricultural watershed management that will include action in the following fields: soil conservation, reforestation, torrent control and ancillary works.

The cost of project studies and of watershed redevelopment measures over four years is estimated at Ptas. 2 000 million. (Original: Spanish)

6. REPORTS BY FRANCE (F)

6.1 National Report (abstract) 74/F.1 (France)

(R. Blais)

The Mountain Areas

6.1.1 Size - The mountain areas encompass 4 643 communes in an area of about 100 000 km^2, which is slightly less than 20% of the area of the whole country.

6.1.2 Population - About 3 million inhabitants. This population is of low density and advancing age, and is decreasing in number.

6.1.3 Economic Aspects - Basis of the mountain economy: agriculture and forestry.
Composition of the land: 30% farmland
30% forest
40% rock, idle lands, moors

Agriculture: Mainly livestock, but in decline because of the handicaps. Accounts for: 10% of the national cattle herd
30% of the sheep herd.

New specific measures:

- law of 3 January 1972 for pastoral development in the mountain economy regions and creating the pastoral land associations and the pastoral groupings.
- a special mountain indemnity per head of large livestock.

Forests: Their protective function defined by the law of 1882 on the reclamation of mountain lands - applied on 300 000 ha of State lands.

Productive function: Developed with contributions from the National Forestry Fund, promoted by the law of 22 May 1971 on forestry structures.

Tourism: High-altitude tourism linked to snow sports - the building of large resorts.
Middle-altitude tourism is versatile and integrates better into mountain life.

6.1.4 Soil management: Secured by land-use plans drawn up with due regard for natural hazards, including avalanches. Maps of avalanche frequency have been compiled (on 500 000 ha).

6.1.5 The environment: Pollution is the same in the mountains as in the lowlands but less intense, less heavy.

6.1.6 Planning: The conventional administrations are joined by the Commisariat à la Rénovation Rurale en Montagne (Commission for Rural Redevelopment in Mountain Regions).

6.1.7 Conclusion: An overall policy for mountain areas is being developed on the transnational level. It has found expression in the directive of the Council of the European Communities on mountain agriculture and disadvantaged areas. (Original: French)

6.2 Experimentation and Research in France in the Field of the Rehabilitation and Conservation of Mountain Lands (abstract) 74/F.2 (France)

(A. Poncet)

The author reports on the current activities of the Erosion Control Division of the Centre Technique du Génie Rural des Eaux et des Forêts at Grenoble, France. This Centre has no prerogatives in basic research, the responsibility for which devolves upon the Institut National de la Recherche Agronomique (National Institute of Agricultural Research); this responsibility includes forestry research.

The activities of the CTGREF are hence primarily technological, and in the aforementioned Division are now pursued toward three ends:

- the establishment of vegetative cover on eroded or scoured mountain lands;
- protective reforestation of high mountain lands;
- the improvement and standardization of torrent control works.

New prospects for useful action are opening for the Division either for reasons of administrative expediency:

- the identification and evaluation of natural mountain hazards other than avalanches in connection with problems of urban development;
- participation in the programming of investments for torrent control; or to prolong forestry research in certain technical matters;
- the study of the pedogenetic value of different types of protective afforestation;
- the influence of forest assemblages and different types of afforestation on the stability of the ground at depth.

But the Division cannot undertake these studies without additional means. (Original: French)

6.3 Forest Management for Tourism (abstract) 74/F.3 (France)

(G. Roger)

In a modern country the forest performs three functions:

- a protective function;
- a social function;
- a production function.

All these functions are of general utility. They must be translated into objectives for managed forests: production objectives, public service objectives, a wildlife objective.

The rise of the civilization of leisure and the advance of urban growth lend increasing urgency to the problems of forest management for tourist purposes.

The first important point to emphasize is the need to open forests to tourism. This implies the dual obligation of receiving each year more visitors who are increasingly motorized, while preserving the natural forest values. Thus, the forester must take and retain the initiative and at the same time prevent the forest from degenerating into a "fun fair".

In forests intended primarily for tourism a recreational infrastructure should be provided:

- parking lots
- picnic grounds
- play areas
- camping grounds
- forest ground cleaning equipment
- fire prevention
- forest roads
- riding trails
- animal enclosures
- marked paths
- development of picturesque sites.

The forester must retain control of the execution of works. In France it is provided that subsidies are to be granted from the national budget to help corporate bodies and public agencies develop forests for tourism.

It must be remembered that tourism management is part of forest management. This implies that the forester must ensure the regeneration of the tract in his care and the management of stands in keeping with the usual rules of silviculture. Hence the obligation to permit very light felling in established stands and to set up regrowth enclosures (of 2 ha) to ensure the continuity of the forest. Some assemblages are to be prohibited (coppices with standards), while the high forest is seen as the ideal form for tourism.

Finally, mutually compatible measures must be taken to meet the needs of recreational users and hunters. (Original: French)

6.4 The Restoration of Torrent Catchments (abstract) 74/F.4 (France)

(A. Poncet)

6.4.1 The restoration of catchments degraded by erosion is based on pedogenesis, whose duration to completion is intermediate between that of human life and that of geological phenomena. The process is abetted by the efforts of biological engineering, which in the more severely scoured catchments must be supported by civil engineering works to control torrents in talwegs and consolidate unstable slopes.

6.4.2 Torrent catchment restoration is a cornerstone of watershed management and, like it, a constituent of natural resource development and of general development policy.

Its methods differ with the stage of development and thus with the economic and social policy of each country.

In many developing countries the need to maintain and support a substantial mountain population eliminates the possibility of giving the forest the place it deserves in torrent catchments and which it is given in developed countries. In the latter, industrialization puts a premium on water, which supplies an economic justification for a more elaborate restoration of higher catchments.

6.4.3 Thus, the prosperity of downstream plains and towns is closely dependent on the mountain water tower. One example in France, relating to the maintenance of a mountain drainage network, shows that lowland and mountain must be regarded as interconnected for purposes not only of investments in restoration works but of maintenance outlays as well.

This interconnection between lowland and mountain is less obvious in the less developed arid countries except where large reservoirs are to be built for lowland irrigation. In these countries purely social considerations are, as a rule, sufficient to justify investments in the restoration of torrent catchments even though in them it has proven more costly to accomplish than in more developed countries. Indeed, it is impossible to resort as extensively as would be desirable to reforestation - which is the most economical and, in the long run, the most reliable method - the purpose must be accomplished by means of more artificial structures to alter the contours of the terrain and act upon the soil. The establishment of these structures entails a considerable effort of persuasion, coercive legislation and a vigorous administration.

While developed countries do benefit more from the multiple advantages of forests in restored catchments, they still run into maintenance and conservation problems despite the existence of old and tested forest laws. One French example attests to the necessary evolution of forest legislation in accordance with an economic evolution that necessitates the moulding of that legislation to a land-use policy that has certain features in common with watershed management. (Original: French)

6.5 Protective Reforestation (abstract) 74/F.5 (France)

(A. Poncet)

After effectively devoting itself from 1860 to 1914 to the reforestation of mountain torrent catchments, for the last 25 years the French administration has been engaged, with financing from the National Forestry Fund, in a major programme of production reforestation and abandoned lands, and, despite studies recently undertaken, the most delicate and least mechanizable techniques of protective reforestation in mountain country have scarcely progressed since DEMONTZEY.

Protective reforestation must be designed from the beginning with a view to arriving, in the relatively long run, at a climax forest. The technical problems are as diverse as the natural environments, of which the French mountain country offers a range that is fairly complete and representative for Europe.

The choice of usable forest species is grounded in a knowledge of their ecology and of the salient features of the regional climate as summarized in certain climatic formulas.

The problems of plant and seed adaptation to the rigours of degraded biotopes may be traced chiefly to two primary and widely differing circumstances:

- The climatic rigours of the subalpine zone near the timberline, which pose mainly problems of heat (low temperatures and brief duration of vegetation) and of countering the effects of the snow mantle.

- The aridity, which makes itself felt in very windy mountain areas but in summer is particularly troublesome in the subarid zone around the Mediterranean.

Preparing the ground by laying out banks or terraces of scoured and tilled soil horizontally across slopes protects young plants against snow creep and from the ravages of aridity.

There follows a statement of general principles for the protective reforestation of degraded terrain and a brief statement of the specific problems now exercising the French foresters engaged in that work. Mechanization is the most important economic problem. But the search for seed of suitable provenance calls for a long-term programme. (Original: French)

6.6 Rehabilitation of Degraded Land (abstract) 74/F.6 (France)

(A. Poncet)

The rehabilitation of degraded land in torrent catchments is considered in three aspects:

i) The surface binding of slopes too unstable to be forested and of terrace slopes by biological engineering works. These works include the establishment of a sward and of brush cover. This cover is indicated for both kinds of slopes in the more difficult situations where the surface ground can only be stabilized by the synergetic effect of the two techniques in combination.

ii) The restoration of degraded agricultural land; methods and techniques developed in the U.S.A. and in northern Africa are compared.

iii) Pasture regeneration, development and management are of primary importance in torrent control.

The principles of old French legislation that has proven its effectiveness are described.

On the subject of current problems arising from a lack of shepherds, two views are stated.

Allowing livestock to range freely over mountains can lead to erosion. The recruitment and training of shepherds must be encouraged and their living and working conditions improved.

In the interest of healthy forests and productive silviculture, the fields of silviculture and pasturage must be kept separate from each other. In some windblown uplands, however, the two types of land use can coexist side by side without encroaching on one another and to their mutual benefit.

This is the "meadow-woodland" system, which is hydrologically desirable because it affords a better spatial and temporal distribution of the snow. (Original: French)

6.7 Watershed Management in Tropical Countries (abstract) 74/F.7 (France)

(P. Goujon)

Two factors, one natural and the other human, characterize and could be said to condition watershed management in tropical countries.

The natural factor is the agressiveness of the tropical climate: rain and wind, which cause erosion, are particularly intense in this environment. Rain always falls in torrential downpours, and intensities in excess of 1 mm per minute are not uncommon. Such rain has a markedly erosive effect on sloped soil that has lost all or too much of its plant cover.

The same may be said of the winds, which are very often violent, with some, such as the trade winds, blowing always from the same direction. This circumstance makes it necessary that any control scheme be preceded by an ecological diagnosis to determine the conditions in the natural environment.

In all cases it is necessary to take soil conservation measures and to make erosion control works an integral part of watershed development.

The human factor here is the rapid and relatively recent growth of the population, with its immediate effect of generating a demand for new farm and grazing land. This "land hunger" has led everywhere to haphazard settlement without any regard for the natural aptitudes of the land; it is here where watershed management really comes into its own.

The problem has been most fully studied in Madagascar, where it is encountered in its most acute form because of the mountainous topography of the island, which makes the soil more susceptible to erosion. After several years of research on the different aspects of erosion and after a series of measurements of runoff and soil losses, the Centre Technique Forestier Tropical has shifted to pilot schemes for the full-scale testing of works developed in that research.

These pilot schemes are both pilot projects and demonstration and training centres for rural populations, and it may be hoped that they will expand gradually into true operations for regional development which at the same time leave the natural situation in the catchment undisturbed. (Original: French)

6.8 Rehabilitation of Degraded Land - The Doukkala Sahel in Morocco (abstract)
74/F.8 (France)

(P. Goujon)

There are in northern Africa large tracts that overgrazing and wind erosion have reduced to wasteland and which can be rehabilitated and made agriculturally productive only by a combination of forest and range management tailored to local conditions.

The tract to be rehabilitated should be closed to exploitation for three or four years. In addition, however, range management must be instituted and enforced to allow the regeneration of fodder plants.

It will definitely take several more years of education and training for Moroccan pastoralists to understand the need to trim the size of their herds and abide by sound grazing rotation rules, without which the regeneration and maintenance of fodder plants is impossible.

The Doukkala Sahel: The Doukkala Sahel extends along the seacoast between the El Jadida - Sidi-Smaïn - Safi Road and the Atlantic.

The works undertaken are of two kinds: the establishment of eucalyptus windbreaks for wind erosion control, and the introduction of fodder plants to improve pastures.

The windbreaks have the purpose of (1) checking the erosive action of the wind, (2) reducing evaporation, (3) providing the stock with shelter from wind and sun, (4) providing users with a source of saw timber and fuelwood in a region where they are completely lacking.

The spacing was calculated on the assumption that each tree would protect a span of ground twenty times as long as its height, estimated at 12.5 m.

The species used are mainly *Eucalyptus gomphocephala* and *Acacia cyanophylla*.

Rangeland improvement: The rangeland between the windbreaks is being enriched. This also allows the development of some indigenous hardy plants, mainly dactylis, trefoil, cytisus and the dwarf fan palm.

The purpose of so improving the natural flora is to develop a range of nourishing species broad enough to provide the stock with green fodder in all seasons.

It was decided to admit a herd of some fifty head of cattle onto the improved tracts in order to study the effect of grazing on improved grassland.

Of course, the stock admitted to the ranges is controlled and weighed to calculate the meat yield from a given quantity of grazing.

Protection and rehabilitation of soils: To facilitate the execution of these works, the Soil Rehabilitation Service enters with corporate and private persons into contracts that vary in form with the region and the nature of the works.

Under these contracts the Soil Rehabilitation Service undertakes to provide for the execution of all works by advancing to the proprietor the funds needed therefor. (Original: French)

6.9 Conservation and Improvement of Protective Forests (abstract) 74/F.9 (France)
(A. Poncet)

All mountain watershed forests must be protected because of the importance of their hydrological function, particularly in moderating floods. But some, because of their situation, provide for downstream settlements immediate protection against several natural hazards, which makes it essential that special precautions be taken in operations to exploit their resources.

An account is given of the French regulations for the exploitation of forests that help hold soil on slopes and protect against avalanches and erosion by and encroachments of water and sand.

The special system prescribed for the exploitation of these forests calls for their rejuvenation by appropriate silvicultural methods. The content of these methods is governed by the special protective function that the forests are desired to perform much more than by the aim of direct economic gain from wood production. Selection stands of mixed broadleaf species are suitable in many cases.

Good regulation of logging operations is not enough to ensure the conservation of protective forests. Also necessary are logging methods and practices that take account of the needs of the forest soil, hold-over trees and new growth, particularly on steep mountain slopes, where heavy machinery can cause dangerous terracing. A minimum network of forest roads and trails is needed, but it should be spare and be extended by more adaptable and light-weight skidding equipment such as cableways.

Finally, fire protection should receive special attention. (Original: French)

6.10 The Medium-Scale Mapping of Probable Avalanche Locations (abstract) 74/F.10 (France)
(L. de Crecy)

In the management of high mountain watersheds for new purposes such as tourism it is necessary to be able to obtain on short notice and at low cost a map that will give a fairly accurate idea of the danger of avalanche at a given location.

A map of "probable avalanche locations" on a scale of 1: 20 000, based on physical considerations and historical records, has been in preparation since 1970. When completed in 1974, it will cover 500 000 ha.

On the physical side, a series of observations on the topography, geomorphology and vegetation at the release points, slide paths and termini of avalanches in order to identify the areas of slide.

On the historical side, the investigation will have recourse to parish, municipal and administrative records, accounts of excursions, cadastres, place names, the location of shrines, etc. It will involve a detailed and on-the-spot study of oral testimony of local inhabitants.

All the geomorphological and physical material is first processed by the stereoscopic photo-interpretation of aerial photos taken in the summer. This work is then completed in the field while the historical investigation is in progress.

The management officer will then have enough information at his disposal with which to decide on a sound basis the broad lines of his project.

This is not enough, to be sure; the next stage includes accurate observations and large-scale prospective plans. It will take much longer to complete and will cover only the areas where structures are to be erected.

The teams of the Institut Géographique National that compiled these maps with us will finish their work in France in 1975. They will be able to give interested countries the benefit of the experience they have acquired in this field. (Original: French)

6.11 Special Report - The Lamellar-arch Dam at Viviez (abstract) 74/F.11 (France)

(L. Clauzel)

After recalling the advantages of the arch in dam design, the author states the principles of the design of a lamellar arch in separate parts (pier-consoles and voussoirs) which result in a structure that deforms slightly under stress and distributes the load more evenly between the supporting rock and the foundations.

The writer then describes the conditions under which a structure of this type, partly prefabricated, was erected experimentally and the technical and financial results obtained. (Original: French)

6.12 Forest Management, Exploitation and Upkeep in Relation to Erosion (abstract) 74/F.12 (France)

(A. Poncet)

This five-page supplement to the 1970 report has been distributed. It covers forests and erosion, the place of erosion control in the forest economy, forest exploitation and erosion, the forest management plan and erosion, forestry equipment and erosion and forest upkeep and erosion. (Original: French)

6.13 1972/73 Bibliography (abstract) 74/F.13 (France)

A list of about 125 articles giving the author, the title, the source and the length of each document. (Original: French)

7. REPORTS BY FAO (FOR)

7.1 Terminology of Torrents and Torrent Control (abstract) 74/FOR.1 (FAO)

(S.H. Kunkle)

A draft version of a French/English terminology was produced which matches the German/French manuscript coordinated by Kronfellner-Kraus (see 74/A.5). This draft, after review, is to become part of the five-language terminology planned for 1975. (Original: English)

7.2 Statement to the 11th Session of the Working Party on the Management of Mountain Watersheds (abstract) 74/FOR.2

(B.K. Steenberg)

This brief statement expressed the FAO Forestry Department Director's opinion on the importance of mountain lands in total rural development (2 pp). (Original: English)

7.3 Status and Problems of Mountain Watershed Management in Latin America; Support Required from the EFC Working Party (abstract) 74/FOR.3 (FAO)

(L.S. Botero, FAO, Santiago de Chile)

After reviewing the situation of Latin America in this field, the paper concludes that the only countries in which torrent control and watershed management activities have started in the past fifteen years are Argentina, Chile, Venezuela, Colombia, Cuba, Jamaica and El Salvador. Four suggestions were submitted to the EFC Working Party on how these activities could be strengthened in Latin America.

a) That the Working Party support to the authorities of FAO the establishment within the Latin American Forestry Commission of a permanent Working Party on Mountain Watershed Management and give the new work group with the necessary guidance in order to make use of its valuable experience.

b) That a delegation from the EFC Working Party participate in a visit to Latin America to become familiar with the problems of the region, advise and encourage the local specialists, and possibly participate in the Second Latin American Seminar on Watershed Management, pending its financing by the UNDP.

c) That the dominant problems and the prevailing levels of technology of Latin America in this field be taken into account by the EFC Working Party as it prepares Manuals, Glossaries and other materials, so that methods and techniques may be proposed that can be used in Latin America and in developing countries in general.

d) That Latin Americans be invited to specialized seminars, that EFC Working Party members connected with universities call their attention to the need to provide scholarships for Latin American foresters that want to specialize in this field, and that the members of the EFC Working Party encourage their Governments to increase their bilateral aid to developing countries in the field of Watershed Management. (Original: English)

8. REPORTS BY ITALY (I)

8.1 Country Report (abstract) 74/I.1 (Italy)

(S. Puglisi)

It was reported at the Tenth Session that the functions in agriculture and forestry, reforestation and watershed management had been transferred from the Central Government to the Regions.

The regions operate through the mountain communities on the basis of socio-economic development plans. The sole function of the Central Government is to finance and coordinate these regional activities and to carry out works of national significance or which affect several regions.

After Presidential Decree No. 748 of 30 June 1972, the General Economic Administration for Mountain Districts and Forests has thus reorganized its managerial staff for the performance of the new functions.

Now in preparation is the "Map of the Mountain Country", which will contain the salient data on physical conditions and measures on behalf of these areas.

The principal natural disasters have been floods and landslides in Sicily, Calabria and Basilicata between December 1972 and April 1973. Near Reggio Calabria a landslide blocked the Bonamico torrent, creating a temporary lake of 15 million m^3 of water. Two special national laws provided financing for the repair of damaged public works and villages and the rebuilding of destroyed farmhouses.

However, institutional changes and the economic situation of the country have limited the volume of operations and have also slowed down somewhat the development of new techniques. (Original: French)

8.2 Slope Stabilization (abstract) 74/I.2 (Italy)

(S. Puglisi)

The subject was divided into three parts:

- sheet erosion control;
- vertical erosion control;
- consolidation of unstable masses.

The reporter's attention was drawn to the different types of works for purposes of illustrating recent developments such as reinforced turf, wattling and the prefabrication of check dams. Some examples for the classification of land slides are given based on their mechanical consituents, and the principal ways of stabilizing the ground are described. (Original: French)

8.3 Statistical Analysis of Heavy Rains Distribution in Eastern Alps (abstract) 74/I.3 (Italy)

(D. Della Lucia and S. Fattorelli)

The authors describe the principal aspects of the method used to identify the best fit probability law for rainfalls of short duration and unusual intensity in the Eastern Italian Alps.

Among the theoretical laws employed in hydrology, this investigation takes into consideration the distributions most widely used in the study of rare events: the FULLER-COUTAGNE, log normal, GUMBEL and FRECHET.

These four laws have been used to fit the empirical distributions of annual maxima for durations of 1, 3, 6, 12 and 24 hours at 79 recording raingauges stations, for which at least 30 years of observations are available.

Using two acceptance criteria (chi-square and sign tests), it has been possible to establish a comparison for the four laws, by means of computer.

The results achieved suggest that the Log-normal distribution provides a suitable fit to the rain samples considered.

The authors point out characteristic parameters for assessing the interrelationship between depth, duration and the return period. (Original: English)

8.4 Research on the Direct and Indirect Advantages and Economic Feasibility of Watershed Management (abstract) 74/I.4 (Italy)

(G. Benini)

Watershed management offers as a rule direct and indirect advantages.

The direct advantages, that is, those accruing in the watershed from the management works as eroded and unstable lands are rehabilitated, are almost always the least important ones.

Much more significant are the indirect advantages. On the one hand, the greater security afforded by a well-managed basin will be followed by the development of industrial, craft and tourist activities there. On the other hand, mountain watershed management greatly influences the regimes of lowland watercourses by reducing excessive sediment discharge and the crest of floods and therewith the likelihood of damage.

It is very difficult to reduce all this to economic terms. The different kinds of benefits have to be quantified and compared to the cost of the management works. Despite these difficulties, an attempt also has to be made to draw a balance on which, along with technical and social considerations, to decide whether the management works are worth undertaking. (Original: French)

8.5 Contribution to the Qualitative and Quantitative Classification of Torrent Catchments in the Trentino (abstract) 74/I.5 (Italy)

(S. Fattorelli)

Research toward quantitative classification has spread in Romania, where a methodology has been proposed based on two components of torrent potential: torrentiality coefficient K_{tor} and transport coefficient K_e.

In the province of the Trentino (Eastern Alps) there are nine representative catchments with rain and stream-flow gauging stations from which to ascertain the relationship between rainfall and discharge and thereby the torrentiality coefficient. The procedure proposed by Gavrilović may be used to find the transport coefficient.

The qualitative method of Margaropoulos was used to classify the nine catchments and found to lack sufficient classes for topography and climate aggressiveness. (Original: French)

8.6 Possibilities of Developing an Effective Flood and Avalanche Warning System (abstract) 74/I.6 (Italy)

(G. Benini)

Short-term flood prediction can be based on observations of stream flow stage, height of precipitation or of onset of surface runoff.

A common feature is the requirement that as little time as possible elapse between the moment when a datum is recorded and that in which the result is obtained. For this reason the data should be transmitted automatically by radio to a central electronic data processing machine for immediate precessing of the material on the basis of a previously designed mathematical model.

Floods can be most reliably predicted from stream-flow gauging station observations but the system is practical only in catchments several thousands of km^2 in area.

Prediction from rainfall data requires an even more complicated and much more advanced mathematical model. However, it is considered practical only in catchments of more than 600-800 km^2 in area.

The procedure based on surface runoff data is subject to excessive uncertainties for accurate results.

Avalanche prediction is based on meteorological observations and records of snow-cover characteristics. The conditions that create an avalanche hazard can be reported, when they arise, even if the avalanche fails to fall. (Original: French)

8.7 Italian Bibliography (abstract) 74/I.7 (Italy)

(G. Benini and G. Mazzoni)

Consists of a list of about 110 Italian publications (in the field) from May 1972 to April 1974, giving titles, names of authors, dates and sources. (Original: French)

8.8 Report on Education (abstract) 74/I.8 (Italy)

(G. Benini)

A review is given of the European situation in university-level instruction on the subjects of torrent control, avalanche control and watershed management.

Because the possession of basic notions is a prerequisite for a course in these subjects, the situation in regard to preparatory courses is also examined.

Brief surveys based on information received are presented for the following countries: Austria, Belgium, France, the Federal Republic of Germany, Greece, Italy, Norway, Poland, Portugal, Romania, Spain, Switzerland, Turkey, the United Kingdom and Yugoslavia.

Though not complete, this account is extensive enough to offer a significant overview and serve as a basis for final conclusions. (Original: French)

9. REPORTS BY NORWAY (N)

9.1 National Report (abstract) 74/N.1 (Norway)

(B. Andersen)

The report shows that eight persons were killed in 1972 and one in 1973 by avalanches. Heavy floods in 1973 in West-Norway have necessitated security works at a cost of approximately 2.3 million dollars. A new research station for avalanche problems has been built in in 1973. There is high activity in Norway regarding environmental problems in connection with management of agriculture and forest, particularly near the towns. (Original: English)

9.2 Effects of Mountain Land Use on Water Quality (abstract) 74/N.2 (Norway)

(B. Andersen)

The report summarizes demographic trends, showing that the mountain land use has an increasing influence on water quality. Norway has considerable resources of fresh water. The principal plan for the future is to safeguard the natural quality, to preserve aquatic life and to maintain aesthetic and hygienic conditions. According to an act of 1970 it is necessary to apply for permission to discharge pollutants.

Research is being done by the Norwegian Institute for Water Research and the University of Agriculture. The report deals with the pollution from industry, agriculture, dwellings and the use of pesticides. At the moment research is underway in many parts of the country. (Original: English)

9.3 Relations Between Forest Management of Mountain Watersheds and Problems Related to Environmental Quality (abstract) 74/N.3 (Norway)

(B. Andersen)

The report deals with the management of resources in Norway and presents a general view of the natural resources. The building act of 1966 draws up guidelines for the use of resources. Problems with the management of forests, such as clear felling, forest road construction and the use of pesticides and forest fertilizers, have been a matter of public concern. As for the forests belonging to the municipality of Oslo, a multiple use plan was presented in 1971, emphazising the total value of the various uses of the forests.

During the last 20 years new acts have stressed the importance of nature conservation. Nature parks have been introduced and recreation areas have been restricted. Since 1972, these matters have been conferred to the Ministry of Environmental Affairs, which also deals with pollution problems. Research regarding environmental problems is underway. (Original: English)

9.4 Spring Flood Forecasting in the Glomma Basin, Norway (abstract) 74/N.4 (Norway)

(K. Hegge)

The spring floods of 1966 and 1967 were unusually high in the Glomma basin, with recurrence intervals of approximately 30 and 100 years. Material damage was considerable.

After the 1966 flood, the Hydrological Division of the Norwegian Water Resources and Electricity Board began examining the possibilities of giving flood warnings.

Observations from 30 previous severe floods were examined, and by means of multiple linear regression analysis, a best-fit prediction. This equation predicts water level at the culmination in Lake Øyeren based on the stages observed at a number of sites in the upper reaches of the river system. The complete prediction equation is:

$$h_{1,\ T+3} = a_0 + a_1 h_{1,\ T} + a_2 h_{2,\ T} + a_3 h_{2,\ T-2} + a_4 h_{2,\ T-5} + a_5 h_{3,\ T} + a_6 h_{3,\ T-2}$$

where h denotes river stage and a_1 are constants.

The indices of stages h indicate gauging station and time in relation to the day of prediction, T.

The forecast period varies from 3 to 5 days according to the development of the flood situation.

$h_{3,\ T-2}$ thus means the river stage at station no. 3, 2 days before the day of prediction. The flood warning system was first operated in 1967 during the greatest flood since 1860. The total flood level rise was about 7 metres and the crest stage was forecast within 12 cm of the actual culmination. The forecast of the stage which turned out to be the highest was given 5 days ahead, which made it possible to reduce flood damage considerably.

It is considered advantageous to base the prediction on river stages instead of discharges, as flood stages are usually the critical element to forecast. A stage-based system also eliminates the need for discharge rating curves, which are frequently inaccurate for flood stages. (Original: English)

10. REPORTS BY ROMANIA (R)

10.1 National Report on Torrent Control in Romania (abstract) 74/R.1 (Romania)

(A. Costin)

Torrential catchment management activities in Romania are planned and aimed at areas where new public works (impoundment lakes and industrial and hydroelectrict power generating installations) and public and forest roads are to be built. Large-scale works are being executed to improve excessively degraded farmland by growing protection forests.

The Ministry of the Forest Economy and Construction Materials and the staffs for torrent control and pisciculture in mountain waters in the Faculty of Silviculture of Brasov University are now engaged in complex studies toward setting up a permanent training facility for torrent control and salmoniculture in the Doftana Ardeleana torrent catchment.

The aim of reducing the quantities of and outlays for the construction materials used in the execution of works has led to the construction of small-section gravity dams of masonry or simple concrete, earth dams with siphon spillways of reinforced concrete pipe, earth dams with the central filtering zone in reinforced concrete, filtering dams with prefabricated reinforced concrete bulkheads and simple concrete buttresses, dams constructed of metallic elements, etc.

The steadily increasing volume of torrent control works has led to the improvement of their technology in recent years and to the increased mechanization of operations at construction sites. New types of equipment have emerged.

Much research has been done in recent years or is currently in progress to bring out the protective functions of the forest in the environment and particularly that of reducing runoff and surface erosion. Research has also been done to determine the best ways to manage the stands established on eroded ground, to develop methods for the control of landslides, etc. (Original: French)

10.2 Survey of the Evolution of the Problems of the Working Party on the Management of Mountain Watersheds (1950-1974) (abstract) 74/R.2 (Romania)

(S. Munteanu)

The report was written to underscore the importance of the forthcoming anniversary of FAO's decision a quarter of a century ago to set up the Working Party that today is called the Working Party on Management of Mountain Watersheds.

The report describes the activities of the Working Party from its inception in 1950 up to the present time.

The report is dedicated to the work done by all the specialists from Europe and elsewhere in the world - silviculturists, agronomists, hydrologists, geographers, geologists, hydrotechnicians, etc. - whose ideas, designs, accomplishments and proposals carried into practice or recorded in hundreds of technical and scientific reports and presented over more than 20 years during the sessions of the Working Party, have identified them with the major problems of water and soil conservation in mountain watersheds and, by extension with raising the level of living of the inhabitants of rural uplands.

The author also pays tribute to the eminent specialist Jean MESSINES DU SOURBIER who with remarkable competence guided the fortunes of this Working Party as its Chairman from its inception to 1970.

The content of the report shows that the Working Party has concerned itself over the years with increasingly varied and increasingly complex problems, and the problems on the agendas of the sessions have steadily evolved from the early preoccupations of the body, which were confined mainly to the technical problems associated with the types of works and methods employed in torrent and avalanche control to an increasingly distinot focus on the complicated social and economic aspects associated with the integral management of mountain watersheds subject to torrential processes and snow avalanches. (Original: French)

10.3 Basic Premises in the Problem of "Underscaled" Dams Used in Torrent Control (abstract) 74/R.3 (Romania)

(S. Munteanu)

Since 1951, the author has been studying low-cost dams for torrent control, and was the first to use so-called "increased-batter" dams and dams in which load-stress assumptions are computed into the design. The practical introduction of these assumptions removed the main obstacles which, imposed by the rigidity of conventional concepts, had prevented diversification of the types of dams and the adoption of increasingly economical profiles. Later, from 1970 on, these assumptions made it possible to experiment with particularly flexible "underscaled" dams.

In the report presented the author underscores five basic premises for the adoption in practice of economical "underscaled" dams, to wit:

- there is a wide safety margin of reserve static stability in these dams relative to the required limit of stability;
- dams used for torrent control differ essentially from dams for hydroelectric purposes not only in their height but also in their function;
- they are intended to retain sediment and form well-drained silt deposits and not to build up bodies of water;
- the range of variation of the loads to which a torrent control dam may be subjected throughout its existence are extremely wide;
- in present design practice, to achieve total certainty that a dam will not give way, the dimensions are calculated on the basis of overturning moments at least four to seven times greater than those that will normally act on the dam throughout its existence after the silt deposit has been built up;
- finally, as the fifth basic premise the author underscores that a dam designed practically to the limit of stability for water pressure alone functions as an underscaled dam if before silting up (i.e., before formation of the silt deposit) it is unexpectedly subjected to floods higher than those assumed in the initial calculation, and as a greatly overscaled dam after formation of the silt deposit even when beset by unusually high floods.

As a general conclusion, the author expresses the basic idea of the introduction in practice, in Romania, of underscaled dams based on the idea of the well-considered utilization of the static reserves offered by the operation of dams after formation of the silt deposit. To be sure, this proposition does not exclude the introduction and utilization in practice of other types of low-cost dams. (Original: French)

10.4 Romanian Contributions to the Classification of Torrent Watersheds (abstract) 74/R.4 (Romania)

(S. Munteanu, A. Apostol, R. Gaspar, A. Costin)

The authors summarize the contributions made by Romanian foresters since 1962 to the classification of torrential watersheds. These contributions are discussed in parallel with the contributions presented from 1957 to 1964 by the first chief rapporteur on the problem, Mr. P. MARGAROPOULOS.

Romanian specialists have worked intensely on this problem. Since 1962, S. MUNTEANU, A. COSTIN and T.R. MECOTA have proposed that the starting point for the classification of torrential watersheds be the "torrent potential" which, in the broadest sense of the term, could be expressed in four main "characteristics", to wit: "the hydrological characteristic" (represented by the liquid discharge of the torrent), "the transport characteristic" (represented by the sediment discharge), "the erosive characteristic" (represented by the quantity of organic matter leached out or by the watershed area eroded, as applicable) and, lastly, "the landslide characteristic" (represented by the area of ground that slides, falls or moves in some other way).

Different contributions on the qualitative and quantitative classification of torrential watersheds in Romania were presented later (S. MUNTEANU, ALEX. APOSTOL, R. GASPAR).

The purpose of the report is to place at the disposal of the next chief rapporteur on the problem of torrential watershed classification, and of other European specialists engaging in torrent control, a unified body of material on the status of Romanian contributions and ideas on the subject. (Original: French)

10.5 Proposals on the Bibliography and the Oxford Decimal Classification System in the Field of Torrent Control, Avalanche Control and Mountain Watershed Management (abstract) 74/R.5 (Romania)

(S. Munteanu, S.H. Kunkle)

The authors deal with some basic aspects of the bibliography and Oxford decimal classification system in the field of torrent control, avalanche control and mountain watershed management.

The authors propose the compilation as heretofore of a general bibliography for each separate country. However, in view of everything that is needed in the manual on torrent control, avalanche control and mountain watershed management, the authors feel that the bibliography compiled on the basis of the system in use at present is too general and hence unsatisfactory.

The authors note that after the afore-mentioned manual has been written, its "Drafting Committee" will have to keep it up-to-date and prepare new editions "from time to time" in the knowledge that every successive edition will be at least partly outdated in two or three years. Now, this permanent function in which the "Drafting Committee" will have to take on, makes it necessary that a carefully systematized bibliography be compiled of the enormous literature published in the world every year. The authors accordingly propose that, along with the general bibliography, each country compile periodically a special bibliography limited strictly to works of importance for updating the manual and organized in the order of the chapters in the manual.

The authors propose that no alteration be made for the moment in the Oxford classification system, which should not be adopted until the proposals already made (by Messrs. A. PONCET and M. de QUERVAIN) have been carefully weighed by the Working Party. This matter will be taken up in the Thirteenth Session of the Working Party. (Original: French)

10.6 Twelfth Session of the Executive Committee of the FAO European Forestry Commission (Geneva, 28-29 March 1974) and the Need that the Watershed Management Working Party Participate in the Colloquium at Interlaken, Switzerland (22-26 September 1975) on the Environmental Role of Forestry (abstract) 74/R.6 (Romania)

(S. Munteanu)

The Chairman of the Working Party presented to the delegates of the member countries an information note on the problems discussed in the Ninth Session of the Executive Committee of the FAO European Forestry Committee at Geneva on 28-29 March 1974.

The Chairman also announced to the delegates that a Colloquium on the Environmental Role of Forestry would be organized during 1975 and be hold at Interlaken, Switzerland, from 22 to 26 September of that year.

Arrangements for the Colloquium would be made by the FAO/EEC Joint Working Party on Forest Statistics and Forest Products and, in addition to general environmental problems, it would also discuss problems relating to the special influences of forestry on the environment.

The Chairman informed the delegates that the Executive Committee of the FAO European Forestry Commission had decided that our Working Party is to collaborate in the proceedings of the Interlaken Colloquium by preparing reports and illustrating their presentations with as many slides as possible on how our Working Party is contributing to the restoration and conservation of mountain watersheds, from which economic underdevelopment is driving the rural population to emigrate to the cities.

On the basis of the above considerations, the Working Party on the Management of Mountain Watersheds designated Mr. A. PONCET to represent it at Interlaken and to present a documented report on its contribution to the improvement and conservation of the environment. The Working Party also voiced the wish that other specialists representing different characteristic zones of Europe (in Italy, Yugoslavia, Turkey, Austria, Norway, etc.) might also participate in the Interlaken Colloquium. (Original: French)

11. REPORTS BY TURKEY (TK)

11.1 Turkey's National Report on Mountain Watershed Management (abstract) 74/TK.1 (Turkey)

According to studies made during the years of 1955-1969, the cost of damage from annual floods in Turkey is over 300 million TL. (Turkish lira). Moreover, from time to time, the state highways and railways in the mountainous regions of eastern part of Anatolia are covered by avalanches.

Based on the 1970 Census, the Population of Turkey is 35.7 million, with 61 percent (22 million) living in rural areas. The main livelihood of this population is agriculture and livestock.

According to 1970 records, the total forest area of the country is 19.1 million ha of which 11.7 million ha are degraded forests and 7.4 million ha productive forests. In fact, it is known that the degraded forests areas were once productive.

Figures from the 1970 census show that 23.6 percent of the country's population lives in and near the forests, with 4 531 000 people in 6 725 villages near forests. The existing agricultural lands and other subsistence resources of these villages are limited, which is why the food supply is insufficient for these people.

With the aim of supporting the development of these villages, a General Directorate of Forests and Village Relations has been established under the Ministry of Forestry.

Matters concerning the above subject within the legislation and duties of the Ministry of Forests are as follows:

- In forest areas, soil conservation and reforestation should be carried out in accordance with watershed management principles.

- Shelterbelts should be established in agricultural lands to guard against wind erosion.

- Cooperative societies should be established for the conservation, irrigation and improvement of the soil in the agricultural areas of the Soil and Water General Directorate under the Ministry of Village Affairs and Cooperatives, providing financial support.

Current Soil and Agriculture Reform Legislation (1973) has brought up new principles, to put in proper order the use of agricultural lands and pastures.

The first soil-map showing land use-distribution in Turkey was made in 1954. Then, during 1966-1967 the Soil-Water General Directorate under the Ministry of Village Affairs and Cooperatives prepared a detailed soil-map of Turkey. Thus, the inventory reports and maps of soil resources for each province is being published.

In Turkey, the research related to watershed management is made by the:

Universities (Istanbul, Izmir, Ankara, Erzurum),
the State Establishment (Ministry of Forestry, Ministry of Food, Agriculture and Animal Husbandry Research Institute) and
the Research Organizations.

Training on watershed management and closely related subjects, offered by the following institutions:

Forestry Faculty of the Istanbul University.
Agricultural Faculties of the Ankara, Aegian and Atatürk Universities and School of Design of the Middle East Technical University.

An appendix lists 10 watershed management pilot projects, with brief descriptions. There is also a description of 5 large projects, giving some details. (Original: French)

11.2 <u>The Soil Erosion Problem and Its Solution in Turkey (abstract)</u> 74/TK.2 (Turkey)
(Faik Tavşanoglu)

Erosion has reached a very advanced stage in Turkey today. Causes of soil erosion in Turkey are as follows: almost half (45 percent) of the slopes in Turkey have a 40 percent gradient or more; Turkey's climate is rather hot and dry with long, dry summers; during the summer rainfall amounts to 50-150 mm. For centuries, large areas on mountain slopes have been overgrazed and subjected to primitive farming methods. No effort has been made to encourage the rational use of the soils nor to plan and improve agriculture and farm animal-economy.

To solve the erosion and torrent problem in Turkey it is necessary to make an investment of about TL 100 000 000 000 during the next 25 years. Fortunately at present, technical personnel are prepared to carry out the erosion and torrent control work in Turkey.

At present four existing state organizations are dealing directly or indirectly with soil and water conservation, but their works cover rather low elevation watersheds. These are:

State Water Works = Devlet Su Işleri (DSI);
Soil and Water = Toprak-Su (TS);
Road-Water-Electrification = Yol-Su-Elektrik (YSE); and
Reafforestation and Erosion Control = Agaçlandirma ve Erozyon Kontrolu (AEK).

An Erosion and Torrent Control Organization is proposed.

According to these general plans, the same units have to prepare improvement projects for all streams of the upper catchments. The improvement projects would cover measures for technical, cultural and management purposes. The most important precautionary measures for management purposes are to protect the soils of the slopes of upper watersheds which are partly or wholly bare and to prevent overgrazing in areas where erosion is extending further. Technical measures would include mechanical torrent control works and biological/mechanical slope stabilization measures.

The State Agricultural and Forestry Organizations have to encourage villages to form cooperatives and make every effort to strengthen and develop them with financial and technical aid.

In addition, the villagers who carry out soil and water conservation works independently should be rewarded. (Original: English)

11.3 Effects of Land Use on Soil Erosion in Turkey (abstract) 74/TK.3 (Turkey)
(Nihat Uçünoğ)

According to the extent of soil erosion, problems of sedimentation and floods have occurred in different parts of the country. Twenty percent of the total area of the country has been surveyed, in order to determine the extent of soil erosion in Turkey. The results of these studies and our observations on the unserveyed parts of the country showed that more than 50 percent of the total area is subject to active soil erosion.

Studies in the field of soil conservation have been carried out by four governmental organizations named DSI (State Hydraulic Works) EIE (Electrical Investigation Agency), Forest Service and TOPRAKSU.

Since 1958, DSI has already completed the studies on 400 small watersheds covering an area of 3 300 000 ha. Land use capability, present land use and soil erosion classes on watershed areas have been determined and mapped. The contents of DSI reports are very useful to explain the effect of land use on natural equilibrium.

The results of the studies indicate that 29 percent of the land is under cultivation, although only 15 percent of the area was suitable for agriculture in the project area surveyed. It may be concluded that 48 percent of the total agricultural land is not suitable for cultivation according to land use capability classes. On the other hand, no significant conservation measures in farming have been practiced. Under these conditions, agricultural activities have disturbed the natural balance, especially in mountainous parts of the country.

Forest and range lands having natural vegetation comprise 66 percent of the project area, although 78 percent of the land is suitable for pasture and forest according to the land use capability classes. This indicates that a big portion of the forest and pasture land has been cultivated and pushed into agriculture, by removing the soil protective cover which has been necessary for natural balance on the steep slopes.

Turkey has tried to solve these problems. Some governmental organizations have been carrying out several projects for soil and water conservation. Sixty-two soil conservation projects have been completed by DSI since 1959 and 17 projects are under construction. (Original: English)

11.4 Present Status of Education, Training, Research and Prospects in Watershed Management in Turkey (abstract) 74/TK.4 (Turkey)

(N. Balci and Özyuvaci)

The watershed as an entity for planning and management has many advantages over any other division of land. It is believed that individual water development projects contribute to solution of problems of a river basin of which they are a part.

"Watershed management" then is defined as "the management of the natural resource in a drainage basin by considering social and economic factors for the production of optimum amount and good quality of water and for control of soil erosion, floods and the protection of aesthetic values associated with water and land".

The definition of watershed management indicated above by the authors' opinion may not agree with those of people having different interests in watershed management.

Although forestry education in Turkey has a relatively long history (more than hundred years), the forestry curriculum (including many engineering courses) has some gaps in the field of watershed sciences.

The authors suggest delineation of the curriculum into three departmental branch programmes.

i) Department of Forest Management

ii) Department of Forest Products Industry

iii) Department of Environmental Sciences, including:

1. a) Watershed Management
   b) Range Management
   c) Wildlife Management

2. a) Landscape Architecture and Park Management
   b) Recreation

Watershed Research work carried out so far through the facilities of the Faculty of Forestry and affiliated government institutions may be summarized in broad categories as follows: Team-Surveys and studies in the drainage areas of dams; studies on soil erodibility; experimental studies on land capability calssification; erosion and sedimentation problems of man made lakes and harbours; water balance studies - studies on the regional criteria for land capability classification in different part of Turkey. (Original: English)

11.5 Variation of Relative Erodibility of Soils as Related to Parent Material, Slope Exposure, Land-use and Sampling Depth in two Different Regions in Turkey (abstract)

74/TK.5 (Turkey) (Nihat Balci and Necdet Özyuvaci)

Erodibility in this paper is defined as the inherent ability of soil to withstand erosion rather than the actual movement of soil material in the field. It indicates then a capacity or tendency rather than actual erosion process.

This paper summarizes the studies on the relations between erodibility and parent material as well as topography and land use in two different regions of Turkey. These regions are North-Central Anatolia, and the Kocaeli peninsula, which have semi-arid and sub-humid climates respectively.

Our studies and field observations have indicated that the parent materials make a very significant contribution to various properties of the soils and their erodibility potentials in both regions. Dispersion ratio as an index of erodibility was employed in these studies as influenced by parent material, topography and land use conditions.

The ranking of the relative erodibility of soils derived from four different parent materials in North Central Anatolia is as follows:

Neocene silt > Sandstone > Andesite > Conglomerate

On the other hand in Kocaeli peninsula, the ranking of the relative erodibility of soils developed on six different geologic formations is as follows:

(Ordovician) arkose sandstone > Eocene sandstone > Plio-quaternary sand and gravel > Devonian shale > Triassic limestone > Upper-Cretaceous limestone.

If these results are further summarized by ignoring the geologic periods and combining the identical litogenic groups, the following ranking may be given for the practical purposes:

Sandstone > Sand and Gravel > Shale > Limestone

It is interesting to note that the soils of both study areas have higher indexes of dispersion ratio, indicating susceptibility to erosion.

In many cases, lands having inadequate vegetative covers were marred by erosion and the parent materials were exposed. Knowing the properties which the parent material imparts to the surface material is very important for field practices. Estimation of peak flows, surface runoff and sediment discharge is intimately related with the hydrological properties of surface and subsurface soil materials in a watershed. Parent materials having significant influences upon such properties are of great importance. Thus, the role of parent materials should be taken into consideration for the construction of hydraulic structures as well as other watershed management practices. (Original: English)

11.6 Research on Forest Influences and Watershed Management (abstract) 74/TK.6 (Turkey)

(H. Aydemir)

An investigation was made on the influence of mountain land use on the transport of solid matter and surface flows from the standpoint of forest influences and watershed management in the Bolu mountain region in 1968-71. The questions to be answered were as follows:

a) Influence of types of mountain land use on runoff and the transport of solid matter.

b) Influence of the plant growth period and the rainy season on runoff and the transport of solid material on lands being used for different purposes.

c) Influence of slope on runoff and the entrainment of solid matter on land being used for different purposes.

d) Linear correlation among precipitations that provoke runoff.

e) Linear correlation between runoff and the entrainment of solid matter.

f) Influence of the kinds of mountain land use on agricultural income.

g) Economic importance of the transport of solid matter and runoff water at the level of the national income. (Original: French)

11.7 Legislation on Torrent Control, Avalanche Protection and Mountain Watershed Management (abstract) 74/TK.7 (Turkey)

(M. Ozbilgin and I. Cireli)

Article 131 of the Constitution of Turkey, adopted on 9 July 1961 and promulgated on 20 July 1961 says that "The State promulgates the necessary legislation and takes appropriate measures for the protection of forests and the expansion of forest lands. All Forests are under the superintendence of the State".

The General Reforestation and Erosion Control Administration is an agency of the Ministry of Forests.

In our country erosion control activities outside the framework of forestry administration are conducted by the National Water Resources Administration, established under Law No. 6200 of 25 December 1953.

Moreover, the General Land and Water Administration has been established to take the requisite measures to prevent water erosion and the erosion of agricultural soils.

Law No. 1757 on Agrarian Reform and Land of 19 July 1973 was promulgated to ensure that the land was worked in accordance with its capability and that every kind of improvement measure was taken, and to group the machinery for this purpose existing in the country under the Agrarian Reform and Land Administration of the Office of the Under-Secretary of State.

The organizations juridically vested with responsibility for the protection of Turkish soils are:

- the National Water Resources Administration (DSI)
- the National Soil Conservation and Irrigation Administration (TOPRAK-SU)
- the General Reforestation and Erosion Control Administration.

Soil conservation can never be ensured more reliably, more inexpensively or more effectively than by placing all land use under a single authority.

It is to this end that a special clause has been included in the recently promulgated Law on the Organization of the Ministry of Forests to provide against the loss of forest land and to preserve the equilibrium of nature in mountain watersheds, which are regarded as a unit in this law.

These three agencies in which the Law vests responsibility for soil conservation are required to work hand-in-hand in their respective operations in mountain watersheds. (Original: French)

11.8 Influences of Soil Erosion and Sediment Discharge on Rise of Water-level of Lake Burdur (abstract) 74/TK.8 (Turkey) (E. Görcelioglu)

The water-level of Lake Burdur which is located in the south-west of Anatolia, has been rising for a long time and this phenomenon has been the source of widespread hazards in the Burdur basin.

Topographic maps printed at different scales in 1949, 1960 and 1968 show the levels of Lake Burdur as 845 m, 850 m and 854 m respectively. According to measurements made by the State Waterworks Organization, the average water level of the lake rose from 851.48 m to 857.12 m between the years 1960 and 1971, i.e., a 5.64 m rise in the last decade.

One of the most important factors affecting this rise seems to be the large amounts of eroded material delivered into the lake. This material has plugged sinkholes at the bottom and on the shores of the lake which previously were transferring water from the closed basin into underground galleries. The basin of the lake itself is also being silted up by this material and gradually losing its storage capacity.

It is estimated that nearly 14.5 million m^3 of soil is eroded annually in the catchment area and about 1.5 million m^3 into the lake every year. In fact, the deepest point of Lake Burdur seems to be filled by about 40 m, according to previous and recent measurements. Material eroded and brought down from the hills also has developed a large strip of piedmont plain, which is composed of several debris cones and deltas. Other cones and deltas are also developing.

The climatic, geologic and vegetative conditions are quite favourable for accelerated erosion in the closed basin of Burdur. Therefore, it is absolutely necessary to consider the problems of soil conservation more seriously and to widen measurements in the framework of a complete watershed management plan. These efforts will bring multiple advantages; for example, denuded hills and slopes in and around Burdur will be covered with green forests, arable and inhabited lowlands will be protected from torrential floods, and the silting up of Lake Burdur, which has a special effect on environmental beauty, will be reduced. (Original: English)

11.9 Equilibrium Between Forest Wildlife (abstract) 74/TK.9 (Turkey) (I. Cireli)

A great percentage of the Turkish fauna inhabit mountain areas covered with forests, which still contain their natural habitat. Mountain and forest areas still have the natural geological formation and climatic conditions and an environment suitable for wildlife in respect to food, shelter, water and territory. The variety of ecological conditions creates a range of fauna types. The main elements of the vertebrate fauna of alpine regions and Turkey's forests are:

Mammals: leopard, bear, wolf, lynx, fox, jackal, wildcat, marten, ermine, weasel, wild boar, red deer, fallow deer, wild goat, squirrel, rabbit and various rodentia.

Birds: partridge, grouse, wood pigeon, wood-cock, birds of prey and a great majority of passerine birds.

Fish: the types adapted to cool waters with a high amount of oxygen, primarily trout. These regions also have various types of amphibious and reptiles.

To maintain protection and reproduction of those races which are in danger, conservation areas, breeding grounds and stations have been allocated and established.

Hunting Legislation No. 3167, adopted in 1937, is regarded as inefficient for today's conditions, therefore a new draft is to be submitted to the Parliament. Each year, in order to regulate the hunting activities, the Central Hunting Commission, presided by the Ministry of Forests, decides the hunting season. A regulation has been issued to administer hunting, fishing and tourism.

Hunting administration is now under the Ministry of Forests, General Directorate of Forests.

Cooperation with FAO should be carried on for studies on the protection and reproduction of rare and diminishing species in Turkey. (Original: English)

11.10 Methodology for Managing Forests for Touristic Purposes (Nature Conservation, National Parks and Tourism) (abstract) 74/TK.10 (Turkey)
(Nejat Özbaykal)

"Environmental problems" are defined as the result of ecological degeneration created by rapid development of technology. Nature is an escape for urban man. Forests offer a great socio-economical potential within the natural structure and are opened to domestic and foreign tourism within the multiple-use concept. According to existing laws and regulations, national parks, protected forest lands and forest recreation areas in the woods are established.

National parks have been established in Turkey since 1956 under Forest Legislation No. 6831, Article 25, which promotes outstanding beauty and significant natural (floral, faunal structures, geological and geo-morphological formations...etc.) and cultural (historical, archeological, ethnographical...etc.) resources within forest areas. Recreational and cultural potentials of national or international value are preserved, adding value to the social and cultural structure of the country within the tourism economy.

The objectives of National Parks are to provide sports relaxation, touristic activities and areas for scientific research (within a definite status of preservation).

Fourteen forested National Parks have been established since 1958. Through coordination of the State Planning Department, master plans have been prepared for seven proposed National Parks outside the forest regions since 1967.

Up to now, protected forest lands have been established in 37 areas for purposes of national defense, hydrological improvement of watersheds, erosion and torrent control, prevention of avalanches and land-slides, pollution prevention and tourism.

In connection with the Forest Department, there are studies directed at benefits from the forests. The public-forest relation is positive. In the forest picnic grounds efficient accommodations have existed since 1956. To date, 179 public Forest Recreation Areas are in use.

Issues emerging during the above studies can be summed-up as: a) ignorance of the public of the concept of preservation of wildlife and national parks; b) need of a definite programme for training and publicity; c) past misuse of highly valuable areas; d) inconsistency of decisions made by various projects; e) lack of specialized staff.

Measures to be taken include: a) establishment of a Ministry of Natural Resources and Environment with the necessary legislation; b) in the international context, acceleration of technical information exchange and training facilities, provision for selection and implementation of pilot-projects; c) establishment of information and documentation centres; d) emphasis on environmental impact statements for the projects. (Original: English)

11.11 The Avalanche Problem in Turkey (abstract) 74/TK.11 (Turkey)

(F. Tavşanoglu)

In Turkey numerous avalanches kill people, destroy buildings (and even whole villages), highways and railroads, blocking traffic for long periods. A law was passed in 1959 to cover "The measures to be taken and aids to be extended during natural disasters which affect public life". Natural disasters covered by the law are earthquakes, fires, floods, landslides, avalanches and rockslides.

The measures to be taken under this law are:

- Medical treatment, provisional housing and feeding of the people faced with natural disasters;

- Repair of houses damaged by natural disasters and resettlement of people whose houses have been destroyed.

The avalanches also destroy young or old forests as well as the soil and slopes, so that erosion severity increases.

Avalanche initiation depends on the relief, climate and vegetation cover. Steep and bare slopes or slopes covered by an insufficient vegetation cover promote avalanches. Basically two forms of avalanches can be distinguished: slab avalanches and loose snow avalanches. The weather conditions influence which form takes place.

To find out the sites where avalanches occur in Turkey, studies were initiated in 1960 with use of questionnaires. The results show that the avalanches occur:

- along State Highways (over 60 000 km length), at 36 places;
- along State Railroads (8 000 km length) at 38 places;
- in State Forest areas (about 97% of total forest areas) at 48 places.

Avalanches prevention in the high altitude and sensitive areas is important, including prevention of new starting sites on the mountains. Measures taken within the framework of forestry activities include special studies to determine where the natural forest boundary limits should lie. The aim is to restore this limit from its present by reduced state (brought about by overgrazing, etc.) to its original position. Therefore the present forests and all reforestation areas below this boundary should be protected with dry wicker works (wattling) against grazing and rolling stones. These areas may be protected against grazing, stones, and at the same time against forest fires, by surrounding them with dry stone walls.

Within forestry activities the dry stone walls (buttresses) in the upper watersheds serve to prevent the start of avalanches and protect young forests and reafforestation areas below the forest boundary during the first 20-30 years. (Original: English)

12. REPORTS BY UNESCO

12.1 UNESCO Programme (abstract) 74/UNS.1 (Unesco)

(B. von Droste)

The programme of Unesco's division of ecological sciences is concerned with the international co-operative interdisciplinary programme of research "The Man and the Biosphere" (MAB) and with the general promotion of integrated land resources research and ecology.

The MAB programme forms the largest single part of Unesco's activities under the theme "Man and his Environment". The programme is an undertaking of international scientific co-operation between Member States themselves. It consists of 18 projects defined in 1971 by the International Co-ordinating Council of the programme. They will be implemented in close co-operation with FAO, WHO, WMO, UNEP and in consultation with ICSU and IUCN.

So far MAB National Committees have been established in more than 60 countries.

The following MAB Projects are of special interest to this working group:

MAB Project 2: which deals with the ecological effects of management practices and different land use on temperate and mediterranean forest landscapes.

MAB Project 5: which focuses on the ecological effects of human activities on the value and resources of lakes, marshes, rivers, deltas, estuaries and coastal zones.

MAB Project 6: which is concerned with the impact of human activities on mountain and tundra ecosystems.

A detailed description of the MAB Programme and its projects is given in the MAB report series which will be sent on request. (See address in the list of participants)

The efforts of Unesco's division of water sciences (hydrology) will be in the future directed towards the implementation of the International Hydrological Programme (IHP). The IHP is intended to start in 1975 as a long-term programme of research and training and to succeed the IHD. In pursuing the main objectives of the IHD, which were to improve knowledge of the world's water resources and to contribute to their national use, the IHP will give greater emphasis to studying water resources in their inter-relations with human activities and thus complementing the MAB programme. Regarding educational activities and training of specialists, Unesco's divisions of ecological and water sciences assist to a number of training courses in various countries.

In order to be informed about MAB, IHD and IHP and other environmental and natural resources research co-ordinated by Unesco, it is recommended to subscribe Unesco's publication, Nature and Resources ($ 4 per year).

There is no need to stress that a close co-operation between this working group and relevant working groups formed under the flag of MAB, IHD and IHP will be of mutual interest. (Original: English)

13. REPORTS BY YUGOSLAVIA (YU)

13.1 Experimental Determination of the Intensity of Water Erosion in Serbia (abstract) 74/YU.1 (Yugoslavia)

(M. Djorović)

The intensity of water erosion has been studied for 5 years throughout the Republic of Serbia (85 000 km^2).

Tests were conducted from 1968 through 1972 on 59 erosion plots located in the central part of Serbia. The plots were tested under four cover conditions: maize, wheat, grass and forest on various slopes (6.12 and 20°) and for various types of soil (brown forest soil, brown acidic soil and smonitza).

Dimensions of the experimental plots are: 20.0 x 2.5 m, providing a surface area of 50.0 m^2. The test plots are bordered by aluminium sheets (0.5 x 0.6 mm of thickness), 20 cm below and 5 cm above surface. The rainfall and other climatic characteristics were correlated with erosion and runoff in an effort to derive a useable mathematical relationship that would express with an acceptable degree of accuracy the expected erodibility of individual intense storms.

Factors studied in relation to runoff and erosion were:

X 1 ... mean sum of precipitation creating runoff (AR)

X 2 ... mean intensity of precipitation creating runoff (AI)

X 3 ... maximum 5 min intensity (Mi 5)

X 4 ... maximum 15 min intensity (Mi 15)

X 5 ... maximum 30 min intensity (Mi 30)

X 6 ... soil moisture at 0-10 cm (SM)

X 7 ... soil temperature at a depth of 2 cm (ST)

X 8 ... air moisture (AM)

X 9 ... air temperature (AT)

X 10 ... runoff when soil losses occur (R)

The maximum 15, 5 and 30 min intensities were found to be the factors most closely related to runoff and erosion. (Experimental station RALJA)

The effect of slope degree of runoff and erosion is defined by the following equations: (Experimental station RALJA)

Under corn (maize)

runoff ..... $Y = 920.0 \times {}^{1.3692}$ (m^3/ha per year)

soil loss ..... $Y = 76.0 \times {}^{1.2149}$ (t/ha per year)

Under wheat

runoff ..... $Y = 1180.0 \times {}^{1.7034}$ (m^3/ha per year)

soil loss ..... $Y = 76.0 \times {}^{1.3779}$ (t/ha per year)

Under grass cover

runoff ..... $Y = 240.0 \times {}^{0.97386}$ (m^3/ha per year)

soil loss ..... $Y = 1.58 \times {}^{1.5826}$ (t/ha per year)

Under forest cover

runoff ..... $Y = 20.5 \times {}^{1.2305}$ (m^3/ha per year)

soil loss .. .. $Y = 1.58 \times {}^{1.11714}$ (t/ha)per year) (Original: English)

13.2 Quantitative Classification of Torrent Waterways on the Territory of Serbia, Yugoslavia (abstract) 74/YU.2 (Yugoslavia)

(M. Djorović)

Since 1957 in SR Srbija the method of quantitative classification of torrential waterways in use is one based on the experience of Dr. S. Gavrilović at the torrent waterways in Grdelica Gorge.

This method makes possible classification of torrential streams according to their potential abilities for soil loss. A rapid approximate cost evaluation of works needed to control any particular torrent and its watershed is also possible. This includes assessment of the proportion of biological and technical works in overall costing of torrent and erosion control.

The method is based on two calculations: (i) calculation of potential production of soil losses in a torrent watershed (W ann) and (ii) determination of the torrential hydrographical class (H_k) by the aid of the following equations:

$$W\ ann. = T \times h \times \bar{u} \times \sqrt{Z^3} \times F \quad (m^3 \text{ annually})$$

$$H_k = F \times A \times K \times \frac{L1 + 1.0}{L + 1.0} \quad (km^2)$$

(These are explained in the report) (Original: English)

13.3 The New Law on the Waters of the Republic (abstract) 74/YU.3 (Yugoslavia)

(M. Zemljić)

The new Slovenian water law, passed on 17 April 1974, regulates the utilization of all water resources, the lands adjacent to bodies of water and their occupants, the construction of large-scale hydrological works and installations, and other interventions in the water regime.

The general provisions of the first chapter declare all the aforementioned water resources and lands to be of general social value and as such to come under special social protection. They must be viewed as an entity in the management and conservation of the water regime in an entire river basin. Moreover, special social utility is attributed to this management for protection against damage by water and erosion.

The second chapter deals with the establishment of water communities, their organization, administrative bodies, functions, etc. Their function is to provide water, which is paid for by the users of the water delivered and of other water services. The minimum essential services required of them also include regular maintenance and the planning of investments for water resources management in catchments of regional and interregional importance, including those containing torrential water courses.

Chapter three authorizes the establishment of agencies to provide water services, that is, water resources management agencies and a torrent control agency for Slovenia as a whole.

Chapter four regulates the hydro-economic foundations on which are based the regional area plans and the water resources development plans.

Chapter five authorizes the issuance of directives, consents and permits required for altering the water regime. Only the Secretariat for Urban Growth of the Republic can issue permits for construction in inter-regional torrent catchments and on land exposed to more intense erosion, or to landslides or avalanches.

According to the sixth chapter, which deals with management of the water regime, protection against water damage, and protection of water quantity and quality, the removal of sand, gravel, etc. from stream beds, the limited rights of owners or users of land, and the stream inspection service, the authority to designate torrent catchments of inter-regional importance rests exclusively with the Executive Council of the Assembly of the Republic.

The subject of the seventh chapter is water surveys, while the eighth regulates the inspection of water services.

The ninth chapter prescribes special regulations to govern the tasks of the Secretary for Urban Growth of the Republic, who must issue technical instructions for the implementation of a number of different paragraphs of the law.

Finally, chapters ten and eleven contain the legal provisions. (Original: French)

13.4 Bibliography in Yugoslavia from 1967 to 1973 (abstract) 74/YU.4 (Yugoslavia) (M. Zemljič)

The bibliography gives the titles of publications (in their original languanges) of about 80 authors, plus a French translation, indicating the origin. (Original: French)

14. FIELD EXCURSION

The Study tour of 9-13 June was very instructive. It demonstrated to the participants both the diversity of the Turkish countryside and the problems which occur in the zone between the capital and the Mediterranean coast in the Antalya area.

The first day the group travelled to the Kizilcuhamam watershed north of Ankara where they visited a pilot project in the Kirmir basin. The project objectives include the protection of the hydro-electric reservoir of Hirfanti through forest improvement and by erosion control in the upstream areas.

The second day took the group to Gözlü, in an area where eolian erosion is being corrected by a range of plants. Afterwards the group travelled to Akşehir to visit the mountain region of Sultandagari and the torrential basin of Tekke which represents flood hazard to the city of Akşehir, the railway line, the major highway and the agricultural activities.

On the 11th of June the study tour went to the Dort watershed where again similar management activities are underway. The main problem is at Burdur where work is carried out to control wind and water erosion. Various types of plantations are envisaged for this purpose.

On 12 June the tour first went to Hacibekàr where various methods have been experimented in order to regenerate forests. The erosion works in the region of Korkuteli are designed to protect the town against flooding from Korkuteli, Fadildere and Kargalik and to reduce the transport of sediment into the lake. The descent from the high plateau then lead the tour to the coastal region which is rich in vegetation and water.

The 13th was mainly dedicated to dune stabilization and afforestation which has been carried out for halting dune encroachment onto cultivated areas and villages.

The study tour ended with a tourist visit to the archeological sites of Side, Perge and Aspendos. The study tour was exceptionally interesting from every point of view. Our Turkish colleagues supplied a wealth of documentation for all the project sites visited. The works visited were obviously made with great perseverance and a high degree of success.

15. CLOSING SESSION

15.1 Tentative Agenda of the Twelfth Session of the Working Party on Management of Mountain Watersheds (Toulouse, France; 6-15 September, 1976)1/

1. Report of the Secretariat

2. Country statements (format of March 1974 of the Secretariat of the Party. Each report should be accompanied by a table of descriptive figures for the entire area affected by control works).

3. Planning in mountain regions

   i) Scope and magnitude in each country (Chief Rapporteurs):

      Mr. Blais for the Alps
      Mr. Balci for the south

   ii) New techniques of combined forest-range management (General Rapporteurs):

      Mr. Castellani (Italy)
      Mr. Carcea (Romania)

   iii) Watershed management and tourism

      Mr. Özbaykal (Turkey)

   iv) Effects of mountain land use on water quality

      Mr. López-Cadenas (Spain)

   v) The use of waste water in the forest

      Mr. Kunkle (FAO)

   vi) Watershed management and the environment

      Mr. Andersen (Norway)
      Mr. Okutan (Turkey)

1/ French Liaison Officer for the 12th Session: Mr. M.R. Blais, Ministère de l'Agriculture des Forêts, 1ter Ave. de Lowendal, 75007, Paris.

vii) Watershed management and special economic aspects
Mr. Calabri and Mr. Binetti (Italy)

4. New techniques for restoration of torrent catchment areas

i) Biological works
Mr. López-Cadenas (Spain)

ii) Hydrotechnical works
Mr. Kronfellner-Kraus (Austria)

iii) Equipment for execution of works
Mr. Comanescu (Romania)

5. New findings in Forest Hydrology Research (including erosion)

i) Influence of vegetation on the water regime
Mr. Brechtel (Germany)

ii) The conservation and improvement of water resources in mountain watersheds
Mr. Criado and Mr. López-Cadenas (Spain)

iii) Mathematical models for floodwater removal
Mr. López-Cadenas (Spain)

iv) The catchment water balance
Mr. Fattorelli (Italy)

v) Mathematical models for the study of water erosion
Mr. Lopéz-Cadenas and Mr. Criado (Spain)

vi) The forest and torrent erosion
Mr. Kronfellner-Kraus, Chief Rapporteur (Austria)
Mr. Babinski (Poland)

Transport and sedimentation on the bed of a torrential stream
Mr. Lichtenhahn (Switzerland)

The forest and surface erosion
Mr. Djorović (Yugoslavia)

The forest and earth slides
Mr. Poncet (France)

vii) The forest, snow and avalanches
Mr. de Crecy (France)

6. Methods for calculating the advantages and disadvantages and the profitability of watershed management

   Mr. Benini (Italy)

7. Classification and cartography

   i) The quantitative classification of torrent catchments

      Mr. Djorović, Chief Rapporteur (Yugoslavia)
      Mr. Apostol, Mr. López-Cadenas and Mr. Fattorelli (Romania, Spain, Italy, resp.)

   ii) Cartography and recording of torrents and avalanches

      Mr. Seyberth, Mr. de Crecy and Mr. Tavşanoglu (German, France, Turkey, resp.)

   iii) Danger zones

      Mr. Kravogel (Austria)

8. Warning system for floods and avalanches

   Mr. Benini (Italy) - floods
   Mr. de Crecy (France) - avalanches

9. Manuals, terminology, bibliography

   i) Manuals (Benini, López-Cadenas, Graf, Kronfellner-Kraus, Kunkle, Poncet, staff)

   ii) Terminology (Kronfellner-Kraus, Poncet, Kunkle, Benini, López-Cadenas, Botero)

   iii) Bibliography (Munteanu, Seyberth, Kronfellner-Kraus, Críado, Poncet, Benini, Andersen, Babinski, Comanescu, Lichtenhahn, Graf, Balci, Zemljić)

10. Legislation

    Mr. Zölsmann (Germany) for central Europe
    Mr. Okutan (Turkey) for southern Europe

11. Education

    Mr. Benini (Italy)

12. Special reports

13. Other business

Observations:

All reports to be presented at the 12th Session should be sent to the FAO secretariat in Rome (in 30 copies) by 1 July 1976. The participant also would personally transport another 30 copies to France.

15.2 Working Party Elections and Business

The 1973-74 officers of the Working Party were approved for another term.

15.3 Conclusions and Recommendations

The 12th Session is planned for September 1976, to be hosted by France. The tentative programme is listed above under Item 15.1. To organize the next session, there is also to be an ad-hoc preparatory meeting of the Working Party officers in Grenoble in June 1975.

Several publications and activities are under way or planned: Terminology on torrents and torrent control (see Item 3 - v), Handbook on torrent control (see Item 3-iii) participation at the Interlaken meeting (see Item 10.6), Avalanche control manual (Mr. Graf, Switzerland) for 1975.

Appendix I

LIST OF PARTICIPANTS

Country	Name	Address
Germany	Brechtel, H.M.	D-351 HANN. MÜNDEN Institute of Forest Hydrology Hessen, Forest Research Org. Gartenstr. 1
	Zanker, K.	Federal Ministry for Food, Agriculture and Forestry 53 Bonn Section Water Eng. and Coastal Protection (FRG)
	Seyberth, M.	Oberste Baudehörde in Bayern Staatsministerium des Innern D-8000 München 22 Karl-Scharnagl-Ring 60
Austria	Kronfellner-Kraus, G.	Forstliche Bundesversuchsanstalt Tirolergarten A-1131, Vienna
	Kravogel, A.	Bundesministerium für Land-und Forstwirtschaft 1010 Wien, Stubenring 1
Spain	Criado, M.B.	INIA-CRIDA-05 Valladolid
	López-Cadenas, F.	Jefe Sección Hidrología ICONA c/Mayor No. 83, Madrid
France	Poncet, A.	Centre Technique du Génie Rural des Eaux et des Forêts B.P. 114-38402 Saint Martin-d'Hères
	Goujon, P.	Centre Technique Forestier Tropical 45 Avenue de la Belle Gabrielle 94130 Nogent-sur-Marne
	Blais, M.R.	M. le Chef du Service des Forêts Bureau des Affaires Générales 1 ter Ave. de Lowendal 75007 Paris
	de Crecy, L.	Division Nivologie C.T.G.R.E.F., B.P. 114 38402 Saint Martin-d'Hères
	Roger, G.	Office National des Forêts 4 Ave. de Saint Mande 75 Paris 12e

Italy	Benini, G.	Sistemazioni Idraulico-Forestali Via Gradenigo, 6 Università di Padova 35100 Padova
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Norway	Andersen, B.	Norwegian Water Resources and Electricity Board Post Boks 5091 Oslo 3
Poland	Babinski, S.	Ministère des Forêts et de l'Industrie de Bois Rue Wawelska 52/54 Varsovie
Romania	Munteanu, S.	Strada Londra 33 Bucarest
	Comanescu, A.	Institut de Recherches et Projets pour l'Industrie du Bois Soseaua Pipera Nr. 46 Bucarest, Sect. 2
Switzerland	Lichtenhahn, C.	Eidg. Amt für Strassen- und Flussbau Monbijoustr. 40 CH-3000 Bern
	Graf, J.P.	Inspection Fédérale des Forêts Belpstrasse 36 CH-3000 Berne 14, Postfach
Turkey	Aşk, K.	Agaçlandirma Genel Müdürü Adakale Sokak 85 Kocatepe, Ankara
	Okutan, M.	Orman Bakanligi Agaçlandirma ve Erozyon Kontrolu Genel Müdürlügü Adakale Sokak 85 Kocatepe, Ankara
	Sönmez, Necmi	A.U. Ziraat Fakültesi Kültürteknik Bölümü Başkani Ankara

Turkey	Özyuvaci, Necdet	I.U. Orman Fakültesi Büyükdere, Istanbul
	Aydemir Hakki	Ormancilik Araştirma Enstitüsü P.K. 24, Bahçelievler Ankara
	A. Sencer Birler	Kavakçilik Enstitüsü Ekonomi Bölümü Başkani, Izmit
	Gireli, Ibrahim	Agaçlandirma Genel Müdür Nuavini Adakale Sokak 85 Kocatepe, Ankara
	Balci, Nihat	DSI Etüt ve Plân Dairesi Yücetepe, Ankara
	Görcelioglu, Ertugrul	I.U. Orman Fakültesi Büyükdere, Istanbul
	Uzunsoy, Orhan	I.U. Orman Fakültesi Büyükdere, Istanbul
	Seren, Halük	Agaçlandirma Genel Müdürlügü Teknik Müşoviri, Adakale Sokak 85, Kocatepe, Ankara
	Özbaykal, Nejat	Orman Genel Müdürlügü Milli Parklar Subesi Müdürü Karanfil So. No. 32/9 Yenisehir, Ankara
Yugoslavia	Zemljić, M.	Faculté Biotechnique Vecna pot 30 61000 Ljubljana
	Djorović	Institute for Forestry and Wood Industry Kneza Viseslava br. 3 11000 Beograd
FAO	Kunkle, S.H.	FAO, Via delle Terme di Caracalla 00100 Rome, Italy
	Abdelhadi, Y.	Head of Soil Survey and Land Classification Section Dry Land Farming Project P.O. Box 41 Karak, Jordan
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Unesco	von Droste, B.	Unesco Division of Ecological Sciences Place de Fontenoy Paris 7ème, France

Interpreters

Mr. A. Sifré	FAO
Mrs. S. Boudet	FAO
Mr. F. Piraud	FAO
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Mrs. H. Moral-López	c/o AIIC, 14 rue de l'Ancien Port, 1203 Genève, Suisse

APPENDIX II

THE PROGRAMME: REPORTS AND ACTIVITIES IN THE SEQUENCE OF THE SESSION

11th Session of the EFC Working Party on
the Management of Mountain Watersheds

Ankara, Turkey, 3-13 June, 1974

PROGRAMME

3 June

09:30 — 1. Opening ceremony

10:30 - 13:30 — 2. Report on the activities of the Working Party on the Management of Mountain Watersheds (Munteanu)

Presentation of country statements

12:30 - 14:30 — Break

14:30 - 18:00 — Discussions or country statements

4 June

09:00 - 12:30 — 3. Integrated forest land use planning in mountain areas

3.1 Forest and wildlife equilibrium
3.2 New techniques of silviculture and pastoral (range) management
3.3 Forest management methods for tourism
3.4 Effects of Mountain Land Use on Water Quality

- Andersen (Norway): for Northern Europe
- Cireli (Turkey): for Southern Europe

3.5 Relationship between forest management in mountain watersheds and problems of environmental quality: Andersen (Norway) and Bossavie (France)

14:30 - 18:00 — 4. Reclamation in torrential catchments

4.1 Protective afforestation (technical and economic consideration)
4.2 Improvement of degraded soils (new techniques)
4.3 Conservation and improvement of protective forests (technical and economic considerations)

(Rapporteur for 4.1, 4.2 and 4.3: A. Poncet - France)

4.4 Torrent control

a) Torrent bed stabilization: Kronfellner-Kraus (Austria)
b) Slope stabilization: Puglisi (Italy)

5 June

09:00 - 12:30

5. Forest influences and watershed management research

5.1 Hydrological research

a) Water regime, particularly total water yield
b) Water quality: Brechtel (F.R. of Germany)
c) Soil erosion: Djorović (Yugoslavia)
d) Torrential erosion: Kronfellner-Kraus (Austria)
e) Snow and avalanches: Graf (Switzerland)
f) Flood discharge in torrential catchments: Lichtenhahn (Switzerland)

5.2 Research on direct and indirect benefits and returns from watershed management (preliminary report): Benini (Italy)

14:30 - 18:00

6. Classification, mapping and warning systems for floods and avalanches

6.1 Quantitative classification of torrential basins: Munteanu, Apostol, Costin, Gaspar (Romania), Djorović (Yugoslavia), Fattorelli (Italy)
6.2 Standardization of torrent and avalanche control methods (preliminary report): Kronfellner-Kraus, Puglisi, Benini, Fattorelli
6.3 Mapping, collection and recording of data on torrents and avalanches: Seyberth (F.R. of Germany) and De Crécy (France)
6.4 Possibilities for development of effective flood and avalanche warning systems (preliminary report): Benini (Italy)

6 June

09:00 - 12:30

7. Manuals, bibliographies, legislation, education and terminology

7.1 Preparation of a manual on torrent and avalanche control and torrential watershed management

Part I: Torrential watershed management
Coordinators: Kunkle (FAO) and Poncet (France)
Part II: Torrent control
Coordinator: Kronfellner-Kraus (Austria)
Part III: Avalanche control
Coordinator: Graf (Switzerland)

14:30 - 18:00

7.2 Terminology: Kronfellner-Kraus (Austria)
7.3 Bibliography and Oxford Decimal System of Classification (Compilation of a bibliography for the period 1970-74): Munteanu (Romania) and Kunkle (FAO)

7 June

09:00 - 12:30

8. Legislation on torrent and avalanche control and mountain watershed management: Zölsman (Central Europe) and Cireli (Southern Europe)

9. Education: Benini (Italy)

10. Special reports

11. Miscellaneous questions

14:30 - 18:00	12.	Future programme
	13.	Date and place of the next session
<u>8 June</u>		
09:00 - 12:30	14.	Closing ceremony
		14.1 Election of officers 14.2 Adoption of the final report
<u>9 - 13 June</u>	15.	Study trip

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