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EUROPEAN FORESTRY COMMISSION

WORKING PARTY ON TORRENT CONTROL, PROTECTION FROM AVALANCHES AND WATERSHED MANAGEMENT

NINTH SESSION AND SEMINAR

Munich, 1 - 14 June 1970

FINAL REPORT

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PART A - REPORT OF THE 9TH SESSION

I. INTRODUCTION

1. The ninth Session of the Working Party was held at Munich from 1 to 3 June 1970. The working meetings were followed by a seminar and a study tour.

2. The session was attended by 35 delegates from the following 12 countries: Austria, Federal Republic of Germany, France, Greece, Israel, Italy, Norway, Roumania, Spain, Switzerland, Turkey and Yugoslavia. Observers from Morocco and from IUFRO were also present. The list of participants is given in Appendix 1.

3. The discussions were carried out under the Chairmanship of Mr. J. Messines (France) who was assisted by Mr. Margaropoulos (Greece) and Prof. Munteanu (Roumania) as Vice-Chairman. In the absence of Prof. Steenberg, Assistant Director-General of the Forestry Department, FAO was represented by Mr. Talât Eren, Forestry Resources Division, who acted as Secretary.

4. The opening meeting took place at the Kongress Zentrum, München, on 1 June 1970. The Head of the Federal Forest Service, Dr. Schleicher, represented the Federal Ministry of Food, Agriculture and Forestry. He welcomed the delegates and underlined the importance of this particular session, which would be followed by a seminar through which the future programme of the Working Party would be determined. The Chairman referred to the cycle of sessions held by the Working Party in the various member countries and remarked that the first phase was now completed, as the meetings started in 1952 in the French Alps and had now completed the cycle in the Bavarian Alps.

5. The Secretary then underlined the importance of the meeting, drawing particular attention to the following:

a) The fact that this session coincided with the European Nature Conservation Year;

b) The growing interest of the Member Governments in the human environment, a great part of which falls within the field of competence of the Working Party;

c) The growing trend towards rural exodus in the European mountain areas;

d) The decision to be taken on the existence and future activities of the Working Party by the seminar which would follow the 9th Session, as recommended by the European Forestry Commission;

e) The great attendance and the interest shown by member governments in the meeting, despite the short notice given as a result of unavoidable delays which have occurred in its preparation.

II. ADOPTION OF AGENDA

6. After the introductory speeches, Mr. Messines suggested a small revision of the Agenda by transferring from Item 3b to Item 4b (New developments in watershed management and torrent control) the discussion on and research on techniques of protection against avalanches. The Agenda was then adopted with this modification. (Appendix 2)

7. The list of documents is attached. (Appendix 3)

III. THE NATIONAL REPORTS

The participants were requested to present briefly their national reports, with particular emphasis on:

a) major floods which had occurred during the inter-session period, with possible causes and estimated damage; b) specific research and implementation projects undertaken in the field of competence of the Working Party; c) exchange of information and contacts established with national and international institutions.

9. The representative of the State of Bavaria gave a complete account of the physical and ecological aspects of the Bavarian Alps, which constitute the mountainous part of Germany and which contain almost 90% of the torrential problems and erosion. After analysing the various problems presented by this particular region as regards torrent and avalanche control, he outlined the salient feature of the Bavarian Water Act of 1962, which includes various biological and engineering measures to rehabilitate the mountainous catchments. He illustrated the planning, financing and administration of these activities, which are carried out in complete coordination by the various agencies responsible, within the framework of the Alpine Plan for 1969-1979, which provides for the expenditure of DM 33 million annually for the next 30 years.

10. The Austrian delegate described the disastrous floods and avalanches which occurred during the period 1965-69 and the plan for establishing (through reforestation) 800,000 ha of protection forests.

11. The French delegate informed the meeting about the reorganisation of the various Departments into the General Directorate of Nature Conservation, and also described the avalanches in Val d'Isère and the land-slide in the Plateau d'Assy, which had a total of 108 dead and 39 wounded.

12. The Italian delegate informed the meeting about the floods which had occurred during the period 1966-68; and about the establishment of a special committee to study the causes and results of these floods. The findings of this committee are in course of publication.

13. The Norwegian delegate stated that since the last session there had been no major floods: however, in 1968 there had been a disastrous avalanche which caused 5 deaths. He described the work carried out by the Norwegian Water Resources and Electricity Board, and the Water Resources Division of the Department of River Maintenance, as the agencies responsible for flood control work. He stated that particular emphasis was put on flood warning, which was quite effective; this warning system, particularly that for the River Glomma, could give reliable information 3 to 4 days in advance of the flood occurrence.

14. The Roumanian delegate informed the meeting about the disastrous flood which had occurred in his country the previous month, affecting 37 of Roumania's 39 Departments, and gave the following details: The floods were caused by a natural catastrophe, the amount of precipitation having reached 50 - 110 liters per square meter during 48 hours of continuous rain; 50,000 km^2 of land was affected by 2500 million cubic meters of water, 90% of which became surface run-off because of the over-saturated nature of the soil. 70,000 houses and 300 big enterprises had been destroyed or severely damaged; the estimate of damage caused to small shops and plants was not yet complete; 700,000 ha of fertile and crop bearing land was submerged and land-slides had affected 12 000 ha of land, covering and destroying houses and communication systems. The total amount of damage caused was far greater than on any previous occasion.

15. The Greek delegate reported on a flood in 1969 caused by heavy rain and large-scale deforestation which had taken place in the catchment area in the Peloponnesus. He then described the strengthening of forest hydraulic research within the Forest Research Institute through UNDP assistance, and also the new legislation promulgated in 1967, which laid down effective measures to deal with the various problems involved.

Because of this efficient legislation and the great interest shown by the Government, the funds allocated for torrent control had risen from 1,3 million dollars in 1967 to US $ 3 million in 1970, with even greater amounts available for the period up to 1972.

16. The Spanish delegate informed the meeting on the following points:

- Recent floods in Spain had not been exceptional in character; they were the usual results of rainfalls reaching 150 mm per hour in areas where the total rainfall was in the region of 400 mm/year.

- Studies on the qualitative and quantitative classification of torrential watersheds had been continued, as had those on sub-sized dams.

- Preliminary studies had been made on measurement of the economic benefits of watershed protection, with particular reference to the catchment areas of the rivers Ebro, Tajo and Guadalquivir.

- The IFIE had published two works, the first on the application of photogrammetry to torrent control projects, the second on the qualitative and quantitative aspects of erosion and silting. A copy of each work was presented to the Secretary of the Working Party.

- Measurements of solid transport in rivers and on the silting of reservoirs had been recorded on bathymetric maps.

- As part of the contribution to the UNESCO Hydrological Decade, the post-graduate course at the Centro Estudios Hidrográficos, Madrid, had been extended to include forest hydrology.

- A decree dated 12 August 1968 had promoted very close collaboration between the Public Works Department and the Forest Service; land required for watershed protection projects was now bought or expropriated by the P.W.D. and placed under the Forestry Administration.

- Several contracts had recently been placed by the Forestry Administration with private and public electricity companies for the protection of dams and other installations. The electricity companies paid almost 40% of the permanent installation costs and 10% of the reforestation costs.

17. The Swiss delegate informed the meeting about the new approach of the Government to solving flood and avalanche problems in an integrated fashion and on a broad regional basis, and also about the strengthening of research activities.

18. The delegate from Turkey underlined the important development which had taken place since the last session of the Working Party: the establishment of the Ministry of Forestry, containing four General Directorates, one of which would deal with reforestation and erosion control, including all aspects of torrent control, avalanche protection and watershed management.

19. The various country representatives then reported the respectably high figures which had been allocated by their respective countries for the implementation of torrent control, avalanche protection and related measures to improve upper watersheds within the framework of forestry activities.

IV. REPORTS ON SPECIFIC PROJECTS AS RECOMMENDED BY THE PREVIOUS SESSIONS

a) Quantitative classification of torrential watersheds

20. Prof. Munteanu,* as principal rapporteur outlined the activities of the Working Party in general and referred in particular to the work accomplished by Mr. Margaropoulos on the quantitative classification and to the studies undertaken by the Roumanian specialists at the request of the 8th Session of the Working Party. He underlined the difficulties encountered with regard to cooperation from the member countries and suggested that in order to develop a common methodology and increase participation he prepare and circulate to member countries a questionnaire based on the classification approved by the Working Party in 1967. The Chairman requested the member countries to designate collaborators to carry out this important and long-term project. He also raised the possibility of obtaining the co-operation of the USA, where various scientists were working on the matter. Prof. Leyton indicated the possibility of getting such cooperation through IUFRO, but drew the attention of the delegates to the fact that the actual work must be carried out by individual specialists, since IUFRO was only an administrative unit for stimulating such cooperation. This showed the need for greater cooperation between the Working Party and other organisations concerned in this particular field. It was also suggested that FAO should try to establish lines of contact between research workers and practitioners in the field.

21. The delegate from Yugoslavia described the amount of research which had been carried out during the last 8 years, which could provide the specialists with certain results already obtained.

b) New legislation on soil and water conservation

22. Mr. Puglisi informed the meeting that he had not received any contributions from member countries to bring the list of legislation in the field of torrent and erosion control up to date, and he requested the delegates to keep him informed about any new legislation in this field.

c) Tools and equipment used in torrent control

23. In the absence of Mr. Comanescu of Roumania, the principal rapporteur on this subject, the documents prepared by him were presented by Mr. Gaspar. While congratulating the author for his excellent work, the meeting considered that in view of the constant changes taking place in the development of new equipment and machinery, this document should be considered as a guide rather than as a complete list of the equipment used in torrent control. It was agreed that the matter should be considered completed and that there need be no follow-up on this item at future sessions of the Working Party.

24. Within the context of the discussions on this item, Mr. Wendl introduced his report on winter construction, with slides and films. Various technical questions were discussed, covering temperature requirements and heating of the concrete during construction, and cost and arrangement of the workshops.

d) Professional training and education in watershed management

25. Mr. Eren presented the Secretariat note, which was prepared, as requested by the Eighth Session of the Working Party, on the basis of questionnaires sent to universities in the member countries. The universities were requested to provide the following information under the headings of torrent control, protection from avalanches, and watershed management: a) total number of hours of courses, lectures and practical training; b) outline of course syllabus; c) special methods used for group practical training, including design and construction exercises, research projects, etc.

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* Since Prof. Munteanu was elected Chairman of the Working group, Mr. N.R. Gaspar was nominated Principal Rapporteur, however the coordination of the work will be ensured by Prof. Munteanu.

26. The analysis of these replies indicated that most of the courses were given for under-graduate degrees, with variations from one country to another depending on topographic and climatic conditions, as well as on the social and economic structure of the country.

27. In view of the new trends and the increasing importance of environmental forestry all over the world, particularly in Europe and the USA, it is safe to say that it would be much more effective to integrate management practices in upper watersheds within the framework of environmental forestry and development. Such studies call for a comprehensive post-graduate course, embracing technical, social and economic aspects within the broad, integrated multiple-use concept. Furthermore, post-graduate studies can easily be arranged without making basic changes in the curricula of the traditional forestry schools.

28. In the absence of information as to whether such comprehensive courses are given in the universities, a post-graduate course programme prepared by Prof. Dils was given as a guideline in developing such courses. After the discussion, various speakers underlined the importance of such studies, all agreeing that they should constitute post-graduate courses, due consideration being given to the conditions of the respective countries. Within this context there were also certain suggestions that preliminary training be provided by the responsible departments within their range of projects, as in-service training for the university students. This would give them the necessary background to follow their courses better. It was decided that the Secretariat should pursue the matter further. Further information was required to give a clear picture and details of these studies, and to show the importance given by the respective universities to this subject. After obtaining the completed replies from the universities, a similar analysis should be made and submitted through the Working Party for the attention of the member governments.

V. THE ROLE OF FORESTRY AND THE DEVELOPMENT OF MOUNTAIN ECONOMY AND WATERSHED MANAGEMENT

29. Under this broad heading the following papers were discussed:

a) Working Party participation at the ECA/EFC ad hoc Conference on the Planning of Rural Areas.

Mr. De Coulon introduced the report which had been prepared by a selected group of experts as requested by the Working Party at its 8th Session for submission to the ECA/EFC ad hoc Conference on the planning of rural areas. This report contains two parts: the first gives a historical review of the Working Party from its establishment and 1st Session in 1952 to its 8th Session in 1967; the second part deals with the social, economic, technical and institutional aspects of mountain economy in the upper catchments.

30. After defining mountain areas, the report illustrates the basic alternatives for formulating a development policy for the mountainous or so-called difficult rural areas. According to the degree of development, countries or regions are roughly divided into two groups:

a) less industrialized, with an economy based on primitive or even subsistence agriculture; relatively low standard of living; densely populated area; surplus labour and underemployment

b) developed countries whose economies are based on industry and services; high standard of living; insufficient labour; heavy immigration to the plain; marginal agriculture which cannot compete with other uses without government support.

31. The rural development policy for the first group should be to encourage agriculture and exploitation of all resources, the development of handicrafts and local industries and tourism. In this case the mountainous area is a heavy burden on the community but has less detrimental effect on the national economy than if rural exodus is allowed to continue to further aggravate the under-employment problem of the plain. In the second group, the policy would be entirely the reverse; but assimilation of the rural population into new professions should be undertaken gradually.

32. In any rural development, land use should be well defined according to capabilities and potentials, with due emphasis on multiple use. Forest land usually accounts for large portions of mountainous rural areas and plays an important role in the general framework of rural development by providing various forest products and services. However, before implementing any development project, corresponding cost/benefit analyses should be made. In such analyses the social functions of the forest (recreation and tourism, amenities and other environmental benefits, water regime, soil conservation, protection from avalanches, water and soil pollution, etc.) must be taken into account, as they often supersede the direct value of forest products. In view of their comparatively small investment requirements and their multiple functions, forests usually constitute the most economic type of land use in such mountainous rural areas. This does not necessarily mean overall reforestation in the region; certain areas which have little value either for production or protection can be left to nature, particularly in sparsely populated areas and where the economy can absorb the population easily in the plain.

33. As a first step, pilot areas should be established for integrated rural development. The size of such development units varies according to the economic and social structure of the country. In Switzerland for example, a few thousand hectares is enough for such an exercise, while in Spain the area needed is around 100,000 ha, on which an integrated development scheme consisting of, for instance, a sawmill and a small particle-board plant, some animal husbandry, agricultural processing units and possibly a tourist centre with the necessary facilities and government services, could be planned.

34. For the efficient development of a rural area, forest economy should offset as much as possible the different standards of living between such difficult areas and more favoured ones. Forestry should first of all provide full-time employment, through either vertical or horizontal integration of various activities. The improvement of working conditions and the creation of cultural and recreational facilities, as well as day-to-day comfort and commodities, are essential to keep young people interested in staying in rural areas. Needless to say, the mountain economy cannot be safely developed without providing protection against the rather harsh conditions, particularly avalanches, floods, landslides, falling rocks for which the necessary protective measures are usually carried out by foresters.

35. Another important problem in rural development is the institutional structure, particularly the ownership pattern. This may involve the regrouping of holdings into economically viable units, or the application of a co-operative harvesting system without changing the conditions of individual ownership.

36. In implementing a rural development plan for a particular area, it is almost impossible to do so in isolation, as plain and mountain, agriculture and industry, urban and rural areas are so interdependent in many respects. The forester, the agronomist and the rural engineer must work as a team within the broad concepts of an integrated approach.

37. Finally, existing legislation should be updated or new laws promulgated in order to provide the financial, administrative and institutional support needed for the implementation of such an approach.

38. This evolution in mountain economy creates new tasks and additional responsibilities for the public services in general and the forest service in particular, as this is very often the main, if not the only, service which deals with mountain economy as a whole. While such tasks call for decentralized, regional administration , certain activities, such as the formulation of a national forest policy, the co-ordination of regional activities and the management of national forests, must always be entrusted to a central forest authority.

39. In many cases the development of these difficult areas is dependent for the provision of transport, communications and protection structures upon the financial support of public authorities, in the form of subsidies or long-term loans. A great part of this financial aid is channelled through the Forest Service even for those works which are outside the forest, such as reforestation, drainage, torrent control, constructions for protection against avalanches, range improvement and transport installations. This demonstrates once more how foresters can take an active part in the development of difficult rural areas. It may be concluded that in view of present trends, agriculture and even animal husbandry in difficult areas will decrease, but that tourism and recreation in various forms will take over. This requires not only a technical infrastructure, but also an agreeable natural environment. Here forests will be prerequisite for the development of difficult rural areas and will provide infrastructure for the mountain economy with their productive and protective roles, particularly as regards water and soil conservation.

40. The Zollikofen conference concluded that forestry could make a large contribution to the development of the hinterland, notably with respect to leisure-time pursuits, recreation and tourism. This involves giving the hinterland a sufficient infrastructure to support and make possible the implementation of integrated planning for the forest regions.

b) New developments in watershed management and torrent control

41. After the Chairman had presented briefly his report on new developments in watershed management and torrent control techniques, Mr. Kronfellner-Kraus introduced his final report on "sub-sized" check dams. After giving various excerpts from the contributions of member countries, he reported on the methods and the research results used in his study. He concluded that by using better quality materials and developing standard norms, as well as by utilizing computers, further economies could be made. The Working Party recommended that this final report be translated into French by FAO and given wider distribution.

42. Mr. Fattorelli (Italy) informed the meeting that he had planned an electronic calculation programme to determine the distribution of the water load on the ground and the actual stresses and deflections on check-dams.

43. Mr. Lichtenhahn (Switzerland) introduced his report on new studies for defining the dimensions of check-dams, based on a new concept and reduced size, which would be much more economic than previous dams.

44. Mr. Puglisi then introduced his report on the use of modern prefabricated materials in torrent control works, which was illustrated with slides. He stated that his report mentioned the types of construction, the dimensions of the dams, the costs and the time necessary for putting the prefabricated materials together; but indicated that the report should be considered only as a preliminary study which should be completed by the contributions of the member countries. He proposed that a questionnaire be prepared for distribution to the member countries. The Chairman requested the member countries to cooperate in this important subject by furnishing the data necessary to enable a complete report to be prepared before the next session. It is

recommended that this project be followed up.

45. Mr. Calabri (Italy) informed the meeting about the new type of prefabricated check-dams to reduce peak flows developed by the Azienda di Stato Foreste Demaniali.

46. Prof. Munteanu briefly presented four reports on torrent control dams concerning problems related to the development of the most economic sub-sized check-dams. Various speakers presented new techniques and calculations for the various types of construction, particularly check-dams, which are used in torrent control. Mr. Gaspar presented his report on dams with permeable foundations.

47. In his introduction, the Chairman emphasized the importance of four main subjects within the broad context of new developments in torrent control, protection from avalanches, and watershed management, with due consideration to the possible expansion of the terms of reference of the Working Party:

1) Afforestation of denuded land, including mountain areas abandoned for agricultural purposes as a result of rural exodus;

2) Improvement of mountain pastures;

3) Construction of the road network;

4) Development of tourism and recreation on forest land.

48. As regards the afforestation of bare land, the Chairman underlined the importance of this exercise, indicating that it is difficult to make a clear distinction between protective and production plantations; some of the protective plantations in the Massif Central for example, have yielded as much as 8 m^3 per ha. The various countries indicated their plantation programmes within this context. The most interesting figures were given by Spain, where annual reforestation covers about 100,000 ha., of which 40% is planted with quick-growing species for production purposes, and 60% is for protection forests.

49. Various methods of using polymerized emulsion material to stimulate the germination procedure of the seeds, and also the percentage of survival, were mentioned. Various experiences were reported and it was underlined that the success of this technique mostly depends upon the type of soil and the climatic conditions. While the results are encouraging in humid regions, on rather coarse soil structure, it is less successful on less permeable soil and in drier climates.

50. The choice of species largely depends on the objective of the reforestation: if the final objective is timber production, the coniferous species should certainly be given higher priority. However, the cost of establishment should be analyzed before launching a large-scale plantation. Under Mediterranean conditions, the establishment of conifers should be carefully studied in view of the existing maquis formation and degraded broadleaved forests. If the main objective is for tourism or for watersheds, then the reforestation has to take into consideration the landscape aspect and the influence of the forest on water balance, according to the climatic and ecological conditions of the regions.

51. As regards the improvement of mountain pastures, and particularly those in the alpine regions, various experiences were reported. There was a consensus that although the area covered by mountain pastures is being reduced, the utilization of these pastures by livestock has not changed. On the contrary, through better utilization, the carrying capacity of these pastures offers the possibility of feeding more livestock. It was also indicated that after reforestation of old rangeland, which can be opened to sheep-grazing after 4 - 6 years, there is a considerable increase in the carrying capacity because of the stabilization of the soil and the increase in its fertility.

52. As regards the construction of road networks, the various advantages and disadvantages were underlined, particularly as regards the use of these roads for tourism.

53. As regards tourism, the Chairman referred to Mr. De Coulon's report and also to the conclusion of the ad hoc Conference on the Planning of Rural Areas, to the effect that more and more the forests are offering various types of outdoor recreation and tourism. In this connection Mr. Betolaud particularly drew the attention of the meeting to the importance of training people and putting them in contact with nature, as this contact has been lost ever since the migration from the mountains to the cities. He elaborated the policy of the General Directorate of Nature Conservation, which deals with tourism and national parks development within the forestland. He indicated two major plans regarding touristic development being undertaken by the forest administration:

a) to provide a green belt around the cities to serve as a kind of recreation area within easy reach of city people; and

b) to develop reserves and national parks for scientific purposes, with the major aim of stimulating interest by putting people in direct contact with nature.

For the whole of France, 30 million Francs have been used for both types of development, 50% being provided by the State and 50% by the communities or departments.

54. Mr. Lyabel (Italy), stated that he completely shared the views of Mr. Betolaud regarding the need to train people to appreciate and respect nature, and said that the Val d'Aosta, rather small but very heavily used by tourists, was a good example. The easy access to the region further aggravated over-use by people of the area. Some areas should be reserved and kept inaccessible to tourists.

55. Mr. De Coulon stressed the importance of the same subject saying that since the government is subsidizing touristic development by as much as 60 - 80%, the roads should not be opened for tourism before the management plan for the area has been approved by the authority concerned.

56. The Chairman then underlined the importance of the warning system as regards avalanches, floods and landslides. He also indicated that before the reorganisation of the French General Directorate of Water and Forestry there was an efficient warning-system, and expressed the hope that through the co-operation of the various institutions concerned, these warning systems would be re-established. The various countries stated that such warning systems are usually the responsibility of the State Meteorological Services, in cooperation with the Ministry of the Interior, and in some cases the Department of Forestry. Usually such warning leads to various security measures by the local authorities. Most of the warning systems are limited to touristic development areas, except in those countries where the systems have been in operation for a long time, owing to various development interests downstream. The Working Party recommended that warning systems be taken up as one of the important items for discussion at its next session.

57. Mr. Roch presented a report on the possibilities of protection against avalanches, covering construction works and related problems. He distinguished three possible ways of protection from avalanches: to prevent the occurrence of avalanches by keeping the snow mass in its place through certain structures to divert the avalanche courses; and protect the villages. He then elaborated on various types of protection and pointed out their advantages and disadvantages, as regards effectiveness and costs. He concluded that in long run direct and complete protection is safest and cheapest, particularly for highways and houses. Mr. Roch emphasized the need for careful studies and planning based on research results, since in snow protection even a small mistake may lead to unfortunate consequences. At the request of the communities, the degree of avalanche danger is mapped in three colours, red being used for the highly dangerous zones, blue for those zones on which protected houses are allowed, and white for the safe zones.

In France and Russia studies of avalanches are made from aereal photographs taken in the summer. These give an astonishingly complete picture of the course of avalanches. They are valuable particularly for remote areas, for highway planning or new resorts. In Switzerland aerial photos are used after catastrophes to determine the rupture lines of an avalanche, its thickness, the amount of snow which slid, the length of the snow mass, the damage to forests, houses etc. Discussions of land planning without reference to hydrological relations are equally restrictive.

c) Review of recent findings and future requirements of research in forest hydrology

58. Prof. Leyton, Leader of Section 11 of IUFRO, briefly summarized his paper on the subject. In his presentation he placed particular emphasis on the following points:

59. 1) The Hydrological aspects of catchment management cannot usually be considered in isolation, but must be treated as part of a more general land management problem with socio-economic considerations.

60. 2) Land use planning requires a more objective evaluation of the hydrological consequences of management; this means that the relations between treatment and effect need to be better understood.

61. 3) More cooperation between different disciplines, as well as better communication between them, is a prerequisite for the effectiveness and applicability of research data. Research is urgently required on both technical problems (replenishment of ground water, soil and water conservation, increasing and regulating streamflow, maintaining and enhancing water quality etc.) and organisational problems, such as developing improved economic and institutional arrangements and sysnthesizing research efforts through systems analysis. Some of these problems are included in the programme of the International Hydrological Decade.

62. Prof. Leyton, then suggested two major problems which have a particular importance in European forest hydrology:

a) Control of snow accumulation and melt rate by manipulation of the forest cover.

b) Pollution, and in particular the effects of biocides and fertilizers on water quality.

63. Prof. Munteanu underlined the importance of the technical aspects, which do not differ as much as the economic and social aspects. He therefore suggested that the hydrology of torrential watersheds should be taken as a common basis within the framework of each country's social and economic system.

64. Various speakers informed the meeting about their research activities, mostly undertaken through the International Hydrological Decade, and including various experiments on the forest's influence on the water balance and on the influence of man on water yield and quality.

65. Mr. Heede explained the hydrological research programme undertaken with UNDP assistance to strengthen the Forest Research Institute in Athens. As part of this programme experiments were being conducted in eleven watersheds by the Forest Research Institute. Instruments were being installed for the measurement of precipitation in both summer and winter, and of stream flow. The altitude of the watersheds ranges between sea-level and 1500 m above sea-level. The common objective for all the studies is to find out: how much water is produced under given conditions; how the water yield is changed by soil preparation and vegetation; what is the relationship between forest type, as well as the condition of the forest, and sediment yield. The paired watershed approach will be used, leaving one watershed as a control for each treated watershed.

66. Mr. Kronfellner-Kraus emphasized the importance of this research, given the difficulties experienced in finding the proper equipment to be used during the winter. He suggested that experts working on forest hydrology should be put in contact with each other through IUFRO and FAO.

67. The Secretary drew the attention of the meeting to the fact that most of these studies had been carried out under the auspices of the International Hydrological Decade and unfortunately without the participation of forest hydrologists or research workers. Furthermore, most of the studies had not been published, as sporadic studies are carried out in isolation. It was recommended that the Working Party study the effect of land use in mountain catchments on water yield, erodibility and torrent erosion. Emphasis should be given to quantitative aspects to allow comparisons between different regions, with the ultimate aim of relating results to general problems in economics or land use, with special reference to forestry. It was hoped that IUFRO, through its contacts in Section 11, would be able to assist in promoting cooperation.

VI. OTHER BUSINESS

68. Under this item the Secretary drew the attention of the meeting to the difficulties encountered as regards documentation, which covers: bibliography, torrent terminology, snow- and avalanche terminology and the Oxford system of decimal classification.

69. The Working Party suggested that the preparation of a bibliography be continued and member governments were requested to send their contributions to the Secretariat.

In the absence of Mr. Balanica (on duty) principal rapporteur for the subject, the Chairman requested the Roumanian delegation either to nominate someone else or to ask Mr. Balanica to prepare the draft of this bibliography.

70. Mr. Balanica was also requested to prepare the proposals as regards the Oxford decimal classification system to cover fully the subjects falling within the field of competence of the Working Party concerning torrent terminology; the draft terminology has been prepared on the basis of information provided by Prof. Weber, which must be checked once more by French and German-speaking experts. The Working Party requested Mr. Kronfellner-Kraus and Mr. Poncet to make the necessary amendments and inform the Secretary accordingly, and recommended that the Director-General of FAO have this text translated into English and Spanish, and the Government of Italy provide the Italian text.

71. As regards snow and avalanche terminology, of which the final draft had been submitted to the Working Party's 8th session, this had been held back for correction upon the request of the Federal Snow and Avalanche Research Institute. Mr. Roch informed the meeting that since UNESCO had already undertaken the preparation of a broad terminology in this field, the subject should not be pursued by the Working Party, in order to avoid duplication.

VII. FUTURE PROGRAMME

72. The Chairman suggested that since the future programme would be discussed during the course of the seminar within the framework of the new terms of reference of the Working Party, this item should be deferred.

VIII. ELECTION OF OFFICERS

73. Mr. Messines resigned as Chairman of the Working Party, after holding the office for 18 years. Several delegates expressed their appreciation of the great services that he had rendered to the Working Party, which under his Chairmanship had accomplished its task with great success and had grown from a small group of experts into an efficient and multidisciplinary group.

74. Mr. Margaropoulos resigned as first Vice-Chairman, due to his heavy workload. On the proposal put forward by the Italian delegation and seconded by the Greek delegation, Prof. Munteanu was elected as Chairman and Messrs. Puglisi and Lichtenhahn as First and Second Vice-Chairman respectively.

IX. DATE AND PLACE OF THE NEXT SESSION

75. The Working Party requested its Chairman and the Director-General of FAO to set the date and place for its next session in 1972.

The Chairman expressed the desire of the Working Party that this session be held in Turkey, in view of the fact that this country has not yet acted as host for the Working Party. In response to this request, the Turkish Delegate expressed his desire to have the next session held in Turkey, but stated that since he had not received any official instructions in this respect he would refer the request of the Working Party to the authorities concerned and the necessary official steps would then be taken accordingly.

76. The final report of the 9th Session of the Working Party on Torrent Control, Protection from Avalanches and Watershed Management was submitted to the session on 4 June 1970 and approved unanimously.

PART B - REPORT OF THE SEMINAR

SEMINAR ON THE FUTURE ORIENTATION OF THE EFC WORKING PARTY ON TORRENT CONTROL, PROTECTION FROM AVALANCHES AND WATERSHED MANAGEMENT

1. The Seminar, which was requested by the EFC to review the activities of the Working Party on Torrent Control, Protection from Avalanches and Watershed Management and provide guidelines for its future activity, was held on 4 and 5 June 1970, with the participation of all the members of the 9th Session, plus Mr. Gschwendtner (Austria), Mr. Hartwagner (Austria), Dr. Zundel (Germany) and Prof. Tavsanoglu (Turkey).

2. Mr. Zölsmann, in his capacity as head of the German delegation, opened the Seminar and underlined the importance of the Seminar. Then Mr. Kalkkinen, representative of FAO explained the objectives of the Seminar and the reasons for taking a new look at the activities of the Working Party. One important reason is that we are living in a society where changes are taking place so fast that matters which were important yesterday become secondary today, and may lose their importance completely tomorrow. He particularly drew attention to the fact that the problems of environmental forestry which have become so important today, are being taken up on every occasion, not only by scientists, but also by politicians. The technical activities of the Working Party are very useful and interesting, but if these activities do not take into consideration the many other inter-related problems they may be ignored completely in the future. If the Working Party is considered the EFC body most qualified and competent to deal with them, this further demonstrates the urgency of linking the technical aspects of the Working Party's activities with the environmental problems of the society and their implications.

3. Mr. De Coulon was elected as Chairman and Mr. Zölsmann as Vice-Chairman; Mr. Bullard FAO, acted as rapporteur.

4. In view of the fact that the documentation for the Seminar was also part of that submitted to the Working Party, and because the Seminar was largely composed of the same delegates, the programme of the Seminar was revised as follows in order to save time:

a) The role of forestry in mountain economy and watershed management - Secretariat Note

b) Historical review of the activities of the Working Party

c) Future programme and proposed changes in the Working Party's activities - Secretariat Note

d) Work which falls within the competence of the Working Party being done by other international agencies

e) Terms of reference of the Working Party and how it should carry out its activities

f) New title of the Working Party

5. Mr. Bullard presented the Secretariat Note on the role of forestry in mountain economy and watershed management, citing the current problems which had already been presented by Mr. De Coulon during the 9th Session of the Working Party and discussing possible solutions. Forestry operations and watershed management and their effects on mountain economy were described, and the need for a broad and integrated approach was stressed.

6. Mr. Messines, who has been associated with the activities of the Working Party, in his capacity as Chairman, from the First Session in 1952 up to the 9th Session in 1970

summarized the history of the Working Party and noted the increasing range of problems studied. He concluded that the request made by the EFC to modify the activities of the Working Party in order to include also land use problems in mountain regions and their social and economic implications, might be met by concentrating future activities on protection forestry, production forestry, tourism and recreation. He added that the several catastrophes which had occurred recently in the mountain areas had accentuated the need to broaden the terms of reference of the Working Party.

7. Mr. Eren presented the Secretariat Note on the future programme and underlined the main reasons for the changes, which have not been accidental but have been the response to changing rural conditions and to the new requirements of society, as outlined by both the Chairman and Mr. Kalkkinen. He then enumerated the proposed terms of reference. He also gave some suggestions for the future programme, to be used as a guide-line in the formulation of the new activities.

8. Before discussing the terms of reference, the Secretariat indicated that no international organization was covering the present and proposed future activities of the Working Party in such an integrated way; land use, particularly in mountain regions, was becoming more and more the forester's responsibility as had been clearly recognized by non-foresters at the joint EFC/ECA ad hoc Conference on the Planning of Rural Areas (See Final Report of the 9th Session). Certain studies, mostly as research projects, had been undertaken within the International Hydrological Decade by UNESCO's Working Party on the Influence of Man on the Hydrological Cycle; IUFRO had a special section whose leader, Prof. Leyton, was present at the Seminar in order to cooperate with the Working Party as closely as possible.

9. A lengthy discussion took place on the terms of reference. The various views and ideas expressed can be divided roughly into two groups:

a. a group in favour of keeping the Working Party as technical as possible, on the ground that it has always been a group of forest specialists in the field of torrent control and avalanche protection, and that if it is expanded it may lose its identity.

b. those in favour of broadening the terms of reference of the Working Party, underlining the changing trends and future requirements, particularly in the field of environmental forestry, a great part of which falls directly or indirectly within the competence of the Working Party.

10. The Secretariat referred to the previous Session's conclusions and recommendations, which called for an expansion. Various speakers also underlined the necessity of dealing with mountain catchment problems in their entirety, torrent control and protection from avalanches constituting only a part. Finally, it was concluded that the terms of reference of the Working Party should be enlarged to cover five major points, in the following order of priority:

a) torrent control

b) avalanche protection

c) soil and water conservation in mountain regions

d) mountain land use, with special reference to forest land, in collaboration with the authorities concerned.

e) evaluation of the direct and indirect benefits of mountain watershed management.

11. As regards the title of the Working Party, various suggestions were made and some participants insisted on the torrential aspects of the catchments. However, in view of the broadened terms of reference, it was decided to call the Working Party:

"EFC Working Party on Management of Mountain Watersheds"

12. The Chairman then introduced the question of defining the long-term and short-term programmes of the Working Party. As regards the long-term programme, Mr. Kalkkinen stated that a questionnaire would be circulated after the meeting of the EFC in September to all member countries, requesting them to indicate the order of priority of all the problems to be taken up by EFC in this field during the next 10 to 15 years. On the basis of the replies received to this questionnnaire, the Secretariat would establish a priority list of activities on the basis of the importance attached to various subjects by the respective member countries.

13. Concerning the short-term programme, the participants were requested to submit proposals, in order of preference to the Secretariat by the end of July at the latest, to establish the subjects which should be taken up by the next Session of the Working Party. The methods of carrrying out these tasks should also be clearly defined (either continuous action to be dealt with at successive sessions of the Working Party, or one-time ad hoc exercises. In the latter case, the possible technical seminars or symposia should not be limited to the members of the EFC, but should be open to all FAO member countries in which considerable experience already exists, as their contributions should facilitate the solution of the problems under discussion.

14. Within this context, the following subject matters were recommended by the Seminar for the future activities of the Working Party:

a) technical improvements in torrent control and protection from avalanches (continuous activity);

b) improvement of techniques of soil and water conservation in mountain land with emphasis on protective reforestation, related silvicultural treatment, silvo-pastoral planning, and drainage (in cooperation with IUFRO);

c) multiple use of mountain lands, especially forest land, with regard to forest protection, production and recreation;

d) qualitative, and where possible quantitative, evaluation of the direct and indirect benefits of watershed management, including methods and practical examples.

15. As regards the ways of carrying out these activities, it was suggested that, apart from the first item, all could be handled either as standing items or as subjects for seminars and symposia to provide further data. Mr. Eren suggested that it would probably be much easier and more practical if the members of the seminar were to list certain activities that they would like to have taken up by the next session. These lists could be handed in during the course of the study tour so that they could be discussed immediately in consultation with the Officers of the Working Party, who would be participating in the Study Tour. The participants responded very favourably to this suggestion and several proposals were received. On the basis of these proposals the following four major items are listed provisionally. They may be supplemented by further suggestions before the end of July, plus those recommended by the9th Session of the Working Party:

a) pre-fabricated elements for avalanche protection and torrent control;

b) organization of warning system services and establishment of avalanche hazard maps and pilot avalanche danger zoning;

c) forest influences on torrent flow, quantity and quality of water and sedimentation;

d) special techniques of reforestation and reconditioning of forests in high mountains to establish protection forests in the mountain regions.

16. In concluding the seminar, the Chairman thanked the German Government and Organizing Committee for organizing this Session and Seminar and offering hospitality to the Working Party.

C

PART C - STUDY TOUR

The majority of the participants took part in the study tour which was organized by the Water Resources Authorities of the Free State of Bavaria in close cooperation with the Forest Administration.

On the first three days visits were made to the Teisenberg, Weisengraben, Leitzach and Kühalpenbach development projects and to the Sylvenstein reservoir, returning each night to Munich; the fourth and fifth days were spent in the Halbech Region with an overnight stay in Hindelang, where a Bavarian folklore show was organized for the participants by the local authorities.

Since complete and detailed information on all the development projects, including the designs and technical data on the construction works, was given in a document distributed to all the participants, only the highlights of these projects will be touched upon hereunder:

Torrent control work, including the improvement and development of catchments, is the responsibility of the Free State of Bavaria, according to article 54 of the Bavarian Water Law; the implementation, financing and maintenance of this work is carried out according to the Alpine plan, as mentioned in the final report of the 9th Session.

Most problems stem from the steep topography of the region, combined with very vulnerable geological formations and high precipitation. For instance, the Teisenberg is part of the Bavarian flysch, which contains marl and slate as predominant deposits. These disintegrate easily and quickly, and this, together with their high-moisture-retaining properties, gives rise to enormous land slides, particularly in the event of heavy precipitation, which can reach 1800 mm per year. In the Leitzach valley, coarse diluvial gravel embedded in the main dolomite depression of the Triassic system and massive alluvial and debris cones at the foot of the mountain cause frequent and disastrous floods. The Northern part of the Halbech region belongs to the flysch zone, the Southern part to the chalk, Jurassic shell limestone and the main dolomite formation, which produces the highest erosion rate in all the Bavarian Alps. Slopes are very steep and mean annual precipitation runs between 1600 - 2500 mm per year. Consequently flood discharges are very high; the highest being 40 m^3/s in Teisenberg, 117 m^3/s in Leitzach and 250 m^3/s in Halbech and 600 m^3/s at the Sylvenstein. The altitude of the catchments ranges between 500 and 800 meters above sea level, and that of the mountain peaks between 1300 and 2400 meters.

Some of the projects go back as far as 1890, e.g. the work carried out in Faltenbach between 1890 and 1913 and in Leitzach in the Bayerischzell Valley between 1894 and 1905. In the Oberteisendorfer Ache Valley, a Water and Soil Association has been in existence since 1904, consisting of: the Teisendorf Forestry Office, the Communities of Oberteisendorf, Neukirchen, Freidling and Markt Teisendorf, the Federal Highway Department (for Fed. Highway 304), the Highway Department of the State of Bavaria (highway 2102) and two owners of power plants. However, most of these works have greatly deteriorated or been completely destoyed, because of technical weaknesses, lack of integration with other improvement measures, lack of maintenance and occurrence of disastrous floods during the early fourties. Comprehensive and integrated projects were not initiated until the late fourties and early fifties. They reached their present perfect level after the promulgation of the Bavarian Water Development Act in 1962 and the implementation of the Alpine Plan for the period 1969-1979.

The objectives of the projects range from the single channel improvement of the torrent which was threatening the village of Oberteisendorf as well as the agriculture, state and federal highways down below, to the integrated rural development project of the Kühalpenbach in the Ettal Region.

There are projects that aim at protecting streams from any pollution which might be detrimental to fish (Weisengraben) and at protecting forests from damage - by fencing - by game, mainly chamoix, roe and deer, the numbers of which are increasing owing to the lack of predators.

The most complete project, which has a particular importance for the Working Party in view of the latest new terms of reference and future activities is the integrated project for the Halbech Region. This project bears the title of "Improvement and Development Plan for the Halbech Region" and covers all the measures necessary to restore the disturbed equilibrium of the water resources thoughout the entire catchment of Halbech, within the framework of integrated rural development.

The increasing deterioration of the upper catchments and their detrimental effects on downstream development as well as on-site activities led to the drawing up of this project by the Kempten Water Board in February 1962. It aims at improving overall land use, particularly by providing improved pastures for the rural communities and improving access to the forest as timber production is one of the major occupations of the rural population. To achieve this and ensure safety and security, torrent control, control channel improvement and the stabilization of slipping land was also included in the plan which consists of the following:

Torrent control work on 11 streams and 33 tributaries: 80 transverse structures in concrete as check-dams and sills, 230 gabion and wooden dams, 2000 m. of embarkment, 5600 m. of stream clearance, 600 m. of channel improvement.

Improvement of access: Construction of 52 km. of rural roads, with 17 reinforced concrete bridges.

Reforestation: 327 ha. of afforestation and stand improvement.

Pasture improvement: 510 ha. of pasture improvement, which includes 120 ha. of drainage, 100 ha. of forest clearance, 38 km. of fencing, 1500 m. of stream-bed improvement, 3 reinforced concrete bridges and 200 ha. of Alpine pasture amelioration, with new Alpine farmsteads.

Stabilization of land slip: after the Rosshallblöse (Rosstal denudation) disaster in 1923, in the middle part of Lobental, when the valley was buried under several hundred thousand cubic meters of soil the land remained in constant movement; it has now been fixed by consolidating the foot of the slope with 5 large concrete check-dams and carrying out biological measures starting from the bottom and working upwards.

The total cost of the Halbeck Improvement and Development Plan is 12,500,000 DM, broken down as follows:

Torrent control (construction)	5,000,000 DM
Road building	3,500,000 DM
Forestry	700,000 DM
Alpine farming and pasture improvmnt.	3,300,000 DM

15% of the cost is sharedby the interested parties and the other 85% contributed equally by the Free State of Bavaria and the Federal Government, according to the Alpine Plan.

The Markt Hindelang is another interesting project, whose main objectives are to keep mountain agriculture alive, improve the forest and preserve the scenery and traditional culture for the ever-growing tourist industry. There is a special road, called the Alpine Road, which is only used for giving access to the development and not for public traffic. The local people take an active part in the implementation of the project.

The loss of large areas of grazing land resulting from large-scale afforestation is compensated by improved pastures with high rates of subsidy. As indicated above, particular attention was paid to harmonizing the constructions with the scenery, especially in the upper reaches, by planting trees as well as grasses on the banks of the channels; a strip

about 2 m. on both sides of the channel is sown with grasses, using the sorbent type of coating, which is mixed with cement as a binding material. Reddish porphyry is selected as building material so that the new constructions will not seem harsh to the eye. Nature conservation is always considered in any big project, from the point of view of the landscape and preservation of the natural environment.

In all torrent correction projects, traditional check-dams (concrete, masonry, gabions, etc.) and brush cordons or plantations of various shrubs are used as technical and biological measure which include the management of existing forests and/or the establishment of new stands, with due consideration to their effect on soil and water conservation, pasture and agricultural improvement, road construction, recreational requirements, wildlife management, preservation of the environment and landscaping are included as an important element of integrated watershed management within the broad rural development schemes. One of the main objectives of forestry is to re-establish mixed forest stands with deep-rooted species such as silver fir, beech, maple, alder and others, instead of the existing, practically pure spruce stands.

The execution of the project is the responsibility of the Water Authorities, which carry out their activities in close cooperation with the Forestry Administration.

Financing is provided partly by the interested parties - 10% to 30%, depending upon the nature of the projects, and the remaining 70-90% is shared equally by the Free State of Bavaria and the Federal Government.

The maintenance of all works is the responsibility of the Free State of Bavaria, according to Article 54 of the Bavarian Water Act.

Engineering skill and the standard of workmanship are extremely high; plans are based on integrated concepts and the work is highly mechanized and well organized. The participants were deeply impressed by the keen interest shown in integrated watershed development both by the governments and the local authorities, and particularly by the active participation of the local people. The party was overwhelmed by the courtesy and joyous hospitality extended on every occasion by the tough, hard-working Alpine population and authorities.

Technical perfection and a beautiful landscape, completed by attractive folk-dances and the melody of the Alpenhorn at 1400 meters above sea-level on snow-capped Alps in the middle of June, left in everyone's heart admiration and unforgettably pleasant memories.

During the course of the study tour, calculation of the torrential check-dams was one of the main subjects on which an intensive exchange of ideas took place. It was suggested that in view of the rapid evolution of technology and the new problems arising in this particular field, close collaboration with IUFRO on the matter was indispensible.

Some problems were singled out for study by the following experts:

a) mathematical models (electronic data processing) based on the existing check-dams (Kronfellner-Kraus, Fattorelli)

b) rectangular and arch-lined dams based on related research in their foundations (Lichtenhahn and Lopez-Cadenas)

c) Utilization of prefabricated elements in torrent control (Pu lisi and others)

d) Open-work dams, check dams (Kronfellner-Kraus, Puglisi, Clauzel, Poncet)

e) provisional results of the studies in undermining and scouring (Katonliss, Margaropoulos, Karamitros)

f) Check-dams with various profiles (Munteanu, Gaspar)

g) Technical norms and specification for torrent control works used in Europe (Kronfellner-Kraus, as Principal Rapporteur).

Although all these subjects are under study, it was suggested that a symposium on these problems should be organized before the next session of the Working Party.

In his capacity as Chairman of the Working Group on Dams and Torrent Management of Section 11 of IUFRO, Mr. Kronfellner-Kraus was requested to study the possibilities of organizing such a symposium in consultation with the Chairman and Secretary of the Working Party.

As regards the suggestions for the future activities of the Working Party, several notes were received which together with any other received from member countries before the end of July 1970, will be circulated to the member countries.

APPENDIX
ANNEXE 1
APENDICE

LIST OF PARTICIPANTS
LISTE DE PARTICIPANTS
LISTA DE PARTICIPANTES

Ninth Session of the Working Party on Torrent Control, Protection from Avalanches and Watershed Management and Seminar on the Future Orientation of the EFC Working Party

Seminaire sur l'orientation future à donner au Groupe de travail CEF de la correction des torrents, la lutte contre les avalanches et l'aménagement des bassins versants

Seminario sobre la orientacfon futura de la labor del Grupo de Trabajo sobre Corrección de Torrentes, Defensa contra Aludes y Ordenación de Cuencas Hidrográficas de la CFE

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APPENDIX 2

EUROPEAN FORESTRY COMMISSION

NINTH SESSION OF THE WORKING PARTY ON TORRENT CONTROL, PROTECTION FROM AVALANCHES AND WATERSHED MANAGEMENT

1. Adoption of the Agenda

2. National Reports: Recent Developments and Follow-up of Working Party recommendations by Member Nations

3. Reports on Specific Projects as Recommended by the Previous Sessions:

   a) Quantitative classification of torrentieal watershed (Rapporteur: Prof. Munteanu);

   b) Professional training and education in watershed management (Secretariat Note);

   c) New legislation on soil and water conservation (Rapporteur: Mr. Puglisi);

   d) Tools and equipment used in torrent control (Rapporteur: Mr. Comanescu);

   e) Documentation and bibliography (Rapporteur: Mr. Balanica)

4. The Role of Forestry in the development of Mountain Economy and Watershed Management:

   a) Working Party participation in the ECA/EFC Ad Hoc Conference on the Planning of Rural Areas (Zollikofen, Bern, Switzerland, 25 - 30 August 1969) (Rapporteur: Mr. De Coulon);

   b) New developments in watershed management and torrent control and protection against avalanches (Rapporteur: Mr. Messines)

   c) Review of recent findings and future requirements of research in forest hydrology (Rapporteur: Dr. Leyton)

5. Other Business

6. Future Programme

7. Election of Officers

8. Date and Place of the Next Session

9. Adoption of the Report

APPENDIX
ANNEXE 3
APENDICE

List of Documents
Liste de documents
Lista de documentos

I. FAO Secretariat Notes:
Notes du Secrétariat (FAO)
Notas de la Secretaría(FAO)

1. Teaching in torrent control, protection from avalanches and watershed management FO:EFC/T/70/3 (a)

2. The role of forestry in mountain economy and watershed management (Secretariat Note) FO:EFC/T/70/4 (a)
La forêt dans le développement de l'économie montagnarde et l'aménagement des bassins versants de montagne

3. Projet de la terminologie de la correction des torrents FO:EFC/T/70/3 (f)

4. Current trends and problems in forest hydrology FO:EFC/T/70/4 (e)

5. The role of forestry in the development of mountain economy and watershed management FO:EFC/T/70/4
Le rôle de la sylviculture dans le développement de l'économie montagnarde et dans l'aménagement des bassins versants

6. Future programme and proposed changes in the Working Party on Torrent Control, Protection from Avalanches and Watershed Management FO:EFC/T/70/6
Programme futur et changements proposés pour le groupe de travail de la correction des torrents, de la lutte contre les avalanches et de l'aménagement des bassins versants

II. National Reports
Rapports Nationaux
Informes Nacionales

Austria
Autriche
Austria

7. Final report on sub-sized check-dams FO:EFC/T/70/4 (b)

8. Jüngere Katastrophen sowie neue Tendenzen und Entwicklungen in Oesterreich

Fed. Rep. of Germany
Rép. Féd. d'Allemagne
Rep. Fed. de Alemana

9. Construction work at torrential building sites taking account of winter construction

10. The impact of man on erosion in mountainous areas

11. Torrent and avalanche control in Bavaria

France
France
Francia

12. Développements récents dans la correction des torrents et l'aménagement des bassins versants

Greece
Grèce
Grecia

13. Perspectives de développement des recherches en hydrologie forestière en Grèce

14. Forest hydrology research in Greece

15. Technico-economic feasibility of watershed restoration projects for flood control - their evaluation upon the benefit/cost ratio criterion

16. Recherches sur l'hydrologie torrentielle et la correction des torrents en Grèce

17. Nouvelle législation sur la conservation des sols et de l'eau

Italy
Italie
Italia

18. La défense du sol et l'intervention publique en Italie

19. Note sur le prototype de barrages en éléments métallique préfabriqués expérimentés par l'administration des forêts domaniales de l'état en Italie

Norway
Norvège
Noruega

20. A general view of the works to prevent erosion and overflow in the torrents and rivers in Norway

Roumania
Roumanie
Rumania

21. Contributions à l'étude du profil de la zone non-déversée des barrages-poids utilisés dans les corrections des torrents

22. Contributions à l'étude économique des barrages-poids calculés au non-renversement utilisés dans la correction des torrents de Roumanie

23. Contributions à la connaissance de l'influence du tourisme sur le rôle anti-érosif de la forêt

24. Considérations préliminaires sur le passage de la classification qualitative à la classification quantitative des bassins torrentiels

25. Contributions au calcul graphoanalytique des canaux à sections trapézoîdales non optima au point de vue hydraulique

26. Contributions à l'établissement de la densité optimum des plantations forestières sur les terrains erodés

27. Sur l'application de la classification qualitative des bassins torrentiels en Roumanie

28. Schémas des bassins torrentiels étudiés (Annexe I)

29. Contributions à la classification quantitative des bassins torrentiels de Roumanie

30. Contributions au problème des barrages-poids sous-evalués

31. Contributions à l'étude du profil économique optimum des barrages-poids utilisés dans les corrections des torrents

32. Contributions à l'organisation d'un bassin pilote pour les recherches hydrologiques et l'étude de la quantité de précipitations retenues dans la litière de pin

33. Tableaux de calcul des barrages perméables à fondation évasée

Spain
Espagne
España

34. Ensayo de estimación cuantitativa del beneficio de los trabajos hidrológicos forestales en la conservación de la capacidad de embalse

35. Aspectos cualitatives y cuantitativos de la erosion hidrica, y del transporte y deposito de materiales

Switzerland
Suisse
Suiza

36. Les précipitations abondantes et la crue de septembre 1968 sur le versant nord del Alpes

37. Dimensions à donner aux barrages en béton non armé et armé établis sur les torrents

38. Directives concernant les mesures pour protéger la pêche, la nature et le paysage lors de corrections de cours d'eau

39. Rapport sur les méthodes de protection contre les avalanches en Suisse

40. Liste bibliographique

41. Rapport succinct sur les mesures prévues pour la correction des torrents situés à l'ouest de Sarnen (Canton d'Unterwald-le-Haut) et l'assainissement de leurs bassins versants

42. Directives concernant les mesures pour protéger la nature et le paysage lors des corrections de cours d'eau 1970

Turkey
Turquie
Turquia

43. Les problèmes de restauration des montagnes en Turquie

Yugoslavia
Yougoslavie
Yugoslavia

44. Note sur la classification des bassins torrentiels - Recherches comparatives en Yougoslavie

45. Evaluation de données quantitatives sur l'érosion et débit solide dans le bassin de la rivière Save

46. Bref rapport sur l'organisation du travail de recherche scientifique dans le domaine de la "protection du sol contre l'érosion"

47. Great Morava river drainage area - Torrents flood occurances 1967-1970

APPENDIX 4

Seminar on the Future Orientation of the EFC Working Party on Torrent Control, Protection from Avalanches and Watershed Management

Munich, 4 - 6 June 1970

PROGRAMME

1. The Role of Forestry in Mountain Economy and Watershed Management (Secretariat Note)

2. Historical Review of the Activities of the Working Party

3. Future Programme and Proposed Changes in the Working Party's activities - (Secretariat Note)

4. Work which falls within the competence of the Working Party being done by other International Agencies

5. Terms of Reference of the Working Party and how it should carry out its activities

6. New title of the Working Party.