

TRAINING AND EDUCATION IN WATERSHED MANAGEMENT

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ABSTRACT

Training and education provide a suitable mechanism and crucial input in developing technical or trained manpower in view of the fast technological advancements being made in watershed management, hydrology & water resources. The watershed management has been recognised as an holistic approach for planning, development and management of natural resources viz. water-land & vegetation. The hydrology and water resources related programmes like erosion control in the catchments of River Valley Projects, treatment of catchment areas of flood prone rivers, Drought Prone Area Programme, Command Area Development Programmes etc. are being operated on the watershed basis. In view of the more attention being given to watershed management programmes and its multi-disciplinary nature, there is a strong need of trained manpower in integrated watershed management to manage the country's land & water resources in efficient way. Although efforts have been made in this direction, enough and serious attention has not been paid towards the development of trained manpower at various levels viz. Supervisory (professionals), assistants (technicians) and specialists. The need and concept of training & education in watershed management, present status of training in India, integrated watershed management training programme of Central Soil & Water Conservation Research & Training Institute, Dehradun, need of trained manpower linked with development programmes and recommendations for strengthening the training & education programmes at various levels have been discussed in the paper.

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## INTRODUCTION

Watershed has been accepted as an appropriate unit for planning, development and management of natural resources viz. water, land and vegetation for comprehensive and integrated basin management in which water is the prime mover and acts as a catalyst for all the developments. The watershed management vis-a-vis soil and water conservation programmes cover protective, curative and ameliorative measures required for the judicious utilisation of these natural resources. The programmes like erosion control in the catchments of River Valley projects, treatment of catchment areas of flood prone rivers for moderating floods, Command Area Development for increasing water use efficiency in the commands, Drought Prone Area programme for mitigating adverse impacts of droughts, reclamation of ravinous areas, shifting cultivation and other soil conservation works which form part of overall water resources development and management programmes, are being operated on the watershed basis. The hydrologists and water resources engineers/managers are also greatly concerned with the watershed management vis-a-vis soil and water conservation, as these measures influence the hydrologic cycle and sedimentation characteristics or behaviour of watersheds in a basin and could alter the water balance components in a basin. Watershed management is thus regarded as an integral part of water resources development and management.

The dimensions of soil and water conservation problems are enormous in the country and these are the associated problems of hydrology and water resources. Nearly 175 m.ha or 53% of the total geographical area was estimated to be the problem area. Out of this about 150 m.ha was said to be subject to soil erosion by water and wind. Another 25 m.ha was reported to be area degraded through special problems like water logging, soil salinity etc. Thus problems of land degradation, erosion and sedimentation, drainage floods and droughts, and water management are concerned



with the watershed approach. The education and training in watershed management is an important aspect in this context as there can be no development or research or training programme without trained manpower at various levels viz supervisory level personnels (Professionals), technicians and specialists.

The educational set-up in general has been such in the country that adequate knowledge to fulfil the requirements of integrated planning and development of watersheds in a multi-disciplinary nature could not be provided. This calls for imparting specialised inter-disciplinary training to the scientists, engineers and field personnels engaged in soil & water conservation & water resources management to work together, understand the problems and adopt an integrated approach for watershed development & management and study their hydrologic behaviour under man's influence. Some aspects of watershed management are partly covered in few educational institutions, including post graduate courses. The specialised integrated training courses for field officers, engineers, scientists and assistants or technicians have been conducted at Central Soil & Water Conservation Research & Training Institute, Dehra Dun and its Research Centres. The forestry aspects of watershed management are also being covered by Forest Research Institutes and Colleges, Dehradun. Besides, some State Govts. have been also imparting soil & water conservation training to the assistants. Although some efforts have been made in this direction, not enough and serious attention has been paid to the area of development of trained manpower and their effective utilisation. It is, therefore, desirable to link the trained manpower need with the projected development, research and training programmes. The present status of training and education, number of persons trained, need of trained manpower, recommendation for strengthening such programmes and making

it more effective are discussed in the paper.

#### TRAINING & EDUCATION - A CONCEPT

Training and education are the important and crucial methods of developing technical or trained manpower. In view of the fast technological advancements being made in hydrology and water resources, watershed management, agriculture and forestry, training forms a suitable mechanism and critical input for development of trained manpower. It is the basic tool for increasing the efficiency and effectiveness of any organisation, Central or State level for achieving the desired output. It is an agreed fact that scientific and systematic development of any field, be it hydrology and water resources, agriculture, soil and water conservation or any other, is a function of multitude of factors including training which is exclusively responsible for transfer of technology and skills to the users. Training and education are understood as a relative mix of knowledge and skills. Training is oriented towards development of skills while education impart more of knowledge and understanding. They are complementary parts of the same process of learning.

Training can be conceptualised in general as the process of development and application of knowledge, skills and attitudes needed to improve individual's ability to solve protection or production oriented problems and adapting improved practices and techniques or skills at field level. Thus, training provides an individual concerned with the improved knowledge and skills necessary to carry out specific work/task for betterment of his performance on job and is, therefore, essentially practical and job oriented. In contrast, educational programmes contain theoretical and conceptual material aimed at stimulating an individual's analytical and critical faculties and its content is widely based. It is, therefore, necessary to strengthen



mechanism for manpower development in the field of watershed management at different levels in the State and Central organisations through specialised training and education programmes so as to conserve country's land and water resources and manage the problems of floods & droughts.

The staff engaged in the programmes of soil and water conservation, drought management, command area development, reclamation of water logged areas belong to various disciplines viz engineering (civil and agricultural), agriculture, forestry, ecology earth sciences & environmental sciences, who do not have necessary training and field experience of integrated and inter-disciplinary approach in watershed management. The training and education in watershed management for engineers, scientists, field personnels and project managers can be broadly categorised in the following three levels:

- a/ Supervisory Staff (Officers, engineers, subject matter specialist etc.) i.e. professionals.
- b/ Technicians (Assistants, sub-assistants)
- c/ Specialist watershed Managers/Scientists (Post graduate programmes)

The level of training and training requirement should be different in each category depending upon the educational background and responsibilities or duties required of the individuals at these levels in any State or Central organisation.

#### STATUS OF TRAINING & EDUCATION IN INDIA

The need for creating facilities for training manpower was realised during the first five year plan itself and the responsibility of imparting specialised integrated training in watershed management vis-a-vis soil and water conservation was given to Central Soil & Water Conservation Research & Training Institute,

Dehradun, and its Centres for training of supervisory level personnels and partly of middle level technicians (i.e Assistants.). The State Governments were given the responsibility of sharing a part of the load of training the middle level technicians and develop their own facilities of training the lower level technicians ( i.e. sub-assistants or observers). Realising the growing awareness in watershed development programme at State and Central levels, short courses were also started by the Central Soil & Water Conservation Research & Training Institute for project managers and policy makers. The facilities of regular training programme is also being utilised by the foreigners sponsored through Colombo plan, FAO, common wealth etc. The Forest Research Institute & Colleges, Dehradun has been also engaged mostly in forestry aspects of watershed management through training of supervisory and middle level technicians in their diploma and refresher courses. Of late in 1980's, the post graduate course in hydrology with specialisation in watershed management has been started at the University of Roorkee with the cooperation of Unesco. Besides this the agricultural Engineering Departments of IIT's and other universities also cover some of these aspects at under graduate & post graduate levels.

#### **Integrated Watershed Management Training Programme :**

##### **Regular Courses**

Central Soil & Water Conservation Research & Training Institute, Dehradun is the premier Institution of the country in imparting specialised multi-disciplinary training in Watershed Management. The Institute offers two courses each of 5½ months duration in a year. The average capacity of each course is about 25 officers. The Training programme has a good coverage of hydrology & soil water conservation engineering, forestry, soil science and agronomy. The entire programme is so organised that more emphasis is given on practical training through class room lectures supplemented with field practicals & tutorials. In order to develop more confidence and provide



practical knowledge, a field exercise on watershed management Planning in selected Watersheds (having mixed land-use) is undertaken by the Officer trainees for a duration of 3 weeks. During this exercise survey, planning & design aspects are undertaken and a Watershed Management Plan prepared by the individual trainees. This exercise provides an opportunity to the trainees to apply the techniques, they have learnt in the class room and practical classes. The outlines of the syllabus of hydrology & engineering, soils, soil conservation forestry & soil conservation agronomy and the outlines of the Watershed Management planning are given in Appendix 1. Socio-economic aspects of watershed management are also covered.

Special project of 3 weeks duration forms another important component of the training programme. Special problem oriented projects such as land slide control, mine spoil reclamation, flood & sediment control, dry land agriculture water harvesting & recycling, water management etc are identified at suitable locations and trainees are asked to select the special project of their choice relevant to their area of interest. It provides an opportunity to gain more in-sight in a specific problem area. Study tour of 2 weeks is included to expose the trainees to different types of soil & water conservation problems and make them aware of different measures taken at the field level. In order to induce more interest and competitive spirit, examinations are conducted and merit certificates are awarded.

Assistant's (technician level) training programmes of 5½ months duration each are similarly run by the Institute at its Research Centres at Kota, Bellary & Ootacamund and at Damodar Valley Corporation (DVC) Hazaribagh. The level of training/teaching is different in this programme although the course outline is broadly the same. More emphasis is given to field surveys & collection of information, rather than planning and

execution.

#### Short & refresher courses:

Besides the regular courses for developing technical manpower, short courses & refresher courses are required to keep the staff updated with latest technology and develop special skills for specific technical jobs from time to time. The CSWCRTI, Dehradun & its Centres have been also engaged in organising such tailor made short courses to some extent. In view of the growing needs & demands, CSWCRTI & its Centres organised refresher & short courses in VI & VIIth Plan for Officer assistants. Two courses on rain water harvesting & conservation were organised at Bellary Centre under USAID programme. The efforts are regularly made to organise such courses for special technical needs, for policy makers, decision makers, administrators bankers & senior level technical persons to meet the growing demands. The Institute has so far trained 929 persons in short & refresher courses. It will require strengthening & building up of the facilities for meeting the demands.

#### Other Courses:

The Institute organises Summer training programmes (Summer Institutes) for University teachers and related technical personnels in Watershed Management and its connected aspects.

#### Trained Man Power & its Need Linked with Development Programmes:

The Central Soil & Water Conservation Research & Training Institute has been in the field of training & since 1955, that is the beginning of the planning era. The table below gives the details of trained manpower in soil & water conservation created in the country till the end of VI Five Year Plan and brings out the future needs.



Table

Period	Officers	Assistants
1. Trained upto VI Plan i.e. upto the end of 1984 (keeping in view that 10% have retired and 10% have been transferred to other jobs)	1093	3550
2. Manpower required in VII plan for treating 22 m.ha. i.e. 4.4 m.ha. per year.	1470	7350
3. Deficit at the beginning of VII Plan.	377	3800
4. Present annual capacity at the Institute and its Centres.	60	240

Manpower required in VII Plan (1470 officers and 7350 assistants) has been calculated on the basis of norms followed in Maharashtra Govt. where one sub-Divisional Soil Conservation Officer along with a team of five assistants is required to treat 3000 ha. per year.

The deficit in respect of manpower at the very beginning of VII Plan is 377 officers and 3800 assistants. In order to bridge this gap, the Institute along with its Centres and State Govts. have to enhance their efforts in manpower development.

#### RECOMMENDATIONS

It is evident from the above discussions that there is a strong need for trained manpower in integrated watershed management to develop & manage the country's water resources in a judicious manner by understanding inter-relationship of land-water vegetation and their successful execution in the field. The role & need of developing small watersheds was emphasised in the recently organised first National Water

Convention at Delhi in November, 1987 as a step towards proper development, conservation & management of water resources & restoring eco-system. Therefore, the engineers, hydrologists, scientists, agriculturists, foresters, soil conservationists are required to have training in integrated watershed management so as to appreciate & understand each others problems well and act in an integrated manner giving due weightages to various aspects. It is clear from the above discussions that the training programme of CSWCRTI fully meets the requirement of an integrated watershed management as the experts of various disciplines such as hydrology & engineering, soil-plant water relationship, forestry, soil conservation agronomy & socio-economics are actively involved in imparting training. The post graduate course run by the University of Roorkee in hydrology with specialisation in watershed management provides more emphasis on watershed hydrology, with some coverage on watershed management aspects. The courses covered in other Universities & Colleges have some input of soil & water conservation in their undergraduate & post graduate levels, but do not cover the aspects of integrated watershed management in a required way. The following recommendations are made in this regard:

1. The Watershed Management component is required to be given much more attention in all the water resources projects concerned with mangement of land-water & vegetation.
2. It is required to strengthen the training activities in the Country, so as to impart specialised training to the professionals & technicians working as hydrologists, engineers, agricultural, forest or soil conservation officers/assistants in the watershed development programmes.
3. It is also required to strengthen the post graduate professional/specialist training activities in watershed management at the educational institutions like University of Roorkee & others already engaged in teaching hydrology,



water resources engineering and soil and water engineering courses.

4. Short courses and refresher courses in specific areas of interest are required to be given more emphasis.
5. The State Governments should utilise the training facilities to get their soil and water conservation personnels trained for manning the development programmes.
6. The subject/topic of watershed management may be included in the syllabus of undergraduate courses in agricultural and civil engineering, agricultural, forestry and earth sciences.

#### REFERENCES

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3. Srivastava, D.K. and Satish Chandra (1981). Watershed management training programmes present programmes and need for integrated training programmes, paper presented at National Workshop on Watershed Management. April 22-24., Dehradun.
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## Appendix-I

### Outlines of the Syllabus of Soil & Water Conservation Training Course

1. **Introduction:** History of erosion, Soil conservation & problems in India & Principles of soil erosion.
2. **Soil & Water Conservation Engineering:** Engineering surveys, Rainfall & hydrologic cycle, Runoff, Hydrologic analysis, soil erosion & sedimentation, Erosion Control structures for agricultural & non-agricultural lands, Farm pond & earthen embankment, Special erosion problems such as moisture conservation practices, gully control, stream bank & torrent control, land slide control, mine spoil control, road side erosion etc, conservation irrigation and agricultural drainage.
3. **Soil-Plant-water Relationships:** Soil formation, Physical & chemical properties of soils, Biological characteristics of soils, Soil classification, land use planning, Soil moisture relationships, Soil-plant-nutrient relations, problem soils like saline-alkali soils & their management.
4. **Soil Conservation Agronomy:** Classification of crops, problems of crop land management, Tillage & tilth, cropping systems, Manures & fertilisers, Agronomic practices in erosion control Dryland farming and management practices for maximising production.
5. **Soil Conservation Forestry:** National forest policy, Forests in relation to its environment, Forest management, Regeneration of forests, wind erosion & its control, Biological measures for special soil-erosion problems, Grass land development & management for soil & water conservation, Farm forestry/ social forestry, conservation horticulture, shifting cultivation, Wild life management and watershed management.



- 6.0 Economic Evaluation: Scope & need of evaluation, principles & standards and methods of calculating B:C ratio.
- 7.0 Communication: Effective speaking, panel discussion and seminars.
- 8.0 Study tour.
- 9.0 Watershed Management planning & Application: General description present land use, Soil & land capability, Problems & need of the area, Proposed land use, Recommended management programme including engineering, agricultural, forestry & other measures in the watershed, economic evaluation and phasing of the works including financial & organisational aspects.
10. Special Project: In one of the following areas:
  - . Watershed management for sediment control.
  - . Watershed management in semi arid regions.
  - . Water harvesting under dry farming.
  - . Watershed management in arid regions.
  - . Watershed management for control of shifting cultivation.
  - . Land development, irrigation & Management.
  - . Ravine control & reclamation.
  - . Grassland development & Management.
  - . Social Forestry and afforestation of denuded lands.
  - . Reclamation of saline sodic lands.