



## PROFILE

### Central Soil and Water Conservation Research and Training Institute, Dehradun



India was among the first few countries to have taken timely cognizance of the problem of soil erosion. This Institute began as the regional centre in 1954, and was reorganized in 1974 under the ICAR as the Central Institute—the *Central Soil and Water Conservation Research and Training Institute*. It has now eight Regional Centres at Agra, Bellary, Chandigarh, Datia, Koraput, Kota, Udhamchandam and Vasad, which along with the headquarters at Dehradun cater to location-specific needs of different regions. The Institute has four divisions—**Soil Science and Agronomy; Hydrology and Engineering; Plant Science; and Human Resource Development and Social Sciences.**

The principal mandate of the Institute is to conserve natural resources, especially soil and water, dovetailed with production from arable as well as non-arable lands. ***The Institution has been identified as the nodal agency to impart long-duration specialized training programmes to Central and State Government Officers and Graduate Assistants in the field of Soil and Water Conservation and Watershed Management as per the specific demands of the organizations.***

#### MANDATE

- Undertake research and develop strategies for controlling land degradation under all primary production systems and for rehabilitation of degraded lands in different agro-ecological zones of the country.
- Act as a repository of information on the status of soil degradation/soil and water conservation.
- Provide leadership and co-ordinate research network with SAUs / Institutions / NGOs / State Departments for developing location-specific technologies in the area of soil-and-water conservation.
- Act as a national and international centre for training

in research methodologies and updated technologies in soil-and-water conservation, watershed development and its management.

- Provide consultancy and collaborate with national and international institutions in the field of soil-and-water conservation.

#### MAJOR ACHIEVEMENTS

##### Research

The Institute has evolved strategies for resolving problems of ravines, landslides, mine-spoils and torrents. Reclamation technologies for torrents, gullies, landslides, mine-spoils, gravelly / bouldery soils, sloping lands, watershed restoration, runoff harvesting, alternate land uses, diversification, biodiversity (ecological successions), bioremediation, management of common property resources and community participation were demonstrated successfully.

- Estimated production and monetary losses due to water erosion in the rainfed areas.
- Validated runoff and erosion prediction models in different agro-ecological regions.
- Completed zonation of Eastern Ghats and Western Ghats for macro-level planning.
- Using remote sensing and GIS in terms of resource-potential planning, delineation and characterization completed of Mahi ravines.
- Assessed status of soil erosion in coastal belt of India.
- Computed Soil Loss Tolerance Limits (T value) for different agro-ecological regions of India.
- On the degraded lands in Doon Valley, completed evaluation of shade-loving intercrops under the mango (*Mangifera indica*) and litchi (*Litchi chinensis*).
- Developed silvipastoral system under the various management practices for degraded lands.
- Identified conservation measures for new tea plantation areas.

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Vertical drain in tea plantation for safe disposal of runoff in the Nilgiri hills

- Multitier cropping systems identified for conserving resources and for augmenting livelihood of small holders.
- Identified different nutrient management systems for soil health and productivity and conservation for export-oriented vegetable crops in the Nilgiris.
- Developed economic fortification of existing forest and horti land use system through medicinal plants in the ground flora.
- For Chambal ravines, intercropping systems identified for contingency crop planning.
- Methodology standardized for design of staggered contour trenches in the degraded areas.
- Evaluated techniques for assessing groundwater recharge.
- Assessed effects of conservation structures on the groundwater recharge.
- Designed and developed site-specific artificial groundwater recharge filters.
- Assessed hydrological behaviour of small watersheds and sustainability of production systems.
- Developed rain-water harvesting and recycling model for Shivalik foothills.



Recharge filter – A cost-effective technology for augmenting groundwater in arable and non-arable lands in the arid and semi-arid regions of Gujarat and Rajasthan

- Technology developed for rehabilitation of mine-spoil affected areas.
- Bio-engineering technology developed for torrent training.
- Geotextile-based technology developed for slope stabilization and erosion control.
- Developed cost-effective technology for treatment of *choes*.
- Combated land degradation through cycling of organic matter under different land-use systems.
- Indicators developed for assessing impact of watershed interventions in different regions.
- Multi-Objective Decision Support System (MODSS) developed for watershed development programmes.
- Integrated farming system developed for Mid-Himalayas.
- Carried out economic analysis in the Nilgiris for soil-and-water conservation measures.
- Constraints analysis and methodology carried out for transfer of technologies in the watershed management programmes.

### Technologies Generated

The Institute has developed a number of resource-conserving technologies for arable and non-arable lands, which have potential to check land degradation, minimize soil erosion, preserve soil fertility, sustain productivity in the long run, conserve *in-situ* rainwater, harvest and recycle inevitable runoff, mitigate droughts, moderate floods downstream and to ensure environmental security. In the process of development, the Institute kept up the efforts for transfer of technologies through its various outreach programmes – Operational Research Projects on Watershed Management, Lab-to-Land Programmes, Model Watersheds under Macro-Management of Agriculture (Ministry of Agriculture), Integrated Wasteland Development Programme (Ministry of Rural Development), Farmer's Participatory Action Research Programme (Ministry of Water Resource), Sustainable Livelihood Security Programme (under the National Agricultural Innovation Project, ICAR), National Bamboo Mission (Ministry of Agriculture) and other programmes directly benefitting farmers. Some important technologies generated are as follows:

- Bio-engineering technology for treatment of torrents in Shivaliks.
- Water-mill based integrated farming system (IFS) for the north-western Himalayas.
- Vegetative barriers for erosion control in the western Himalayan region.
- Conservation ditching for efficient resource conservation and enhanced productivity of semi-arid Vertisols.



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Conservation Technologies



Monitoring station for appraisal of soil erosion by water in lower mid-Himalayas



A good crop of *Aloe vera* in tree interspaces of *ber* orchard to sustain productivity and provide alternative source of income to farmers of ravine region



Conservation technology demonstration in tribal dominated Eastern Ghats Highland Zone of Odisha for livelihood and environmental security



*Grewia optiva* + Hybrid Napier for conservation and productive utilization of non-arable land in Doon Valley



Castor+greengram intercropping for delayed onset of monsoon in the south-eastern Rajasthan for resources conservation, insurance against crop failure, and maximizing production and returns



An integrated farming system comprising water mill, fish farming, poultry, pig-rearing and agriculture suitable for Uttarakhand, Jammu and Kashmir and Himachal Pradesh

- Bio-fencing technology for the Vertisols of the semi-arid region.
- Compartmental bunding for *in-situ* rainwater conservation in medium to deep black soils.
- Improved design of mechanical spurs for control of torrents in the lower Himalayas.
- Technologies for rehabilitation of mine-spoil areas in the hilly regions.
- Conservation bench-terrace system – a viable alternative to conventional system in sub-humid climates.

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- Potassium application for resource conservation and enhanced productivity in the north-west Himalayan region.
- Balanced and integrated nutrient management in dominant cropping systems for enhanced crop-water productivity in the farmer's field of the north-west lower Himalayan region.
- *In-situ* sunnhemp green-manure mulching in rainfed maize-based cropping system for higher productivity.
- Utilization of degraded lands for mango-based agricultural system in the north-western Himalayas.
- Utilization of degraded lands for peach-based agri-horti system in the north-western Himalayas through micro-soil improvement.
- Improved tillage and mulching practices for resource conservation and higher yields of sorghum in red soils.
- *Jhola Kundi*: a low-cost water-harvesting technique for augmenting production of *jhola* lands in the Eastern Ghats' High Land Region of Odisha.
- Contour furrows for enhancing productivity in medium to deep black soils of the south-eastern Rajasthan.
- Stabilization of bench-terrace risers with tea-crop.
- Recharge filter – a cost-effective technology for augmenting groundwater.

### Human Resource Development

The Institute conducts capacity-building courses regularly of varying durations for policy-makers, NGOs, field functionaries and farmers in the field of soil- and water conservation and watershed management.

Since 1956, it has been organizing regular training courses of 22 weeks, twice a year, in soil-and-water conservation and watershed management for officers and graduate assistants from various state agencies and from other countries. The Institute also conducts specialized tailor-made short-term training and sensitization courses for officers/officials sponsored by various agencies in India and abroad.



Terraced fields with *kharif* vegetable crop cucumber in Fakot watershed of Uttarakhand

### Integrated Wastelands Development Programme

In the late nineties, under the Integrated Wastelands Development Programme (IWDP) of the Ministry of Rural Development (MoRD), Government of India, six model watersheds located in six states, representing different agro-ecological regions of the country, were developed by the Institute following participatory approach. Under environmental benefits, runoff from the watersheds was reduced by 9% to 24% and reduction in soil loss varied from 32% to 90%, with an average of 72%. The Induced Watershed Eco-Index showed 12% improvement; indicating that additional watershed areas were rehabilitated through green biomass. Crop Productivity Index increased by 12% to 45% with overall increase of 28% in crop productivity. Crop Diversification Index (CDI) also increased by 6% to 79% in the watersheds with average increase of 22%. With higher CDI, the risk in farming could be minimized. Cultivated Land Utilization Index also improved significantly (2% to 81%) with an average value of 27%. These programmes created additional mandays casual employment (average 17,004 mandays) during the project. The average annual family income increased by 8% to 106% with an overall increase of around 49%. **The projects were found economically viable ventures having benefit:cost ratio of more than 1.14 to 1.69.**

### Watershed Management

The concept of watershed planning, development and management, which was evolved and demonstrated by the Institute in 1970's, has emerged as a new paradigm for efficient management of land, water and other natural resources following bottom-up participatory approaches. The success of watershed management concept in flood and drought moderation, groundwater augmentation, increased biomass production, employment generation and improvement in the socio-economic conditions of the local people was amply demonstrated through four model operational watershed projects implemented at Sukhomajri and Nada (Haryana), Fakot (Tehri-Garhwal hills of Uttarakhand) and G.R. Halli (Chitradurga, Karnataka). *With the experience gained from these watersheds, the ICAR had entrusted CSWCRTI, Dehradun, and CRIDA, Hyderabad, during 1980-86 with the development of 47 model watersheds in 16 states in collaboration with SAUs and State Departments through active participation of the local community.* Participatory integrated watershed development programmes like NWDPA, IWDP and NAEP were undertaken during



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### Best Institute Award

The Institute was bestowed with the most prestigious 'Sardar Patel Outstanding Institution Award – 2005' for the best performance in the Agricultural Research and Education

### Best Annual Report Award

The Institute won the ICAR Trophy for 'Best Annual Report 2009-10' in the big Indian Council of Agricultural Research Institutes' category.

1988-91 and previously launched rural development programmes such as RVPs and FPRs, WDPSCA, EAS, DPAP and DDP were converted to participatory integrated watershed management approach from 1990's onwards, covering several thousand watersheds. Up to March 2007, **56.54 m ha were treated in the country with an expenditure of ₹19,470.57 crore under various watershed development programmes** of the Ministries and other agencies.

### THRUST AREAS FOR XII PLAN

To carry out research and training in the recently developed fields using the state-of-art technology, besides on-going programmes, the following new initiatives will be taken up by the Institute during the XII Plan.

- *Platform Research:* Water, Climate Change (NICRA, NBAIM) and Conservation Agriculture
- Assessment of soil erosion through redistribution analysis of <sup>137</sup>Cs fallout in humid subtropical region of India.

- Development of sloping agricultural land technology (SALT) for resource conservation and economic upliftment.
- Resource budgeting in agroforestry by modifying WANuCAS model.
- Moisture conservation techniques for tree-borne oilseeds in Bundelkhand.
- Study influence of aromatic grasses and tree management on the soil moisture and health of bouldery lands.
- Hydrological behaviour and production potential of land-use systems in the agro-ecological regions.
- Design of trenches for degraded lands in the agro-ecological regions.
- Carbon sequestration potential of tree-based production systems in Chambal ravines.
- Soil organic carbon in transit under erosion process.
- *In-situ* rain-water harvesting for establishing fruit-tree-based agroforestry system in saline sodic Vertisol.
- Efficacy of resource-conservation measures on the bamboo productivity in the Himalayan foothills.
- Extraction of river-bed material from rivers for monitoring river morphology.
- Conversion of ITKs to MTKs on the soil-and water-conservation.
- Establishment of Advance Skill Development Centre for Soil-and-Water Conservation and Watershed Management at Dehradun headquarters with network at all the eight Regional Centres.

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