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

Mixed vegetative barrier of pineapple and grass— an effective soil and water conservation measure for Western Ghats region

Bamboo and anjan grass for enhancing productivity of Mahi ravines in Gujarat with soil and water conservation measures

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

- Potassium application for resource conservation and enhanced productivity in north-western Himalayan region.
- Balanced and integrated nutrient management in dominant cropping systems for enhanced crop-water productivity in farmer's field of north-western 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 agri-horticultural system in north-western Himalayas.
- Utilization of degraded lands for peach-based agri-horti system in 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 Eastern Ghats Highland region of Odisha.
- Contour furrows for enhancing productivity in medium to deep black soils of 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

Director, CSWCRTI addressing Gazetted Officers during passing out function of a 5½ months Regular Training Course on Soil & Water Conservation and Watershed Management

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

assistants from various state agencies and from other countries. Till October 2012, a total of 2717 Gazetted Officers and 5538 Assistants have been trained, including 41 foreign participants, through 129 and 161 courses, respectively. The Institute also conducts specialized tailor-made short-term training and sensitization courses for officers/officials sponsored by various agencies in India and abroad. Upto October 2012, 248 short courses for Officers training 4332 participants and 715 short courses for Assistants training 19770 personnel have been conducted, including 95 foreign participants.

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 socio-economic conditions of the local people was amply demonstrated through four model operational watershed projects implemented by CSWCRTI during 1970's at Sukhomajri and Nada (Haryana), Fakot (Tehri-Garhwal hills of Uttarakhand) and G.R. Halli (Chittradurga, 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. The institute did pioneering work in evolving and popularizing the concept of participatory integrated watershed management in the country with due emphasis on social fencing, transparency and equitable sharing of benefits and resources, through community based organizations and people's participation. Participatory integrated watershed development programmes like NWDPRA, IWDP and NAEP were undertaken during 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.

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 of 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.

BEST INSTITUTE AWARD

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

BEST ANNUAL REPORT AWARDS

The Institute won the ICAR Trophy for 'Best Annual Report' for the years 1998-99 and 2009-10.

VISION 2030

To accomplish its mission, Central Soil and Water Conservation Research and Training Institute will concentrate on the followings:

- Assess in depth the status of land degradation due to soil erosion by water, the major cause of land degradation in the country, at watershed, region and country levels by innovatively employing appropriate modern tools and procedures.
- Innovate and test cost effective resource conservation technologies for increasing biomass production from all primary production systems on rainfed, marginal and degraded lands.
- Introduce and evaluate exotic/improved germplasm of crops and trees for rehabilitation of degraded lands, generating higher productivity, soil rejuvenation through carbon sequestration, and mitigating adverse effects of climate change.
- Assess water availability/yield at different scales and locations, as well as under different conservation practices and climate change effects, for water harvesting and its effective utilization leading to enhanced and sustainable production.
- Develop indicators, decision support systems, policies and institutional mechanisms for efficient planning, execution, monitoring and evaluation of watershed development programmes, including quantification of tangible and intangible benefits.
- Collaborate with national and international R&D institutions, including state development agencies, in multi-locational technology development, refinement and evaluation of projects for erosion appraisal, conservation planning, and capacity building of scientists in advanced tools and techniques.
- Provide training to field functionaries in the area of soil and water conservation and watershed management through upgraded and tailor made training modules covering all categories of stakeholders, right from grass-root workers to policy planners in different states, organizations, and agencies for effective implementation of various government sponsored watershed development programmes in the country.
- Develop live models of watershed development projects for demonstrating doable soil and water conservation technologies in different agro-climatic, topographic and socio-economic settings, and strive for their wider dissemination to the end users through the concerned state agencies by employing appropriate methods.

हर फसल, हर इलाके
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद्

Agriesearch with a human touch

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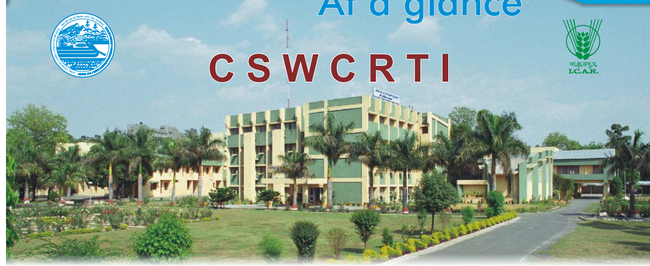
At a glance

CSWCRTI

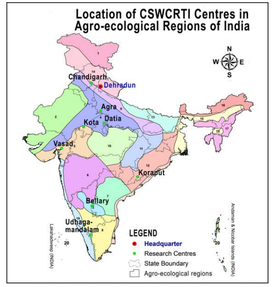


India was among the first few countries to have taken timely cognizance of the problem of soil erosion. This Institute began as a Regional Centre in 1954, and was reorganized in 1974 under the ICAR as a Central Institute— the **Central Soil and Water Conservation Research and Training Institute.** It has now eight Regional Research Centres at Agra, Bellary, Chandigarh, Datia, Koraput, Kota, Udhagamandalam and Vasad, which along with Headquarters at Dehradun cater to location-specific needs of different regions. The Institute has four divisions— Soil Science and Agronomy; Hydrology and Engineering; Plant Sciences; 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. Through its network of Headquarter and Regional Research Centres at nine locations having annual rainfall ranging from 510 mm (Bellary) to 1625 mm (Dehradun) and different soil types including alluvial, medium and deep black, red, lateritic, and forest & hill soils, the Institute undertakes research, training and extension activities in multi-disciplinary mode addressing different problem areas in seven agro-ecological regions of the country. **The Institute 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 State Agricultural Universities/Institutions/NGOs/



Location of the Central Soil and Water Conservation Research and Training Institute and its Regional Research Centres in different agro-ecological regions of India

Central Soil and Water Conservation Research and Training Institute, Dehradun (India)

Details of Research Centres of Central Soil and Water Conservation Research and Training Institute

Location (State), Year of Estd.	Problem area	Agro-ecological region (AER)	Altitude, m MSL (Annual rainfall, mm)
Dehradun (Uttarakhand) 1954	North-western Himalayan Region	14 (Warm sub humid to humid with inclusion of per humid eco-region with brown forest and podzolic soils).	683 (1625)
Agra (Uttar Pradesh) 1957	Upper Gangetic Alluvial Plains (Ravine problem on the banks of Yamuna river)	4 (Hot semi-arid eco-region with alluvium derived soils).	169 (760)
Bellary (Karnataka) 1954	Semi-arid Black Soil and Southern Red Soil Regions	3 (Hot arid eco-region with red and black soils).	445 (510)
Chandigarh (Punjab & Haryana) 1957	Sub-montane tracts in the North-western Himalayan region with special reference to Shiwalik hills	9 (Hot sub humid (dry) eco-region with alluvium-derived soils).	370 (1128)
Datia (Madhya Pradesh) 1986	Bundelkhand Region	4 (Hot semi-arid eco-region with alluvium derived soils).	342 (860)
Koraput (Odisha) 1992	Eastern Ghats Highland Zone having shifting cultivation problem	12 (Hot sub humid eco-region with red and lateritic soils).	883 (1350)
Kota (Rajasthan) 1954	Upper Gangetic Alluvial Plains of Semi-arid South-eastern Rajasthan (Ravine problem on the banks of Chambal river)	5 (Hot semi-arid eco-region with medium and deep black soils).	257 (750)
Udhagamandalam (Tamil Nadu) 1954	Southern Hilly High Rainfall Region	19 (Hot humid per-humid eco-region with red, lateritic and alluvium derived soils).	2217 (1204)
Vasad (Gujarat) 1955	West Coast Gujarat Alluvial Plains (Ravine problem on the banks of Mahi river)	5 (Hot semi-arid eco-region with medium and deep black soils).	34 (839)

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.

STAFF STRENGTH AND FACILITIES

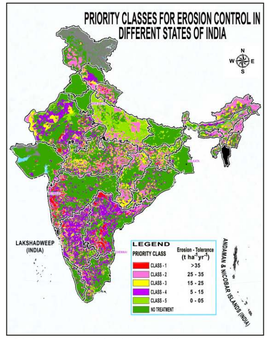
For achieving the above mandate, the CSWCRTI has a sanctioned strength of 128 multidisciplinary scientists of soil & water conservation engineering, soil science, agronomy, horticulture, forestry, agro-forestry, genetics & plant breeding, fishery, animal nutrition, agricultural economics, agricultural statistics, agricultural extension, and computer application in agriculture, 182 well trained technical staff and 86 personnel as administrative staff. The Institute and its Regional Research Centres are endowed with laboratories and experimental research farms having modern facilities for conducting research, training and extension in different agro-ecological regions of the country. The Institute has a central library at the Headquarter and each of its Regional Research Centres have a rich collection of all types of books, literature and modern tools relevant to the disciplines of natural resource conservation and management under one roof.

MAJOR ACHIEVEMENTS

Research

Since its establishment, the R&D activities of the Institute and its Research Centres have evolved strategies of soil and water conservation on watershed basis, and rehabilitation of degraded lands in different agro-ecological regions. Multi-disciplinary research agenda not only focuses on realizing higher productivity and food security, but also on maintaining/enhancing quality of natural resource base. It has evolved strategies for tackling special problems such as ravines, landslides, mine spoils and torrents. Technologies for reclamation of torrents, gullies, landslides, mine spoils, gravelly/ bouldery soils, and sloping lands; watershed restoration; runoff harvesting; alternative land uses; diversification; biodiversity (ecological successions); bioremediation; management of common property resources; and community participation have been amply demonstrated with fairly good degree of success. The Institute is presently conducting its mandated research activities under seven major research programmes including water erosion appraisal in different agro-ecological regions, conservation measures for sustainable production systems, hydrological behaviour of watersheds for conservation planning, rehabilitation of areas affected by mass erosion, participatory integrated watershed management, socio-economic analysis and policy development for watershed management, and human resource development and technology transfer. Salient R&D products of the Institute during past decade are:

- Estimated production and monetary losses due to water erosion in rainfed areas.
- Prioritized erosion risk areas for effective planning and implementation of conservation programmes.
- 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 for resource development planning, completed delineation and characterization of Mahi ravines.



Priority classes for erosion risk areas in different states of India

- 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 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.

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

- Multitier cropping systems identified for conserving resources and for augmenting livelihood of small holders.
- Identified conservation measures for new tea plantation areas.

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

- 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, identified intercropping systems for contingency crop planning.
- Methodology standardized for design of staggered contour trenches in degraded areas.
- Evaluated techniques for assessing groundwater recharge.
- Assessed effects of conservation structures on groundwater recharge.
- Designed and developed site-specific artificial groundwater recharge filters.

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

- Assessed hydrological behaviour of small watersheds and sustainability of production systems.
- Developed rain-water harvesting and recycling model for Shivalik foothills.
- 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 a *choe* in Shivaliks.
- 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 of soil and water conservation measures for the Nilgiris.
- Carried out constraints analysis for transfer of technologies in 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, and moderate floods downstream to ensure environmental security. They include agronomical, mechanical and biological measures, alternative land use systems, techniques for mass erosion control and water harvesting, and integrated watershed management. In the process of development, the Institute kept up the efforts for transfer of technologies (TOT) 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 Wastelands Development Programme (Ministry of Rural Development), Farmer's Participatory Action Research Programme (Ministry of Water Resources), Sustainable Livelihood Security Programme (under the National Agricultural Innovation Project, ICAR), National Bamboo Mission (Ministry of Agriculture) and other TOT programmes directly benefitting farmers. These technologies are also being passed on for increasing production in agricultural fields through state line departments by way of imparting specialized trainings, field visits to successful model watersheds, sensitization workshops, farmers' day, Kissan Mela/Goshthi, exhibitions and distribution of technology brochures. Some important technologies generated are as follows:

- Bio-engineering technology for treatment of torrents in Shivaliks.
- Water-mill based integrated farming system (IFS) for north-western Himalayas.
- Vegetative barriers for erosion control in western Himalayan region.
- Conservation ditching for efficient resource conservation and enhanced productivity of semi-arid vertisols.
- Bio-fencing technology for vertisols of 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 lower Himalayas.
- Technologies for rehabilitation of mine-spoil areas in hilly regions.
- Conservation bench-terrace system— a viable alternative to conventional system in sub-humid climates.

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

Performance of different winter crops with compartmental bunding in semi-arid region of Karnataka

An earthen embankment planted with grass in Shivalik region

Vermi-compost— an effective conditioner for red soils of Bundelkhand region

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