



सत्यमेव जयते

# Elucidation of the 4<sup>th</sup> National Report submitted to UNCCD Secretariat 2010



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जहाँ है हरियाली ।  
वहाँ है खुशहाली ॥

**Government of India**  
**Ministry of Environment & Forests**

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Front cover photo: Bada Bhilwada JFM site, Jhadol block, Udaipur district, Rajasthan (By Seva Mandir, Udaipur)

Back cover photo: Sand dune stabilization at Smrutivan, Jaipur, Rajasthan (By CEE)



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## FOREWORD

It gives me great pleasure to introduce India's 4<sup>th</sup> National Report to UNCCD, 2010. This report provides a holistic overview capturing comprehensively India's policies and programme related to desertification, land degradation and drought.

Poverty and environmental degradation are major problems in dry lands, where forests and trees contribute significantly to rural livelihoods. In order to eradicate poverty in the dry lands, it is important to protect the land from deforestation, fragmentation, degradation and drought. About 228 mha (69%) of India's total geographical area (about 328 mha) is under dry lands (arid, semi-arid and dry sub-humid). These areas incidentally are highly populated which makes the people vulnerable to environmental stress and impacts livelihoods directly.

In order to tackle the issues of desertification, land degradation and droughts, 22 major programmes are being implemented in the country, including, the "Mission for Green India", one of the Missions under the National Action Plan on Climate Change, which will address dry land forests, in addition to other ecosystems.

This report not only encompasses the Government of India's initiatives but also Civil Society's contribution in addressing the issues of desertification, land degradation and drought.

I am confident that this report will enable us to understand the key issues as also the measures undertaken to address the same; and will be useful for policy makers, planners, academicians, civil society groups and relevant stakeholders.

  
(Jairam Ramesh)

# Abbreviations

AFRI	Arid Forest Research Institute
AICRPAM	All-India Coordinated Research Project on Agro-Meteorology
AIS&LUP	All India Soil and Land Use Survey Organization
AOFFPS	Area Oriented Fuel wood and Fodder Project Scheme
ARWSP	Accelerated Rural Water Supply Programme
ASTRPS	Association of ST and Rural Poor in Regeneration of Degraded Forests
BRGF	Backward Regions Grant Fund
BT	Box Trench
CADP	Command Area Development Programme
CAZRI	Central Arid Zone Research Institute
CBO	Community Based Organisation
CDM	Clean Development Mechanism
CDWM	Command Area Development and Water Management programme
CEE	Centre for Environment Education
CGWB	Central Ground Water Board
CONS	Consolidated Performance Indicators
COP	Conference of the Parties
CPP	Country Partnership Programme
CRIC	Committee for the Review of the Implementation of the Convention
CRIDA	Central Research Institute for Dryland Agriculture
CSO	Civil Society Organisation
CSSRI	Central Soil Salinity Research Institute
CSWCRT	Central Soil and Water Conservation Research and Training Institute
CSWRI	Central Sheep and Wool Research Institute
CT	Contour Trench
DLDD	Desertification, Land Degradation and Drought
DRDA	District Rural Development Agency
DSM	Desertification Status Monitoring
EGS	Employment Guarantee Scheme
ENVIS	Environmental Information System
FAO	Food and Agriculture Organisation
FDA	Forest Development Agency
FES	Foundation for Ecological Security
FFS	Farmer Field Schools
FPR	Flood Prone Rivers
FSHG	Federation of Self Help Groups
FSI	Forest Survey of India
GBPIHED	Govind Ballabh Pant Institute of Himalayan Environment and Development
GEF	Global Environment Facility
GOI	Government of India
GP	Gram Panchayat
GVT	Gramin Vikas Trust
IAEPS	Integrated Afforestation and Eco-development Project Scheme

ICAR	Indian Council of Agricultural Research
ICFRE	Indian Council of Forestry Research and Education
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IGNFA	Indira Gandhi National Forest Academy
IGFRI	Indian Grassland and Fodder Research Institute
IIFM	Indian Institute of Forest Management
IRDP	Integrated Rural Development Programme
IREDA	Indian Renewable Energy Development Agency
ISRO	Indian Space Research Organisation
IWMP	Integrated Watershed Management Programme
JFM	Joint Forest Management
JFMC	Joint Forest Management Committee
KJBF	Kamalnayan Jamnalal Bajaj Foundation
KVK	Krishi Vigyan Kendra
M&E	Monitoring and Evaluation
MASS	Manav Adhikar Seva Samiti
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
mha	Million Hectares
MoEF	Ministry of Environment and Forests
MSP	Medium Scale Project
MWS	micro-watersheds
NABARD	National Bank for Agriculture and Rural Development
NAEB	National Afforestation and Eco-Development Board
NAIP	National Agricultural Innovation Project
NAP-CD	National Action Programme to Combat Desertification
NAP	National Afforestation Programme
NARS	National Agricultural Research System
NATMO	National Atlas and Thematic Mapping Organisation
NBA	National Biodiversity Authority
NBSS&LUP	National Bureau of Soil Survey and Land Use Planning
NCSA	National Capacity Self Assessment
NGO	Non Governmental Organisation
NRAA	National Rainfed Area Authority
NRASA	National Remote Sensing Agency
NRCAF	National Research Centre on Agroforestry
NRDWP	National Rural Drinking Water Programme
NREGA	National Rural Employment Guarantee Act
NRLM	National Rural Livelihood Mission
NRM	Natural Resource Management
NRSC	National Remote Sensing Centre
NSC	National Steering Committee
NTFP	Non-Timber Forest Produce
NWDPPRA	National Watershed Development Project for Rainfed Areas

O&M	Operation and Maintainance
PPS	Programme and Project Sheet
PRAIS	Performance Review and Assessment of Implementation System
PRI	Panchayat Raj Institutions
R&D	Research and Development
RAP	Regional Action Programme
RKC	Rural Knowledge Centre
RRR	Repair, Renovation and Restoration
RVP	River Valley Project
SAC	Space Applications Centre
SFA	Standard Financial Annex
SGP	Small Grant Programme
SGSY	Swarnjayanti Gram Swarojagar Yojna
SHGs	Self Help Groups
SLEM	Sustainable Land and Ecosystem Management
SLUSI	Soil and Land Use Survey of India
SOC	Soil Organic Carbon
SPV	Solar Photovoltaic
SPWD	Society for Promotion of Wasteland Development
SRAPS	Sub-Regional Action Programmes
ST	Scheduled Tribes
STI	Scientific and Technical Institutes
SWC	Soil Water Content
TFO	Technical Facilitation Organisation
TGA	Total Geographical Area
TGCS	Tree Growers Cooperative Society
TNP	Thematic Programme Network
UDWDP	Uttarakhand Decentralized Watershed Development Project
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations National Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
VD	V-ditches
VUS	Van Utthan Sansthan
WALMI	Water and Land Management Institutes
WII	Wildlife Institute of India
WORLP	Western Orissa Rural Livelihood Project
WOTR	Watershed Organization Trust
₹	Indian Rupees

# India's drylands and emerging challenges



Photo: Seva Mandir, Udaipur

Dry deciduous ecosystem of Jhadol block, Udaipur district, Rajasthan.

## Drylands

India has a total geographical area (TGA) of 328.2 million hectares (mha) with drylands covering 228.3 mha (69.6%) of the total land area. Within the drylands, arid area is 50.8 mha (15.8% of TGA), semi-arid is 123.4 mha (37.6 % of TGA) and dry sub-humid is 54.1 mha (16.5 % of TGA) (DSM Atlas, 2007). The drylands comprise a large belt running from the border in the northwest through Peninsular India to the southern tip of the country.

The hot arid regions in India occupy major parts of Rajasthan (Western), Gujarat, southern Punjab and

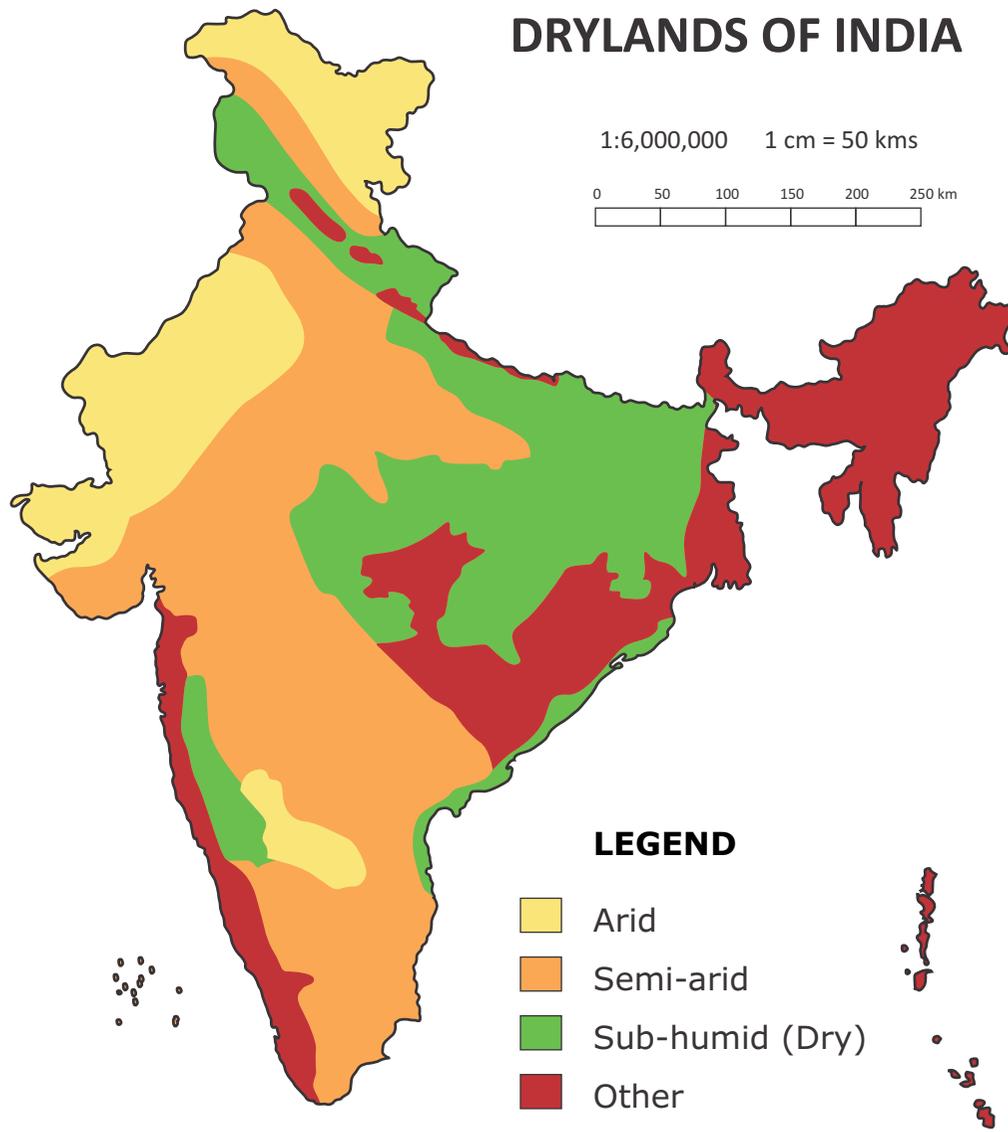
Haryana and a small portion of Deccan Peninsula in the States of Andhra Pradesh, Karnataka, and Maharashtra. Roughly, three-fourth of the State of Rajasthan, comprising 12 western districts, falls within the hot arid zone. The Great Indian Desert also known as the 'Thar' Desert lies in Western Rajasthan and comprises an area of 196,150 sq km. In addition, an area of about 15.2 mha of cold desert is located in Jammu and Kashmir and the Lahul-Spiti region in Himachal Pradesh (NAP, 2001).

About 123.4 mha (37.6% of TGA) consist of semi-arid region (NBSSLUP, 2001). The semi-arid tropical areas can be further classified into dry and wet. Crops and

cropping systems are quite diverse here depending on soil type and length of agricultural season. Sorghum, cotton, soyabean, groundnut and pulses are the major crops.

About 54.1 mha (16.5% of TGA) fall within the dry sub-humid region. Receiving fairly high rainfall the region gets ample opportunities for water harvesting. Rain-fed rice is the predominant crop followed by pulses, oilseeds and to some extent, vegetables and fruit crops are also an important component of the production system (DSM Atlas, 2007).

The hot arid region suffers low and erratic rainfall, frequent droughts, high evaporation, intense heat and high winds. The soils are not conducive to intensive cropping. The density of both human and livestock population is high as compared to the national average. A part of this population is nomadic following a pastoral system of living. This has put the scarce natural resources under severe stress. The agricultural season here is very short, so livestock farming forms an integral part of livelihoods.



Source: Agro-Ecological Subregions of India, NBSS&LLP (ICAR), Nagpur

## Land Degradation and Desertification

Land degradation and desertification are complex phenomena caused by natural and anthropogenic factors. Desertification in this context refers to 'land degradation in drylands'. In fact, UNCCD (Art.1) defines desertification as "land degradation in arid, semi-arid and dry sub-humid areas resulting from multiple factors, including climatic variations and human activities."

It is estimated that about 32% of India's total land area is affected by land degradation and 25% of the geographical area is affected by desertification. About 69% of the country's land is drylands and degradation of this land has severe implications for the livelihood and food security of millions (DSM Atlas, 2007).

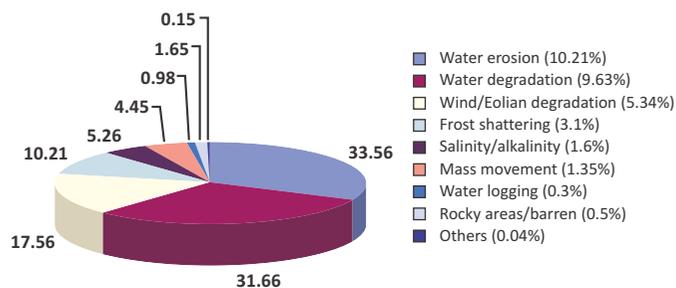
Land degradation impacts agricultural productivity, bio-diversity, groundwater and overall water availability. All these lead to a decline in the quality of life, eventually affecting the socio-economic status of the region. Land degradation has far-reaching consequences that affect lives and livelihoods of the population, often precipitating forced migration and socio-economic conflicts.

## Causes of Land Degradation

### Natural

- The major process of land degradation is soil erosion (due to water and wind erosion), contributing to over 71% of the land degradation in the country. Water erosion, the most widespread form of degradation, occurs widely in all agro-climatic zones. It has caused up to 26.21 mha (10.21% of TGA) of land degradation. Wind erosion dominant in the western region, leading to loss of topsoil and shifting of sand dunes, has caused upto 17.77 mha (5.34% of TGA) in degradation. Also vegetal degradation of 17.63 mha (9.63% of TGA), and frost shattering of 9.47 mha has occurred. The other processes include problems of water logging, salinity-alkalinity. Rajasthan (12.79% of TGA), Gujarat (12.72% of TGA) and Maharashtra (12.66% of TGA) have high proportions of land undergoing degradation (DSM Atlas, 2007). Land degradation

is also a serious problem even in the humid/sub-humid regions, particularly in the hilly regions, where the main process of land degradation is water erosion resulting in high losses of top soil and fertility.



Processwise status of land degradation in India

Source: DSM Atlas, 2007

- Scarce water resources in dryland regions limit green coverage coupled with stress on land due to increasing demand for agriculture and fodder production for livestock. Agricultural practices like excessive use of fertilizers, pesticides, intensive cropping patterns, inappropriate technologies, etc have lead to further degradation of land. In regions with higher demands on land production, unsustainable agricultural practices cause severe harm. Poor and inefficient irrigation practices, over exploitation of ground water, particularly in the coastal regions resulting in saline intrusion into aquifers, etc lead to land degradation and desertification.
- Drought, a naturally occurring phenomenon, can be exacerbated due to absence of vegetative cover impacting the hydrological regime. It is also another causative factor for land degradation in arid and semi-arid regions, instigating crop failures and then famines. Recurrent droughts cause lower biomass production, poor grain yields and scarcity of fodder. Further more, scarcity during drought years leads to enhanced grazing pressure by the livestock, which accentuates the problem of loss of vegetative cover.
- The process of land degradation is further aggravated by high biotic pressure - human

population and livestock population. India has livestock population of about 485 million, consequently burdening the limited land resources for fodder. Short-lived yet recurrent droughts can aggravate conditions interfering with the natural capacity of land to recover and advance the process of desertification.

### **Anthropogenic**

- Anthropogenic causes include expansion of agriculture and unsustainable agricultural practices such as intensive cultivation, chemical nutrient use, poor irrigation practices, and overgrazing. Such unsustainable resource management practices are often induced by population pressures, social conflicts, unsuitable planning etc. People affected by desertification need to draw on their limited assets in order to survive, accentuating their poverty. This constitutes a vicious cycle linking deteriorating natural resources to deteriorating livelihoods as people need to encroach further on fragile soils, sparse vegetation and limited water resources to meet their basic needs.
- Diversion of land from forestry and agriculture to other land uses has been one of the principal causes of land degradation. Wherever diversion of forest land is unavoidable, for instance for important developmental programmes, compensatory afforestation on non-forest land is mandatory. However, the loss of prime forests impacts the long-term stability of forests.
- The causes and effects of deforestation and forest degradation are interlinked. Some direct causes of deforestation are land clearance for agriculture (including shifting cultivation). Other land use changes include unplanned development, land transfers, different forms of encroachment, over-grazing, uncontrolled and wasteful logging, illegal felling and excessive fuel wood collection. In this context, however, it is necessary to understand that in India fuel wood contributes 84% of the total household energy consumption (UNDP, 1997) and there are 66.5 million tribal people in India, who, with a few exceptions, are forest dwellers (FAO, 1997).

- Industrial effluents are emerging as significant agents of land degradation. Industrial effluents discharged into barren lands and inland water bodies degrade the land and the water table. Industrial effluents discharged into non-perennial streams and rivers cause long term contamination impacting local agriculture and the quality of ground water.

- Mining is another factor causing land degradation in India. This is especially the case with unplanned open cast mining and where dumping of mine refuse occurs in the vicinity of agricultural lands. Open cast mining of sandstone, limestone, marble, gypsum and clay is largely practiced by small scale entrepreneurs who do not take up post mining operations, consequently, such areas gradually turn into wastelands. China clay, Fuller's earth, calcite and gypsum generate fine particles which are washed down slopes with runoff and get deposited in the adjoining cultivated fields. This eventually leads to problems of water logging and salinity.

Most rural communities in drylands rely on a combination of rain-fed agriculture, livestock rearing and other income generating activities that are extremely vulnerable to the expected climate change impacts. Land degradation and depleting water supply are already critical problems. Desertification and loss of biological potential will restrict the transformation of drylands into productive ecosystems. Development in the drylands depends on addressing degradation of the ecosystem, mainstreaming sustainable natural resources management and building upon the existing adaptive capacities of community and institutions. Climate change will further challenge the livelihoods of those living in these sensitive ecosystems and may result in higher levels of resource scarcity.

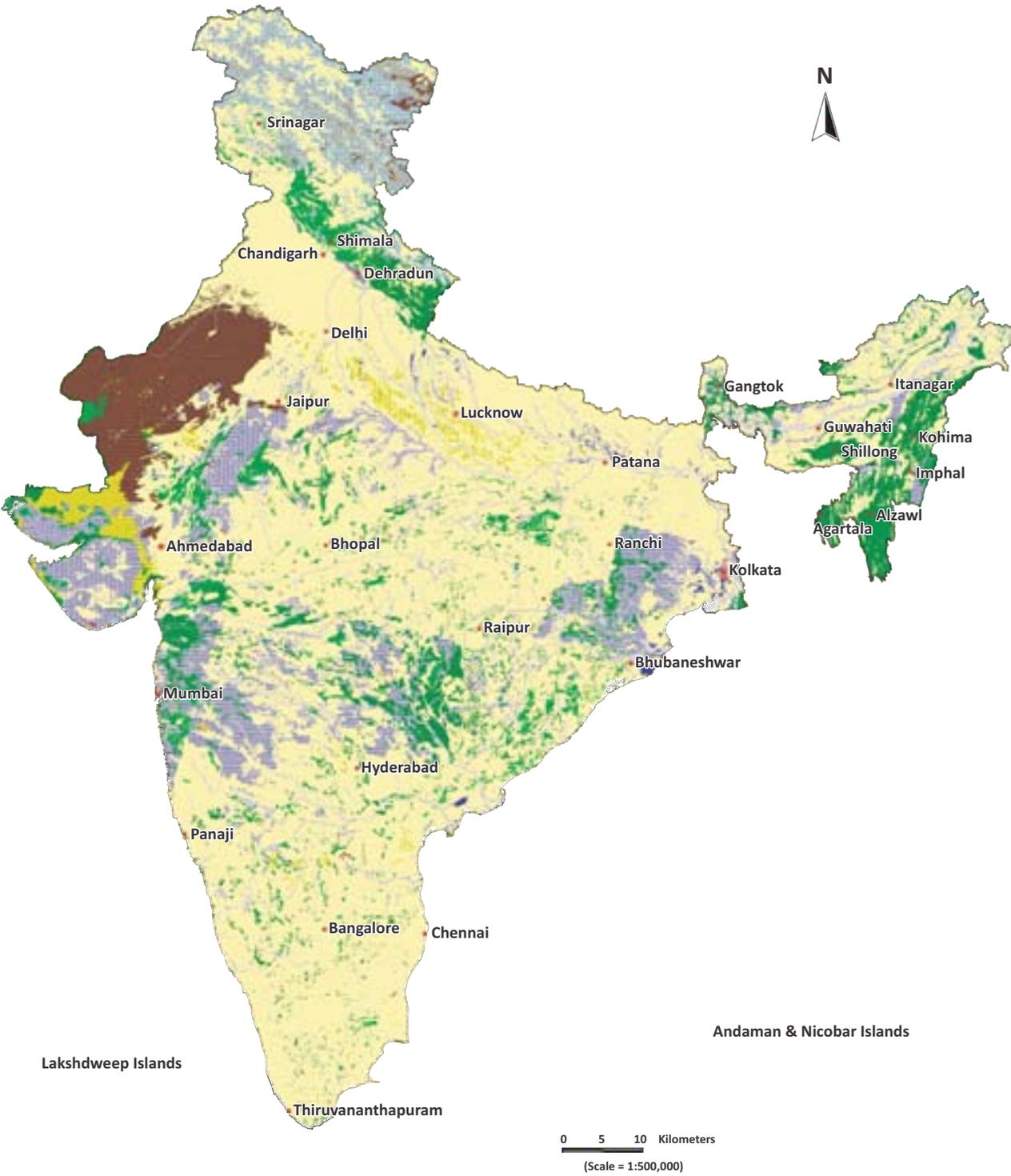
The DLDD issues and livelihoods security is addressed by the various projects and programmes under various Government of India agencies. Programme and initiatives have been underway over the past 40 years. Some of the major programmes and initiatives developed and underway are discussed in detail in Chapter 4.



Photo: Seva Mandir, Udaipur

Status of Aravali, Jhadol block, Udaipur district, Rajasthan.

# DESERTIFICATION STATUS MAP OF INDIA



## Legend

Code	Description	Code	Description
Fv1,2	Forest/Plantation, Vegetal degradation	Ee1,2	Dune/Sandy area, Wind erosion
Gv2	Grassland/Grazing land, Vegetal degradation	Ds1,2	Agriculture Unirrigated, Salinization/alkalization
Sv1,2	Land with scrub, Vegetal degradation	Is1,2	Agriculture Irrigated, Salinization/alkalization
Dw1,2	Agriculture Unirrigated, Water erosion	Ss1,2	Land with scrub, Salinization/alkalization
Iw1,2	Agriculture Irrigated, Water erosion	Bs1,2	Barren, Salinization/alkalization
Fw1,2	Forest/ Plantation, Water erosion	DI1,2	Agriculture Unirrigated, Water logging
Sw1,2	Land with scrub, Water erosion	II1,2	Agriculture Irrigated, Water logging
Bw1,2	Barren, Water erosion	Bl1,2	Barren, Water logging
Rw1,2Ew1	Rocky area, Water erosion	Bg1,2	Barren, Mass movement
EW1	Dune/Sandy area, Water erosion	Ch2	Glacial, Frost heaving
Lw1	Periglacial, Water erosion	Lf1,2	Periglacial, Water erosion
De1,2	Agriculture Unirrigated, Wind erosion	Fm2	Forest/Plantation, Man made
Ie1,2	Agriculture Irrigated, Wind erosion	Bm1,2	Barren, Man made
Se1	Land with scrub, Wind erosion	Tm1,2	Others, Man made
Be1	Barren, Wind erosion	NAD	No Apparent Degradation

1=Low 2=High

## Classification System

Land use/Land cover			Process of degradation			Severity	
Symbol	Code	Description	Symbol	Code	Description	Code	Description
	I	Agriculture Irrigated		V	Vegetal degradation	1	Low
	D	Agriculture unirrigated		W	Water erosion	2	High
	F/P	Forest/Plantation		e	Wind erosion		
	G	Grassland/Grazing land		s/a	Salinization/alkalization		
	S	Land with scrub		l	Water logging		
	B	Barren (Barren Scree)		g	Mass movement		
	R	Rocky area		h	Frost heaving		
	E	Dune/Sandy area		f	Frost shattering		
	W	Water body/Drainage		m	Man made		
	C	Glacial		NAD	No Apparent Degradation		
	L	Periglacial					
	T	Others					

International Boundary

State Boundary

River/Stream

Settlement



Area not taken for mapping

Source: IRS-P6, AWIFs data (2003-2004) and Ancillary Information  
Prepared by: Space Applications Centre, Ahmedabad & Collaborating Agencies

# India and United Nations Convention to Combat Desertification (UNCCD)



Sand dune stabilization at Smrutivan, Jaipur district, Rajasthan.

The United Nations Convention to Combat Desertification (UNCCD) is one of the three Rio Conventions that focuses on desertification, land degradation and drought (DLDD). UNCCD is the only convention that focuses on sustainable land management and arresting land degradation. This convention was adopted on 17th June 1994 and entered into force on 26 December 1996. 'Desertification' as defined in the UNCCD is land degradation in the drylands (arid, semi arid and dry sub humid regions) resulting from various factors and does not denote spread or expansion of deserts.

UNCCD with 194 Parties recognizes land degradation

as an important factor affecting some of the most vulnerable people and ecosystems in the world. The UNCCD aims at combating desertification / land degradation and mitigating the effects of drought while contributing to the achievement of sustainable development. The Convention benefits from universal membership and is increasingly recognized as an instrument that can make a lasting contribution to poverty reduction and other developmental and environmental goals.

The Convention stresses the need for integrated efforts and long-term strategies on cross-sectoral issues such as environmental conservation,

agricultural productivity, sustainable energy, fodder production and use, activities targeting socioeconomic condition of local communities, and efficient management of natural resources. Thus the UNCCD provides a platform for addressing these issues at the national as well as in the global context.

The convention promotes sustainable land management (SLM) as a solution to global challenges. Land degradation causes long-term loss of ecosystem functions and productivity from which the land cannot recover unaided. Sustainable Land Management is focused on changes in land cover/land use to maintain and enhance ecosystems functions and services.

India became a signatory to the UNCCD on 14th October 1994 and ratified it on 17th December 1996. With about 32% of its land being affected by land degradation, India has high stakes and stands strongly committed to implementing the UNCCD. The Ministry of Environment and Forests (MoEF) is the nodal Ministry in the Government of India for the UNCCD. The formation of Desertification Cell within the MoEF reflects India's active and involved commitment to the UNCCD and focused efforts at combating desertification, land degradation and drought across the nation.

India actively participates in international events on desertification and is currently the Chair of the Regional Implementation Annex for the Asia and the Pacific region. As host country for the Thematic Programme Network (TPN-2) on Agroforestry with Central Arid Zone Research Institute (CAZRI), Jodhpur as the host institution, MoEF published the "Agroforestry Manual for Asia-Pacific Region" in collaboration with the UNCCD in 2004 (<http://moef.nic.in/unccd/book01/books-1.htm>). India is a leading country on the work on TPN-1: Desertification Status Monitoring (DSM). Space Applications Centre, Ahmedabad published a DSM Atlas of the country in 2007, which is a globally pioneering work, based on a pilot project sponsored by MoEF ([http://moef.nic.in/modules/divisions/desertification-cell/contents/desert\\_atlas.pdf](http://moef.nic.in/modules/divisions/desertification-cell/contents/desert_atlas.pdf)).

## Policy Initiatives and Institutional Mechanisms

Though India does not have a specific policy or legislative framework for combating desertification. The concern for arresting and reversing land degradation and desertification gets reflected in many of the national policies which have enabling provisions for addressing these problems. Various policies and acts are given below.

Table-1: Policies and Acts		
Sl.	Policy/Act	Weblink
1	Indian Forest Act, 1927	<a href="http://www.envfor.nic.in/legis/forest/forest4.html">www.envfor.nic.in/legis/forest/forest4.html</a>
2	Forest (Conservation) Act, 1980	<a href="http://www.envfor.nic.in/legis/forest/forest2.html">www.envfor.nic.in/legis/forest/forest2.html</a>
3	Environment (Protection) Act, 1986	<a href="http://www.envfor.nic.in/legis/env/env1.html">www.envfor.nic.in/legis/env/env1.html</a>
4	National Forest Policy, 1988	<a href="http://www.envfor.nic.in/nfap/detailed-policy-1.html">www.envfor.nic.in/nfap/detailed-policy-1.html</a>
5	National Agricultural Policy, 2000	<a href="http://www.agricoop.nic.in/agpolicy02.htm">www.agricoop.nic.in/agpolicy02.htm</a>
6	Biological Diversity Act, 2002	<a href="http://www.nbaindia.org/act/act_english.htm">www.nbaindia.org/act/act_english.htm</a>
7	National Water Policy, 2002	<a href="http://www.mowr.gov.in/writereaddata/linkimages/nwp20025617515534.pdf">www.mowr.gov.in/writereaddata/linkimages/nwp20025617515534.pdf</a>
8	National Environmental Policy, 2006	<a href="http://www.envfor.nic.in/nep/nep2006.html">www.envfor.nic.in/nep/nep2006.html</a>
9	National Policy for Farmers, 2007	<a href="http://www.agricoop.nic.in/NPF/npff2007.pdf">www.agricoop.nic.in/NPF/npff2007.pdf</a>
10	National Green Tribunal Act, 2010	<a href="http://www.moef.nic.in/downloads/public-information/NGT-fin.pdf">www.moef.nic.in/downloads/public-information/NGT-fin.pdf</a>

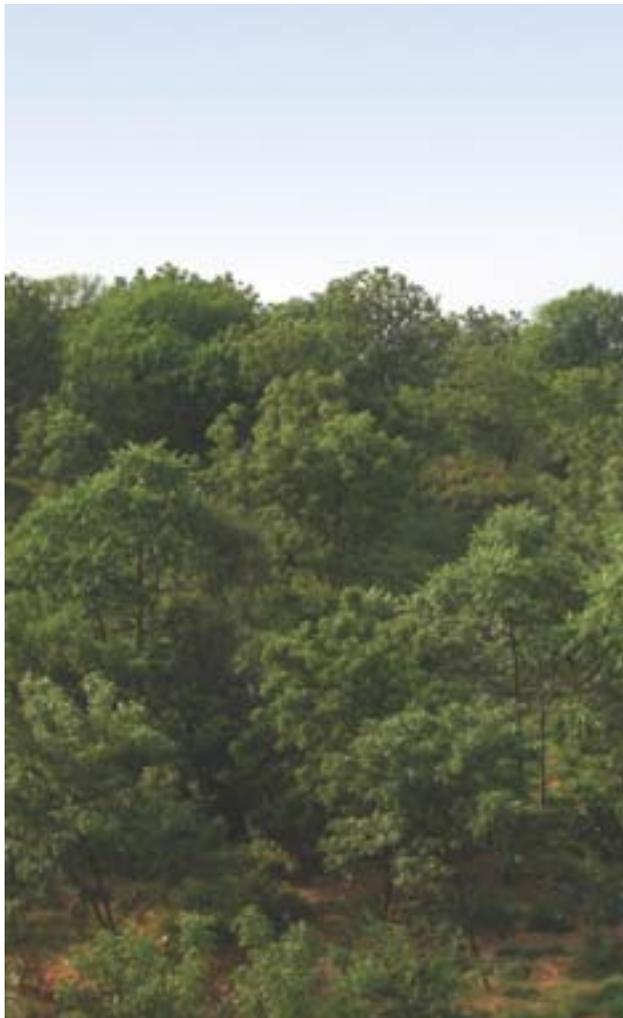


Photo: FES, Anand

**Ravine reclamation at Khorwad, Umreth block, Anand district, Gujarat.**

After independence, India has taken a number of steps to tackle the problem of land degradation and desertification. The first five year plan (1951-1956) had 'land rehabilitation' as one of the thrust areas. In the subsequent plans, too, high priority has been consistently attached to development of the drylands. Systematic efforts through the launching of long-term counter measures were initiated in the Second Plan (1956-61) which were substantially expanded during the Fourth Plan (1969-1974). The Fourth Plan suggested that much of the amount spent on relief in famine-affected areas could be "so deployed in the areas chronically affected by drought" as to generate employment in rural sector. Various projects and programmes related to desertification control were

launched and are continuing within the framework of the Ninth Five Year Plan. The Working Group for formulation of 10th Five-Year Plan (2002-2007) recommended twenty year projections (2002-2022) for watershed development, rainfed farming and natural resource management.

The Ministry of Environment and Forests is the focal point at the national level, with several other ministries having a number of programmes and policy initiatives related to the DLDD issue. State government also have a major role in combating DLDD by implementing central government programmes, schemes, and regulations. Civil Society organizations, grassroots organizations and larger NGO's also undertake grassroots projects on issues pertaining to NRM, livelihoods and sustainable land management. Some of the major ministries/departments involved are:

- Planning Commission
- Ministry of Rural Development
  - Department of Land Resources
  - Department of Rural Development
  - Department of Drinking Water Supply
- Ministry of Agriculture
  - Department of Agriculture & Cooperation
  - Department of Agricultural Research and Education/ Indian Council of Agricultural Research
  - Department of Animal Husbandry, Dairying & Fisheries
- Ministry of Water Resources
- Ministry of New and Renewable Energy
- Ministry of Earth Sciences
  - India Meteorological Department
  - Department of Science and Technology
- Ministry of Space
  - Space Applications Centre
- Ministry of Consumer Affairs & Public Distribution
- Ministry of Panchayati Raj
- Ministry of Science and Technology
- Ministry of Environment and Forests
  - National Afforestation and Eco-development Board
  - Environment Education Division
  - National Biodiversity Authority

In order to provide research support to the various programmes for combating desertification, Government of India (GoI) has established a network of national level research institutes as detailed in table below:

<b>Table-2: Scientific and Technical Institutes</b>	
<b>Scientific and Technical Institutes</b>	<b>Website</b>
Central Arid Zone Research Institute (CAZRI), Jodhpur	www.cazri.res.in
Indian Council of Forestry Research and Education (ICFRE), Dehradun	www.icfre.org
Arid Forest Research Institute (AFRI)	www.afri.res.in
Forest Survey of India (FSI), Dehradun	www.fsi.org.in
National Bureau of Soil Survey and Land Use Planning (NBSS&LUP), Nagpur	www.nbsslup.nic.in
Indian Institute of Forest Management (IIFM), Bhopal	www.iifm.ac.in
Wildlife Institute of India (WII), Dehradun	www.wii.gov.in
Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad	www.crida.ernet.in
Central Soil and Water Conservation Research and Training Institute (CSWCRT), Dehradun	www.cswcrtiweb.org
National Research Centre on Agroforestry (NRCAF), Jhansi	www.nrcaf.ernet.in
Central Soil Salinity Research Institute (CSSRI), Karnal	www.cssri.org
Indian Grassland and Fodder Research Institute, (IGFRI), Jhansi	www.igfri.ernet.in
Central Sheep and Wool Research Institute (CSWRI), Avikanagar	www.cswri.res.in
Water Technology Centre at the Indian Agricultural Research Institute, New Delhi	www.iari.res.in
Indira Gandhi National Forest Academy (IGFNA), Dehradun	www.ignfa.gov.in
National Afforestation and Eco-Development Board (NAEB), New Delhi	www.naeb.nic.in
National Biodiversity Authority (NBA), New Delhi	www.nbaindia.org
National Tiger Conservation Authority, New Delhi	www.projecttiger.nic.in
National Remote Sensing Centre (NRSC), Hyderabad	www.nrsc.gov.in
National Rainfed Area Authority (NRAA), New Delhi	www.nraa.gov.in

States have also established institutions and agencies to conduct research and implement programmes at the local level.

#### **The National Action Programme to Combate Desertification (NAP-CD)**

The NAP-CD formulated and submitted to UNCCD in 2001, identifies the need to address and incorporate the following into an integrated planning for sustainable development-natural resource conservation and management, socio-economic issues, strengthening the process of decentralisation of governance and formulation of more community

driven projects and programmes, gender issues, public participation, strengthening the interface and co-ordination between various stakeholders, and awareness raising. The NAP-CD be downloaded at <http://moef.nic.in/modules/divisions/desertification-cell/?f=nap>

In order to achieve the above, NAP-CD mentions a greater shift from centralised mode of governance to more decentralised governance; identification of problems/

priorities by the local communities and a greater devolution of powers to the local communities; Greater integration of existing programmes and activities not only at the national level but a more coordinated approach, particularly at the local level. A step towards 'Single window' implementation of programmes and schemes through local self governments (Panchayats) is emphasised. Water would be made central to all conservation measures and for production systems. Focus would be to improve the quality of life. The local communities are empowered to take decisions, and implement programmes relating to their livelihood.

The approach and strategy to combat desertification under UNCCD is appropriately described in NAP-CD. With reference to UNCCD decision 3/COP.8 the NAP-CD needs to be aligned with the 10-year strategic plan and framework to enhance the implementation of the Convention.

#### **National Capacity Needs Self-Assessment (NCSA)**

NCSA prepared in 2007 suggested that India has sufficient capacity requirements for meeting UNCCD obligations. Some of the strengths are :

1. Address all causes of desertification in implementation of NAP to combat desertification;
2. Mainstreaming of combating desertification works for lands that are not yet degraded;
3. Provide legislative support pertaining to combating desertification;
4. Provide for effective participation at the local, national and regional levels of NGOs and local;
5. Establish and strengthen early warning system for combating desertification

Some of the important deficiencies in capacity needs are

1. Implement action of NAP to combat desertification
2. Research and development
3. Conceptualize and formulate policies, legislations, strategies and Programs
4. Incorporation of traditional knowledge
5. Mobilization of private sector contributions.

The above depiction of strengths and deficiencies clearly indicate that the country is strong in large number of capacities especially in terms of implementation of

national plans as well as preventive measures for lands that are yet not degraded; information generation and early warning, and transfer of adaptation and development of technology. There are however few inadequacies that need immediate attention. Following the Strategy adopted in 2008, follow-up of NCSA in review and follow-up with the Strategy is needed.

#### **Sustainable Land and Ecosystem Management (SLEM) Programme**

The SLEM Programme is a joint initiative between the Government of India (GOI) and the Global Environmental Facility (GEF), under the later Country Partnership Programme (CPP) under GEF 4-cycle. The objective of SLEM Programmatic Approach is to “promote sustainable land management and use of biodiversity as well as to maintain the capacity of ecosystems to deliver goods and services taking into account climate change”.

SLEM programme is based on the following-

- Prevention and/or control of land degradation by restoration of degraded (agricultural and forested) lands and biomass cover to produce, harvest, and utilize biomass in ways that maximize productivity, as well as by carbon sequestration, biodiversity conservation, and sustainable use of natural resources;
- Enhancement of local capacity and institution building to strengthen land and ecosystem management;
- Facilitation of knowledge dissemination and application of national and international good practices in SLEM within and across states;
- Replication and scaling up of successful land and ecosystem management practices and technologies to maximize synergies across the CBD, UNFCCC, UNCCD conventions.

Under the SLEM Programmatic Approach, seven projects have been formulated and are under various stages of implementation. (<http://moef.nic.in/modules/divisions/desertification-cell/?f=slem>)

#### **UNCCD 10 year Strategy (2008-18) and the 4th National Report**

As the Convention entered into its second decade, the Parties unanimously adopted the 10-year strategic

plan and framework to enhance the implementation of the Convention for 2008-2018 at COP8, held in Madrid in September 2007. The Strategy provides a unique opportunity to address some of the Convention's key challenges, to capitalize on its strengths, to seize opportunities provided by the new policy and financing environment, and to create a new, revitalized common ground for all UNCCD stakeholders. The Strategy contains the "strategic objectives" to be achieved over the 10 years and the "operational objectives" that guide the actions of short and medium-term effects. The strategy can be downloaded at <http://www.unccd.int/knowledge/docs/The%20Strategy%20leaflet-english.pdf>

As an integral part of its obligations, India submits a National Report to the UNCCD Secretariat as per COP decisions. Till date four National Reports have been submitted. The first report was submitted in 2000, second report in 2002, and the third report in 2006. The fourth national report was submitted online in October 2010, and reported for three years (FY2007-08, 08-09, 09-10). (All the national reports can be accessed on the MoEF website <http://moef.nic.in/modules/divisions/desertification-cell/>).

The 4th National Report had a revised reporting format vis-à-vis the previous years. To support this

new result-oriented management structure, UNCCD had Parties at the Ninth Session of the Conference of the Parties (COP 9), decided on a new Performance Review and Assessment of Implementation System (PRAIS). This allows the Committee for the Review of the Implementation of the Convention (CRIC) to effectively review the implementation of the Strategy and the Convention, based on a new methodological approach, which envisages reporting on performance and impact indicators, best practices and financial flows.

The 4th National report confirms to the Strategic and Operational Objectives of the 10 year Strategy of UNCCD. But for this particular reporting, country parties were expected to report on the 5 Operational Objectives and Expected Outcomes (against Performance Indicators) only, which are as detailed below. And the reporting on the Strategic Objectives (against Impact Indicators) will be from the next reporting period, i.e. 2012.

#### **Operational Objectives and Expected Outcomes**

1. Advocacy, awareness raising and education: To actively influence relevant international, national and local processes and actors in adequately addressing desertification/land degradation and drought-related issues.



Photo: GUIDE, Bhuj

**Grasslands of Bunni, Kachchh district, Gujarat.**

2. Policy framework: To support the creation of enabling environments for promoting solutions to combat desertification/land degradation and mitigate the effects of drought.
3. Science, technology and knowledge: To become a global authority on scientific and technical knowledge pertaining to desertification/land degradation and mitigation of the effects of drought.
4. Capacity-building: To identify and address capacity-building needs to prevent and reverse desertification/ land degradation and mitigate the effects of drought.
5. Financing and technology transfer: To mobilize and improve the targeting and coordination of national, bilateral and multilateral financial and technological resources in order to increase their impact and effectiveness.

**Strategic Objectives:**

1. To improve the living conditions of affected populations
2. To improve the condition of affected ecosystems
3. To generate global benefits through effective implementation of the UNCCD
4. To mobilize resources to support implementation of the Convention through building effective partnerships between national and international actors

Through the fourth reporting and review process Parties and the other reporting entities provided information on:

- Performance indicators for the five operational objectives of the Strategy;
- Financial flows (through the Standardized Financial Annex (SFA) and Programme and Project Sheet (PPS));
- Best practices on SLM technologies, including adaptation;
- Feedback on indicators and methodologies applied in this reporting and review process, as well as other pertinent information that reporting entities may wish to provide to the COP.

The process of preparation of the report included data collection and synthesis of important programmes undertaken by the various Government of India ministries, research institutes, and civil society organisations. National consultations with ministries and departments were an ongoing process and a National Consultative meeting was held on August 17, 2010. The Consultative meeting with the Civil Society Organisations (CSOs) was organized on 14 Sept 2010 to invite inputs for the National Report. The validation meeting was organized on 1 October 2010 and the national report was finalized for submission.

The 4th National Report submitted to UNCCD secretariat online in October 2010, was limited in scope as it did not reflect India's initiatives related to desertification, land degradation and drought issues in a holistic and summarized format. Therefore, this report is the 'Elucidation' of the fourth National Report and contains detailed information that could not be incorporated in the on-line report and that could be shared widely with multiple stakeholders. Chapters in this report are organized according to the reporting format to reflect background to these initiatives and a summary highlighting the country's commitment to addressing the issues of desertification, land degradation and drought.

The focus of Chapter 1 is essentially on providing a background to the concept of land degradation and desertification in India; and Chapter 2 summarizes the programmes and initiatives of various Government of India agencies in an effort to arrest land degradation. Chapter 3 includes analysis of the Performance Indicators; while Chapter 4 summarises the programmes categorised as per the thematic areas: a) Land (Land resources, Agriculture, Afforestation); b) Water; c) Livelihoods; d) Renewable Energy; e) Science and Technology Initiatives; and f) Sustainable Land and Ecosystem Management programme (SLEM); last but not the least, Chapter 5 covers the 11 Best Practices from across the country that has been reported on sustainable land management techniques, including adaptation.

The original fourth National Report submitted online can be accessed at <http://moef.nic.in/modules/divisions/desertification-cell/contents/India-4th-national-report-2010.pdf>.

# Reporting on the Operational Objectives of 'the Strategy'



Photo: CEE Photo Bank

Degraded village pasture lands at Jasdan block, Rajkot district, Gujarat.

United Nations Convention to Combat Desertification's (UNCCD) 10 year strategic plan and framework was adopted at Conference of the Parties (COP 8) at Madrid to enhance the implementation of the Convention for 2008–2018. The Strategy provides a unique opportunity to address some of the Convention's key challenges, to capitalize on its strengths, to seize opportunities provided by the new policy and financing environment, and to create a new, revitalized common ground for all UNCCD stakeholders. The Strategy contains the “strategic objectives” to be achieved over the 10 years, and the “operational objectives” that guide the actions of

short and medium-term effects.

Performance indicators compare actual conditions with a specific set of reference conditions. They measure the 'distance(s)' between the current situation and the desired situation (target). The performance indicators were developed to measure the progress of the five operational objectives of The Strategy, in line with decision 3/COP.8 (Conference of Parties). The affected country Parties were to report on the following fourteen performance indicators out of the eighteen Consolidated Performance Indicators (CONS).

**Table-3: Operational Objectives and Performance Indicators**

Operational Objective	Outcome No.	Reporting format (4 <sup>th</sup> National Report)	
		Indicator No.	Indicator name
Advocacy, Awareness and Education	1.1	CONS-O-1	Number and size of information events organized on the subject of desertification, land degradation and drought (DLDD) and/or DLDD synergies with climate change and biodiversity, and audience reached by media addressing DLDD and DLDD synergies.
	1.3	CONS-O-3	Number of CSOs and STIs participating in the Convention processes.
		CONS-O-4	Number and type of DLDD-related initiatives of Civil Society Organisations (CSOs) and Scientific and Technical Institutes (STIs) in the field of education.
Policy Framework	2.1 2.2 2.3	CONS-O-5	Number of affected country Parties, subregional and regional entities to have finalized the formulation/revision of National Action Programmes (NAPs)/Sub-Regional Action Programmes (SRAPs)/Regional Action Programmes (RAPs) aligned to The Strategy, taking into account biophysical and socio-economic information, national planning and policies, and integration into investment frameworks.
	2.5	CONS-O-7	Number of initiatives for synergistic planning/programming of the three Rio Conventions or mechanisms for joint implementation, at all levels.
Science, Technology and Knowledge	3.1 3.2	CONS-O-8	Number of affected country Parties, subregional and regional entities to have established and supported a national/subregional/regional monitoring system for DLDD.
		CONS-O-9	Number of affected country Parties, subregional and regional entities reporting to the Convention along revised reporting guidelines on the basis of agreed indicators. <i>(Due for reporting in 2012)</i>
	3.3 3.4	CONS-O-10	Number of revised NAPs/SRAPs/RAPs reflecting knowledge of DLDD drivers and their interactions, and of the interaction of DLDD with climate change and biodiversity.
	3.5	CONS-O-11	Type, number and users of DLDD-relevant knowledge-sharing systems at the global, regional, subregional and national levels described on the Convention website.
Capacity Building	4.1 4.2	CONS-O-13	Number of countries, subregional and regional reporting entities engaged in building capacity to combat DLDD on the basis of National Capacity Self Assessment (NCSA) or other methodologies and instruments.
Financing and Technology transfer	5.1	CONS-O-14	Number of affected country Parties, subregional and regional entities whose investment frameworks, established within the IFS devised by the GM or within other integrated financing strategies, reflect leveraging national, bilateral and multilateral resources for combating desertification and land degradation.
	5.2	CONS-O-16	Degree of adequacy, timeliness and predictability of financial resources made available by developed country Parties to combat DLDD.
	5.3	CONS-O-17	Number of DLDD-related project proposals successfully submitted for financing to international financial institutions, facilities and funds, including the Global Environment Facility (GEF).
	5.5	CONS-O-18	Amount of financial resources and type of incentives which have enabled access to technology by affected country Parties.

A brief analysis of the information provided in this segment of the reporting format is as follows.

### **Operational Objective 1: Advocacy, awareness raising and education**

Government of India, Science and Technology Institutes and the civil sector have placed significant emphasis on the issues of DLDD. The reporting on awareness generation activities and media campaigns though undertaken across the nation, however, have not been quantified and inbuilt into the reporting mechanism at the national level. With regard to education, several research institutions operating within dryland regions focus their research on region-specific issues which include DLDD. Additionally, cross cutting agricultural educational institutions focus on systems, methods, technology which can assist in adaptation to these regions. These could and would include awareness generation on methods of combating desertification, improving the water table to reduce impacts of drought and land degradation etc. A few case studies of the events and activities towards advocacy, awareness raising and education on DLDD are also included in the chapter on programmes and best practices.

The number of information events organized was 10,725 and 102,786 during 2008 and 2009, respectively, across the country by various government agencies and civil society organisations. This shows almost a 10 fold increase in the number of events in this reporting period. Estimated number of research papers related to DLDD that reached the key stakeholders was 14 and 15 during 2008 and 2009, respectively. There were about 52 (2008) and 131 (2009) media outreach programmes through radio and TV; and 10,000 products shared through other ICT (Websites, CDs, DVDs, etc.).

The trend of participation of CSOs and STIs in DLDD-related programmes/projects is rising. The government is undertaking initiatives to increase the delivery of DLDD-related efforts in the formal and non-formal education sector by CSOs and STIs. However, the reporting period is too short for a more detailed trend analysis.

### **Operational Objective 2: Policy framework**

India's National Action Programme to Combat Desertification (NAP-CD) for combating desertification was formulated in 2001. NAP-CD integrates traditional and modern scientific knowledge and takes into consideration the programmes and activities undertaken by various ministries and departments. Considering that the UNCCD 10 year Strategy was adopted in 2008, NAP-CD is yet to be aligned with 'the Strategy' and is under consideration. It is relevant for all stakeholders, both at national and international level, to take appropriate action in addressing the problems of land degradation and desertification for achieving sustainable development. Hence, NAP-CD alignment will draw upon the latest national policies and acts that have implications on and relates to addressing DLDD issues.

### **Operational Objective 3: Science, technology and knowledge**

The national level environmental monitoring system of India partially covers the monitoring of DLDD. Consequently India does not have an independently established and supported monitoring system for DLDD at national level. There are monitoring systems at the sub-national levels which contribute to UNCCD reporting. Most of the DLDD performance indicators related to science, technology and knowledge are monitored by these systems, some of which are listed below.

- Desertification Atlas of India, Space Applications Centre, Indian Space Research Organization- Commissioned by NFP, UNCCD, Ministry of Environment ([http://moef.nic.in/modules/divisions/desertification-cell/contents/desert\\_atlas.pdf](http://moef.nic.in/modules/divisions/desertification-cell/contents/desert_atlas.pdf))
- Land Degradation Mapping, Soil and Land Use Survey of India, Department of Agriculture & Cooperation (<http://dacnet.nic.in/aislus/index.asp>)
- Detailed Soil Survey, Soil and Land Use Survey of India, Department of Agriculture & Cooperation (<http://dacnet.nic.in/aislus/index.asp>)

**Table-4: Knowledge-sharing system**

SL	Knowledge-sharing system	Internet Link
1	Drought Management Information System	<a href="http://www.agricoop.nic.in/DroughtMgmt/drought.htm">www.agricoop.nic.in/DroughtMgmt/drought.htm</a>
2	Watershed Atlas of India	<a href="http://www.cgwb.gov.in/watershed/about-ws.html">www.cgwb.gov.in/watershed/about-ws.html</a>
3	<i>Krishi Vigyan Kendra (KVK)</i>	<a href="http://www.icar.org.in/en/krishi-vigyan-kendra.htm">www.icar.org.in/en/krishi-vigyan-kendra.htm</a>
4	Crop Weather Outlook- All-India Coordinated Research Project on Agro-Meteorology (AICRPAM)	<a href="http://www.cropweatheroutlook.ernet.in/">www.cropweatheroutlook.ernet.in/</a>
5	Weather Based Agro Advisory	<a href="http://www.icar.org.in/en/crop-management-advisory.htm">www.icar.org.in/en/crop-management-advisory.htm</a>
6	Weather Forecasting District Level Forecast	<a href="http://www.imd.gov.in/section/nhac/distforecast/INDIAct.htm">www.imd.gov.in/section/nhac/distforecast/INDIAct.htm</a>
7	Agromet Services All India AAS Bulletin	<a href="http://www.imdagrimet.gov.in/ALL%20INDIA%20AAS%20BULLETIN/ALL%20INDIA%20AAS%20BULLETIN.htm">www.imdagrimet.gov.in/ALL%20INDIA%20AAS%20BULLETIN/ALL%20INDIA%20AAS%20BULLETIN.htm</a>
8	State wise composite Agromet Advisory Service Bulletin	<a href="http://www.imdagrimet.gov.in/COMPOSITE%20BULLETIN/composite%20bulletin21.09.10.htm">www.imdagrimet.gov.in/COMPOSITE%20BULLETIN/composite%20bulletin21.09.10.htm</a>
9	District Level Agromet Advisory Services	<a href="http://www.imd.gov.in/section/nhac/dynamic/daasindiact1.htm">www.imd.gov.in/section/nhac/dynamic/daasindiact1.htm</a>
10	Special Monsoon Report	<a href="http://www.imd.gov.in/section/nhac/dynamic/SPLNEW.HTM">www.imd.gov.in/section/nhac/dynamic/SPLNEW.HTM</a>
11	Decision Support Centre- ISRO	<a href="http://www.dsc.nrsc.gov.in:14000/DSC/index.jsp">www.dsc.nrsc.gov.in:14000/DSC/index.jsp</a>
12	Environmental Information System (ENVIS)	<a href="http://www.moef.nic.in/envis/envis.html">www.moef.nic.in/envis/envis.html</a>

- Forest Cover Mapping, Forest Inventory and State of the Forest Report, Forest Survey of India, Ministry of Environment and Forests (<http://www.fsi.org.in/>)
- National Agricultural Drought Assessment and Monitoring System, Disaster Management Support Programme, National Remote Sensing Centre (<http://dsc.nrsc.gov.in:14000/DSC/Drought/index.jsp>)
- Wasteland Atlas of India, Department of Land Resources, Ministry of Rural Development ([http://www.dolr.nic.in/wasteland\\_atlas.htm](http://www.dolr.nic.in/wasteland_atlas.htm))
- Ground Water Monitoring, State Ground Water Profiles and District Ground Water Brochures, Central Ground Water Board, Ministry of Water Resources (<http://cgwb.gov.in/>)

India has created an enabling constitutional, legal, policy and programme framework for addressing these issues through its Five-year Plans. Over the years a large number of new initiatives have been taken to strengthen the policies and programmes in

the relevant sectors that include agriculture, environment and forests, rural development, social welfare, poverty alleviation and women's empowerment. These include initiatives for addressing food production, preventing and reversing land degradation as also the associated issues of human development, which are inextricably interlinked with DLDD.

India has rich and diversified DLDD-related knowledge-sharing systems and networks at a national level. There is additionally adequate scientific and traditional knowledge, including best practices, which is suitably released to end-users.

#### **Operational Objective 4: Capacity building**

Assessment on DLDD-related capacity building activities show a positive trend and also recognizes the need to focus and strengthen the implementation of NAP-CD across the country. A total of 93 activities have been reported in this

period, which fall outside the areas of intervention as mentioned in the National Capacity Needs Self-Assessment (NCSA) report. Consequently, the MoEF, Government of India will be addressing the issues mentioned in the NCSA framework. The NCSA is concerned with a country's capacity – the abilities of individuals, groups, organizations and institutions to address the priority environmental issues as part of the efforts to achieve sustainable development. The NCSA focuses on India's capacity requirements to implement the three 'Rio Conventions' on – biodiversity (CBD), land degradation (UNCCD) and climate change (UNFCCC). In addition, the NCSA process aims to identify cross-cutting capacity issues and foster synergies among these.

### **Operational Objective 5: Financing and technology transfer**

Substantial funding has been raised around the issues of DLDD. The amount of funds raised for the on-going projects in the corresponding Standard Financial

Annex (SFA) during 2007-10 was ₹. 44.50 billion (USD 0.99 billion approx.). This reflects across 5 programmes reported in the SFA and relates to the same reported in the programme and project sheets. All other programmes are funded by the government agencies both centre and state.

This operational objective also incorporates information pertaining to the Integrated Investment Framework, which aims to catalyze investments in SLEM from such sources as public expenditure at the national and local levels, private sector investments (including investment by farmers and communities) and funds from international development partners. In India investment in SLEM is across various ministries and departments, and it may not be possible to achieve the level of integration expected. However, the process for integration of programmes to avoid duplicity and for maximum resource utilisation is in place and, in future, will be part of the DLDD-related activities as well.

# Programmes and Initiatives



**LAND**



**WATER**



**LIVELIHOODS**



**RENEWABLE ENERGY**



**SCIENCE AND TECHNOLOGY INITIATIVES**



**SUSTAINABLE LAND AND ECOSYSTEM MANAGEMENT**

# Introduction

This section highlights the 27 programmes and initiatives reported for the period 2007-2010, and contain information as reported in the Programme and Project sheets (PPS) & the Standard Financial Annexe (SFA). It may be noted that though some of these programmes have been implemented over decades, only the relevant components including finances have been reported for the above mentioned period. Also only five out of seven SLEM programmes have been reported as the other two programmes were not in the implementation phase at the time of reporting. The programmes categorized as per thematic areas are as follows

## Land

- 1 Integrated Watershed Management Programme (IWMP)
- 2 National Afforestation Programme (NAP)
- 3 Soil Conservation in the Catchment of River Valley Project and Flood Prone River
- 4 National Watershed Development Project for Rainfed Areas (NWDPA)
- 5 Fodder and Feed Development Scheme- component of Grassland Development including Grass Reserves

## Water

- 6 Command Area Development and Water Management (CADWM) programme
- 7 National Rural Drinking Water Programme (NRDWP)
- 8 National Project for Repair, Renovation and Restoration (RRR) of Water Bodies

## Livelihoods

- 9 The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)
- 10 Swarnjayanti Gram Swarozgar Yojna (SGSY) / National Rural Livelihood Mission (NRLM)

## Renewable Energy

- 11 National Biogas and Manure Programme
- 12 Biomass Energy and Cogeneration (Non-bagasse) in Industry
- 13 Biomass Gasifier Programme
- 14 Solar Photovoltaic (SPV) Programme

## Science and Technology Initiatives

- 15 Desertification Monitoring and Assessment: Desertification Status Mapping
- 16 Arid Zone Research
- 17 Identification and Demarcation of Degraded Watersheds in the Catchment Area for Macro Level Planning
- 18 Efficacy and Economics of Water Harvesting Devices in Controlling Run-off Losses and Enhancing Biomass Productivity in Aravalli Ranges
- 19 Generation of Detailed Database on Soil and Land Characteristics for Degraded Watersheds
- 20 Addressing the Issue of Land Degradation is a Component in some of the R&D Projects of the Institute
- 21 Enhancing Productivity of Saline Wastelands in Kachchh- through Improved Tree Planting Techniques and Silvopastoral Study
- 22 Study of Characteristic Features Pertaining to Bio-drainage Potential of some Selected Tree Species

## Sustainable Land and Ecosystem Management (projects under GEF)

- 23 Policy and Institutional Reform for Mainstreaming and Upscaling Sustainable Land and Ecosystem Management (SLEM) in India
- 24 Sustainable Rural Livelihoods Security through Innovations in Land and Ecosystem Management
- 25 Sustainable Land, Water and Biodiversity Conservation and Management for Improved Livelihoods in Uttarakhand Watershed Sector
- 26 Integrated Land and Ecosystem Management to Combat Land Degradation and Deforestation in Madhya Pradesh
- 27 Sustainable Participatory Management of Natural Resources to Control Land Degradation in Thar Desert Ecosystem

# 1 Integrated Watershed Management Programme (IWMP)

## Summary:

- Integrated Watershed Management Programme (IWMP) is being implemented by Ministry of Rural Development. It is a comprehensive programme that brings together three different long existing watershed programmes viz. Drought Prone Areas Programme -DPAP (started 1973-74), Desert Development Programme – DDP (started 1977-78) and Integrated Wasteland Development Programme – IWDP (started 1989-90) to be implemented under Common Guidelines on Watershed Development, 2008.

*The main objectives of the IWMP are to restore the ecological balance by harnessing, conserving and developing degraded natural resources such as soil, vegetative cover and water.*

IWMP is a comprehensive programme implemented to develop widespread degraded land across the country by common guidelines. These guidelines broadly indicate a fresh framework for the next generation watershed programmes. The key features are as follows:

- States are empowered to sanction and oversee the implementation of watershed projects within their areas of jurisdiction and within the parameters set out in these guidelines.
- Dedicated implementing agencies with multi-disciplinary professional teams at the national, state and district level for managing the watershed programmes.
- Additional financial assistance provided for strengthening institutions at the district, state and national level to ensure professionalism in management of watershed projects.
- The project duration has been enhanced in the range of 4 to 7 years depending upon the nature of activities spread over 3 distinct phases viz., preparatory phase, works phase and consolidation phase.
- Productivity enhancement and livelihoods are given priority along with conservation measures. Resource development and usage are planned to promote farming and allied activities to promote local livelihoods while ensuring resource conservation and regeneration.
- The new cluster approach envisages a broader vision of geo-hydrological units normally of an average size of 1,000 to 5,000 hectares comprising clusters of micro-watersheds.
- Special efforts are made to utilize information technology and remote sensing inputs in planning, monitoring and evaluation of the programme.
- Capacity building and training of all functionaries and stakeholders involved in the watershed programme implementation to be carried out on war footing with definite action plan and requisite professionalism and competence.
- Multi-tier ridge to valley sequenced approach is adopted towards the implementation of the Watershed Development Projects.

The watershed development process is synergized with the employment generating programmes such as the Mahatma Gandhi National Rural Employment

## Guiding Principles

- Equity and gender sensitivity;
- Decentralization;
- Facilitating agencies;
- Centrality of community participation;
- Capacity building and technology inputs;
- Monitoring, evaluation and learning;
- Organizational restructuring.

Guarantee Scheme (MGNREGS), Backward Regions Grant Fund (BRGF) etc. thus providing strong coordination.

IWMP emphasises on people's participation through watershed committees at village level, which consist of Self Help Groups (SHGs), users group and cross section of village community including marginalized communities, labourers and women. For its implementation, planning, monitoring and technical input, IWMP involves a number of Scientific and Technical Institutes (STIs) like International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Central Research Institute for Dry-Land Agriculture (CRIDA), Indian Space Research Organization (ISRO),

Central Arid Zone Research Organization (CAZRI), Indian Council of Forestry Research and Education (ICFRE), Indian Council of Agricultural Research (ICAR) and Civil Society Organisations (CSOs) such as Mysore Resettlement and Development Agency, People's Science Institute, Watershed Support Services and Activities Network, Advanced Center for Water Resources Development and Management. The line departments of State Governments – Agriculture, Forest, Soil and Water Conservation, Land Resource Development, Land and Water Development, Rural Development etc – are also active partners in the implementation of Integrated Watershed Management and were also involved for research and expertise input for scientific implementation of the same.

## Achievements:

- 46,666 watershed projects sanctioned.
- 24.725 mha area covered under the programme.
- Out of 33,724 projects, 22,597 watershed projects are completed (67%).
- 580 million person days generated.

Facts and Figures (2007 - 2010)		
1	Nodal/Implementing Agency	Department of Land Resources, Ministry of Rural Development
2	Area covered	5.6 million ha
3	Target group	Individuals, Self Help Groups, user groups, people living in watershed project areas
4	Programme period and status	Ongoing
5	Funding	Department of Land Resources, Ministry of Rural Development - ₹ 39204.20 million Approx. (USD 871.20 Million Approx.) Department of Land Resources, State Governments - ₹ 8465.07 Million Approx. (USD 188.11 Million Approx.) Total : ₹ 47669.27 (USD 1059.32)

**For more information:** [www.dolr.nic.in/iwmp\\_main.htm](http://www.dolr.nic.in/iwmp_main.htm)

## 2 National Afforestation Programme (NAP)

### Summary:

- National Afforestation Programme (NAP) is implemented by National Afforestation & Eco-Development Board (NAEB), Ministry of Environment and Forests. It has been formulated by the merger of four centrally sponsored afforestation schemes i.e. Integrated Afforestation and Eco-development Project Scheme (IAEPS), Area Oriented Fuel wood and Fodder Project Scheme (AOFFPS), Conservation of Non-Timber Forest Produce including Medicinal Plants (NTFPs), and Association of Scheduled Tribe and Rural Poor in Regeneration of Degraded Forests (ASTRPs) during Ninth Five Year Plan (1997–2002).
- The problem of developing arid lands and improving the well-being of the people living on them is that of both magnitude and complexity, magnitude in terms of the large area involved and complexity because their development cannot be dissociated from their ecological, social and economic characteristics. Afforestation is emerging as a potent tool for arresting the degradation and over-exploitation of lands and environmental degradation in India.

***NAP aims to support and accelerate the ongoing process of devolving forest protection, management and development functions to decentralized institutions of Joint Forest Management Committee (JFMC) at the village level, and Forest Development Agency (FDA) at the forest division level.***

Four centrally sponsored afforestation schemes were merged for reducing multiplicity of schemes with similar objectives, ensuring uniformity in the funding pattern and implementation mechanism, avoiding delays in availability of funds at the field level and institutionalising people's participation in project formulation and implementation. NAP is the flagship scheme of NAEB and it provides support, both in physical and capacity building. It is a 100% Centrally Sponsored Scheme (except for the components of Area Oriented Fuel Wood and Fodder Projects Scheme).

### **Institutional framework and its strengthening**

The scheme is being implemented through State agencies by a two-tier set-up, namely Joint Forest Management Committee (JFMC) at the village level, and Forest Development Agencies (FDA) at the forest

division level. Thus, FDA is the confederation of JFMCs in that forest division to undertake holistic development in the forestry sector with people's participation.

The experiences with the present institutional framework of FDA at the forest division level and JFMC at the village level are encouraging. Some noteworthy features of this framework are as follows:

- The district-level officers of relevant line departments of the State Govt. and Panchayat Raj Institutions (PRIs) are members of FDA. The institutions of FDAs and JFMCs are highly innovative resource transfer mechanisms whereby the Government of India channelizes funds directly to the grassroot level implementing agency for the afforestation activities.
- The structure of FDAs and JFMCs is gender

## Short term objectives

- Regeneration and eco-development of degraded forests and adjoining areas on a watershed basis.
- Raising coastal shelterbelts to mitigate the adverse impacts of cyclonic winds.
- Development and extension of improved technologies such as clonal propagation and use of root trainers for raising seedlings, mycorrhizal inoculation, etc.
- Rehabilitation of special problem lands like saline/alkaline soils, ravines, desert areas, coastal areas, mined areas, Himalayas, Aravallis and Western Ghats.
- Employment generation for the disadvantaged sections of society, particularly women, scheduled castes/ scheduled tribes and landless rural labourers, inhabiting the forests and adjoining areas.

## Long-term objectives

- Protection and conservation of natural resources through active involvement of the people.
- Checking land degradation, deforestation and loss of biodiversity.
- Ecological restoration, environmental conservation and eco-development.
- Evolving village level people's organisations which can manage the natural resources in and around villages in a sustainable manner.
- Fulfilment of the broader objectives of productivity, equity, and sustainability for the general good of the people.
- Improve quality of life and self-sustenance aspect of people living in and around forest areas.

sensitive. Women's membership up to 50% is mandatory in these bodies. Members of Scheduled Castes and Scheduled Tribes are the focus groups in JFMCs.

- This decentralized institutional structure allows greater participation of community both in planning and implementation of the appropriate afforestation programmes.
- The village is recognised as a unit of planning and implementation and all activities under the programme are conceptualized at the village level. Under Entry Point Activities, community assets are created with a 'care and share' concept.
- The two-tier approach, apart from building capabilities at the grass-roots level, also empowers the local people to participate in the decision making process.
- Capacity building of FDA and JFMC members is organized by State Forest Departments, as well as by seven Regional Centres of National Afforestation and Eco-development Board.
- To help and guide the FDAs and JFMCs, there is a national-level Steering Committee of NAP and at state level one called the State-level Coordination Committee chaired respectively by the Secretary (Environment and Forests), Government of India, and the Chief Secretary of the representative State Government.

## Components:

Financial support under NAP scheme is available for

- (1) Mobilisation of village JFMC and micro-planning in project villages
- (2) Afforestation: Aided Natural Regeneration, Artificial Regeneration, Bamboo & Cane Plantation, Mixed Plantation having NTFP and medicinal value, Regeneration of perennial herbs and shrubs of medicine value and Pasture Development/Silvipasture
- (3) Soil and Moisture Conservation
- (4) Entry Point Activities (for village development, average assistance of ₹ 0.16 Million per village)
- (5) Fencing, Monitoring and Evaluation, Training,

Awareness raising, and Overheads.

### Achievements:

- 42,535 Joint Forest Management Committees (JFMC) and 800 Forest Development Agencies (FDAs) have been included in the programme since

its inception.

- 1.69 million ha area has been afforested at an expenditure of ₹ 22373.584 Million.
- During 2007-10, 18,333 JFMCs and 71 FDAs were created and brought under the programme.

### Some of Activities

- In situ soil and moisture conservation measures like contour furrows, staggered trenches, mulching, box trenches, bench terracing, vegetative barriers, etc.
- Soil and moisture conservation by construction of small scale engineering structures like gully plugging, check dams, retaining and breast walls, toe walls, spurs and torrent control measures, small water harvesting structures including ponds, tanks and such vegetative measures as may be necessary. In the case of projects implemented in the periphery of national parks and sanctuaries, augmentation of water supply, facilities for bunds, dams, wells and for transporting and/or pumping of water may be permitted.
- Planting and sowing of multi-purpose trees, shrubs, grasses, and legumes, as well as non-timber species.
- Fuel wood and fodder plantations including pasture development for meeting biomass needs of the rural communities.
- In situ conservation of medicinal plant species and augmenting their plant population by undertaking plantation in the watershed.
- Raising of bamboo, cane plantations and medicinal plants.
- Raising of coastal shelterbelts in problem areas.
- Cultural operations like cutting back of existing root-stocks, tending, coppicing/pollarding, climber cutting, weed removal, soil working to encourage natural regeneration.
- Promotion of agro-forestry and sericulture etc., as appropriate.
- Wood substitution and fuel wood conservation measures such as distribution of fuel-efficient stoves.
- Measures needed to disseminate new technology such as use of root trainers for raising seedling in nurseries, mycorrhizal treatment of soils, clonal propagation of plants, etc.

### Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	National Afforestation and Eco Development Board, Ministry of Environment & Forests
2	Area covered	770,052 ha
3	Target group	Panchayat, Villagers and Forest Department.
4	Programme period and status	Ongoing
5	Financing pattern	100% central funding with some exceptions
6	Funding	Ministry of Environment and Forests - ₹ 10567.20 Million Approx. (USD 234.83 Million Approx.)

**For more information:** [http://www.naeb.nic.in/NAP\\_Guidelines.pdf](http://www.naeb.nic.in/NAP_Guidelines.pdf)

### 3 Soil Conservation in the Catchment of River Valley Project and Flood Prone River

#### Summary:

- This project is being implemented by the Ministry of Agriculture, and Department of Agriculture, State Governments of all the states.
- In November 2000 two earlier separate schemes - Soil Conservation in the Catchments of River Valley Projects (RVP), and Flood Prone Rivers (FPR) were merged and this scheme came into effect.
- In this project, all types of land - agriculture, wasteland, forest land - are treated in an integrated manner with suitable packages of treatment e.g. construction of Contour Vegetative Hedge, Contour/ Graded Bunding, Horticulture Plantation, Contour/ Staggered Trenching, Sowing and Planting of Plants, Silvi-Pasture Development, Pasture Development, Afforestation, Farm Pond, Percolation Tank, Drainage Line Treatment like Earthen Loose Boulder structures, Water Harvesting Structures, Check Bund, Spill-way, Sediment Retention Structures, etc.

*The treatment measures under RVP and FPR are essentially designed in the context of highly degraded areas of the catchments to prevent soil erosion, improve land capability, moisture regime, biodiversity and biological resource endowment.*

The Centrally Sponsored Scheme of soil conservation in the catchments of River Valley Projects was launched in 1962-63 for mounting a concerted effort at prevention of catchment deterioration. Whereas Flood Prone Rivers (FPR) project was started for proper catchment management of moderating peak floods and improvement of land resources and moisture regime and reduction of silt load in the channel flow affecting river beds in the Sixth Five-Year Plan (1980–1985).

These schemes were primarily meant for treating catchment areas with appropriate soil and water conservation measures to enhance the productivity of degraded lands, minimize siltation rates in reservoirs and reduce flood peaks in flood prone rivers. Thus both were merged and also been integrated under Macro Management of Agriculture.

#### Approach

The treatment of the watersheds is planned for a period of five years. The watershed is divided into

micro watersheds of 500 – 1000 ha, and the watershed development work is segregated on the basis of these micro watersheds.

The treatment of each micro watershed is phased over 3 to 5 years. Treatment measures for soil and moisture conservation and afforestation are planned in a synchronized manner so as to complete the treatment of the whole watershed within the planned period.

High priority is given to vegetative measures like afforestation, growing grasses and shrubs, agro-forestry, horticulture and planting fuel, fodder, timber and fruit trees species. Bio-diversity is the guiding principle in the 'greening' programme. Contour bunds, vegetative contour barriers, earthen contour bunds, check bunds along drainage lines from top downward, plantation along field boundaries as per the need of the site after discussions with the beneficiaries are adopted. Land shaping, terracing and leveling are avoided as they give rise to

## Objectives:

- Prevention of land degradation by adoption of multi-disciplinary integrated approach of soil conservation and watershed management in the catchment areas.
- Improvement of land capacity and moisture regime.
- Promotion of land use that matches land capacity.
- Prevention of soil loss from the catchments to reduce siltation of multipurpose reservoirs and enhance the in-situ moisture conservation and surface rain water storages in the catchments to reduce flood peaks and volume of runoff.

substantial soil erosion.

Multi-disciplinary approach, involving various line departments like Agriculture, Forests, Horticulture, Animal Husbandry, Minor Irrigation etc. is adopted at the district and project level while evolving programme measures and conducting farmer training.

Emphasis has been placed on entry point activities, transfer of technology, water harvesting structure in arid and semi arid regions, involvement of beneficiaries for planning, implementation and post care maintenance of assets created under the programme and collection of information for self appraisals.

The All India Soil and Land Use Survey Organization

(AIS&LUS) is engaged in the task of priority delineation and detailed soil survey for guiding the treatment of degraded areas and improving land capabilities.

Presently, this project is being implemented in 60 catchments having a total catchment area of about 114.44 million hectares out of which about 30 million ha is categorized as priority area, need urgent treatment spread across 27 States of the country.

## Achievements:

- Increase in Agricultural Yield – increase in the yield of agricultural crops varies from 2.7% to 76% in the watersheds treated under the programme.
- Increase in Cropping Intensity – cropping intensity has increased ranging from 85% to 115% in Matatila (Uttar Pradesh), Nizamsagar (Andhra Pradesh) and Ukai (Gujarat) catchments.
- Sediment Production Rate – has been reduced ranging from 17% to 94% in Matatila, Nizamsagar and Ukai catchments.
- Peak Rate of Runoff – reduction in runoff peak volume varies from 46.6 to 1.6% in different watersheds of Sahibi (Haryana) catchment.
- Ground Water Recharge – increase of water table in wells in the watershed area ranged from 1 to 2.5 metres.
- Employment Generation – employment generated due to watershed intervention ranges from 2.0 to 7.9 lakh person days in various watersheds treated under the programme.

## Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Ministry of Agriculture, Department of Agriculture of all states
2	Area covered	411,300 ha
3	Target group	District level organizations and individuals inhabiting the watersheds treated and those living downstream
4	Project period and status	Ongoing
5	Funding	Ministry of Agriculture, Department of Agriculture of all states – ₹ 3570.96 Million Approx. (USD 79.35 Million Approx.)

**For more information:** [www.agricoop.nic.in/Nrm/RVP.pdf](http://www.agricoop.nic.in/Nrm/RVP.pdf)

## 4 National Watershed Development Project for Rainfed Areas (NWDPPRA)

### Summary:

- National Watershed Development Project for Rainfed Areas (NWDPPRA) introduced by the Ministry of Agriculture in 1990-91 is based on the twin concepts of integrated watershed management and sustainable farming systems.
- The activities undertaken in these programmes include soil and moisture conservation measures like construction of check dams, water harvesting structures, desilting of village ponds, treatment of drainage lines/ gullies, land leveling, bunding of farms, treatment of problem soils, agro-forestry, agri-horticulture, silvi-pasture, organic farming, use of bio-fertilizers, value addition and marketing of produce through farmers groups, training and capacity building of stakeholders.
- The project provides flexibility in choice of technology, decentralization of procedures, provision for sustainability and ensures active participation of watershed community in the planning and execution for their watershed development programme

*This project is aimed at restoring ecological balance in degraded and fragile rainfed eco-systems and promoting diversified farming systems to enhance the income levels of farmers and village communities on a sustainable basis.*

Watershed development has evolved from an externally imposed purely technical intervention of the 1980s to a more participatory structured climate change action which local people help design and implement management plans. Also, the thrust is on low-cost, location specific technologies which are more knowledge-based and give room to local innovation rather than being capital and chemical intensive. It is not only a livelihood development programme for sustainable development but also a tool for gender development by encouraging, increasing participation of women as women play a central role in the management of natural resources.

Rainfed areas constitute about 85 mha, i.e. 60% of the total 142 mha net cultivated area in India. Rainfed agriculture is characterized by low levels of productivity and low input usage. Therefore, the National Agriculture Policy seeks to promote an

integrated and holistic development of rainfed areas through conservation of rain water and augmentation of biomass production through agro and farm forestry with the active involvement of the watershed communities.

Hence, highest priority is given to the holistic and sustainable development of rainfed areas through a watershed development approach. To give a special thrust to these areas the National Rainfed Area Authority (NRAA) was set up in November 2006.

### Main features

- Promotion of low-cost and eco-friendly technology.
- Integrated watershed management approach.
- Farming systems development.
- People's participation through suitable

## Objectives:

- Prevention of land degradation by adoption of a multi-disciplinary integrated approach of soil conservation and watershed management in the catchment areas.
- Conservation, development and sustainable management of natural resources including various uses.
- Enhancement of agricultural production and productivity in a sustainable manner.
- Restoration of ecological balance in the degraded and fragile rainfed ecosystems by greening these areas through appropriate mix of trees, shrubs and grasses.
- Reduction in regional disparity between irrigated and rainfed areas.
- Creation of sustained employment opportunities for rural communities including the landless.

institutional arrangements.

- Management of common property resources and cost-benefit sharing.
- Long-term sustainability.

## Main components are as following

- Treatment of arable and non-arable lands through various soil and watershed activities.
- Treatment of drainage lines.
- Production system in arable and non-arable lands.
- Livelihood support.
- Institution and capacity building.

## Achievements:

- Increase in groundwater recharge
- Increase in the number of wells and water bodies
- Enhancement of cropping intensity
- Changes in cropping pattern
- Higher yields of crops and reduction in soil losses

## Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Ministry of Agriculture and Departments of Agriculture of all the State Government
2	Area covered	907239 hectares
3	Target group	Watershed Users' Group, farmers, and villagers
4	Project period and status	Ongoing
5	Financing pattern	Central Vs State Ratio is 90:10 except for north eastern states where 100% funding is central
6	Funding	Ministry of Agriculture and Dept of Agriculture through sectoral budget support – ₹ 7672.69 Million approx. (USD 170.50 Million approx.)

**For more information:** <http://agricoop.nic.in/dacdivision/NWDPRA.pdf>

# 5 Fodder and Feed Development Scheme- component of Grassland Development including Grass Reserves

## Summary:

This Centrally Sponsored Fodder and Feed Development Scheme is being implemented by Department of Animal Husbandry, Dairying & Fisheries', Feed and Fodder Unit since April 2005. It includes four components.

- a. Establishment of Fodder Block Making Units
  - b. Grassland Development including Grass Reserves
  - c. Fodder Seed Production and Distribution.
  - d. Biotechnology Research Project
- As part of the Fodder and Feed Development Scheme, under component 2, emphasis is laid on grassland development including grass reserves.
  - The scheme envisages improvement of degraded grasslands and rehabilitation of problematic soils like saline, acidic and heavy soils through vegetation cover.

***Under this scheme, planting of specific grasses and legumes suitable for particular type of soil is promoted so that a vegetation cover may be provided to give fodder as well as to rehabilitate the degraded areas.***

The nutritive value of feed and fodder has a significant bearing on productivity of livestock. Due to increasing pressure on land for growing food grains, oil seeds and pulses, attention towards adequate fodder crops has reduced. Further, on account of diversified use of agriculture residues, the gap between the demand and supply of fodder is increasing. According to the report of working Group on Animal Husbandry and Dairying for Tenth Five Year Plan (2002–2007), the available fodder can meet the demand of only 46.7 percent of the livestock. Eleventh Five Year Plan (2007-2012) Working Group, National Bank for Agriculture and Rural Development (NABARD) and National Institute of Animal Nutrition and Physiology have also estimated shortage of feed and fodder in the country. This leads to enhanced pressure on village commons, community managed and other forest areas in the country.

To overcome this environmental pressure on land and forests, the Department of Animal Husbandry, Dairying and Fisheries has two schemes, namely

- 1) Central Fodder Development Organization and
- 2) Centrally Sponsored Scheme for Assistance to States for Feed and Fodder Development, which has grassland development as one of the components.

As part of the scheme, the fertility status of land is improved by introducing suitable legumes. Grasslands requiring regeneration through the process of natural recovery by closure/exclusion of biotic interference are also eligible for funding under the scheme. This involves fencing of the area, establishment of soil and moisture conservation structures to support natural regeneration such as contour bunding, furrowing, ploughing, fertilization, etc.

Photo: Prayatna samiti, Udaipur



**Grasslands development through community participation, Udaipur district, Rajasthan.**

Central Government provides 100% assistance to states to support proposals for improvement of grass lands, or even perennial fodder crop cultivation on individual fields, where farmers can make agreements with NGOs or SHGs to continue cultivations.

### Objectives:

- Improve the degraded grasslands by introducing suitable grass, legumes and fodder trees.
- Minimize the extensive erosion presently taking place in these lands.
- Minimize the bio-mass produced will help to minimize the gap between availability and requirement of fodder.
- Establish fodder banks, depots as reserves where the forage obtained from these lands will be stored.
- Enhance biomass production from grassland, which will be cheaper and will increase the animals' productivity.
- Increase fodder production through individual farmers.

### Achievements:

JFMC at the village level are encouraging. Some noteworthy features of this framework are as follows.

- Improvement of degraded grassland and also the vegetation cover of problematic soils like saline, acidic and heavy soil.
- Identification of specific fodder trees (silvi-pasture), grasses and legumes specific to soil type.

### Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture
2	Area covered	4,161 ha
3	Target group	State Departments of Animal Husbandry, Agriculture and Forest, Farmers , NGOs, Goshalas (cattle care centres), Self Help Groups
4	Project period and status	Ongoing
5	Financing pattern	100% central grant
6	Funding	Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture - ₹ 295.24 Million Approx. (USD 6.56 Million Approx.)

**For more information:** [http://www.naeb.nic.in/NAP\\_Guidelines.pdf](http://www.naeb.nic.in/NAP_Guidelines.pdf)

# 6 Command Area Development and Water Management (CADWM) Programme

## Summary:

- Command Area Development and Water Management (CADWM) programme implemented by Ministry of Water Resources, aims to bridge the gap between the irrigation potential created and that utilized. This is done through micro level infrastructure development, efficient farm water management practices for optimizing agricultural productivity and improving socio-economic condition of farmers.
- In 1974 initiated as Command Area Development Programme (CADP) aiming to improve irrigation potential utilization and optimize agricultural production from irrigated land through integrated and coordinated approach of efficient water management, it was revised and from 2004 a more comprehensive and integrated programme came into effect known as CADWM.
- It is a centrally sponsored scheme where the central government gives grant to the state governments for carrying out on-farm development and water management activities.

*It envisages integration of all activities relating to irrigated agriculture in a coordinated manner with a multi-disciplinary team under a Command Area Development Authority.*

CADWM is a programme being executed by Ministry of Water Resources. Some of the programme components are as follows.

- Survey, planning and designing of On-Farm Development (OFD) works;
- OFD works comprising construction of field channels and realignment of field boundaries;
- Construction of field, intermediate and link drains for letting out surplus water;
- Correction of system deficiencies above the outlet up to distributaries of 150 Cusec (4.25 cumec) capacity;
- Reclamation of water-logged areas including use of location specific bio-drainage techniques to supplement conventional techniques for reclamation of water-logged area;

- Training/adaptive trials/demonstrations through Water and Land Management Institutes (WALMI) and other Central/State institutions

Some other components supported under the programme include institutional support to Water Users' Associations R&D, Enforcement of Warabandi, Renovation and Desilting of Tanks, etc.

Participatory Irrigation Management (PIM) puts emphasis on optimal upkeep of irrigation systems and efficient utilization of water through maximizing involvement of beneficiaries in the process. PIM also helps to develop community responsibility to collect water charges and raise internal resources and to create a sense of ownership of a water and irrigation system among users. Under the CADWM programme, formation of Water Users' Associations is mandatory.

## Thrust Areas

- Beneficiary Participation in construction and O&M;
- Water Management above, at and below farm level;
- Reclamation of water-logged areas;
- R&D on Bio-drainage;
- Adaptive Trials/ Demonstrations and Training;
- Strengthened Monitoring and Evaluation Mechanism;
- Emphasis on Data Collection, Analysis and Dissemination.

## Achievements:

- 14 States viz. Andhra Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu and Uttar Pradesh have either enacted exclusive legislation or amended their Irrigation Acts for involvement of farmers in irrigation management. Other States are also taking steps in this direction.
- Water Users' Associations, numbering 56,539, have been formed in various States covering an area of 13.156 mha under various commands of irrigation projects.



Photo: CEE Photo Bank

**Moisture conservation at Rural Knowledge Centre, Halvad block, Surendranagar district, Gujarat.**

- 482 schemes of 9 States, namely, Bihar, Gujarat, Madhya Pradesh, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, Orissa and Uttar Pradesh have been approved for reclamation of 63566.49 ha water-logged area. Out of this, an area of 50,249 ha has been reported to be reclaimed by these States.

## Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Ministry of Water Resources
2	Aggregate no. of Projects presently	136 projects under implementation
3	Area covered	101410 ha
4	Target group	State Governments, Villagers, Farmers
5	Programme period and status	Ongoing
6	Funding	Ministry of Water Resources- ₹ 10151.30 Million Approx. (USD 225.58 Million Approx.) State Governments - ₹ 10151.30 Million Approx. (USD 225.58 Million Approx.) • Total: ₹ 20302.60 Million (USD 451.17 Million)

**For more information:** <http://mowr.gov.in/index2.asp?sublinkid=343&langid=1&slid=339>

# 7 National Rural Drinking Water Programme (NRDWP)

## Summary:

- National Rural Drinking Water Programme (NRDWP) is implemented by Department of Drinking Water Supply, Ministry of Rural Development is the fourth generation Drinking Water Supply programme which goes beyond the earlier approach of 'providing a water supply system in the village' to 'ensuring water supply security at the household level.
- It recommends adopting 'Wise Management of Water' for the equitable use, management and allocation of water for domestic purposes, which involves optimized use of both conventional and non-conventional water resources and focuses on both the 'water quality and water quantity', by providing solutions from the catchment to consumer.
- It lays major emphasis on ensuring sustainability of water availability in terms of potability, adequacy, convenience, affordability and equity while also adopting decentralized approach involving Panchayati Raj Institutions (Local Self Government) and community organizations.

***The goal is to provide every rural person with adequate water for drinking, cooking and other domestic basic needs on a sustainable basis. This basic requirement should meet certain minimum water quality standards and be readily and conveniently accessible at all times and in all situations.***

Government of India's effective role in the rural drinking water supply sector started in 1972-73 with the launch of Accelerated Rural Water Supply Programme (ARWSP), with a major thrust on ensuring provision of adequate drinking water supply to the rural community. In 1986-87, launch of the Technology Mission which stressed on water quality, appropriate technology intervention, human resource development support and other related activities marked the 2nd generation of water supply programmes. This was renamed as Rajiv Gandhi National Drinking Water Mission. Later in 2002, through the Swajaldhara Programme community participation was encouraged. NRDWP is more flexible and broad based which merges adequacy with quality and community participation.

## NRDWP – Sustainability

Ensuring sustainability is an important sub-mission for the success of water supply schemes, on a long-term basis.

- Sustainability funds for improving the source and system sustainability by augmenting drinking water resources.
- Ground water recharge through check dams, percolation tanks, etc., surface water impounding like ponds, etc., improvement of traditional water bodies, conversion of defunct bore wells into point source recharging systems can be taken up under this component.
- Convergence with MNREGS by planning funds required for excavation from MNREGS with

material component from NRDWP-Sustainability funds.

- Promoting use of new and renewable energy sources, wherever necessary
- Conjunctive use of ground-water, surface water and rainwater harvesting to ensure drinking water security
- Priorities to over-exploited, critical and semi-critical blocks identified by Central Ground Water Board (CGWB).
- 20% of funds provided under NRDWP to States for sustainability as 100% Central assistance.

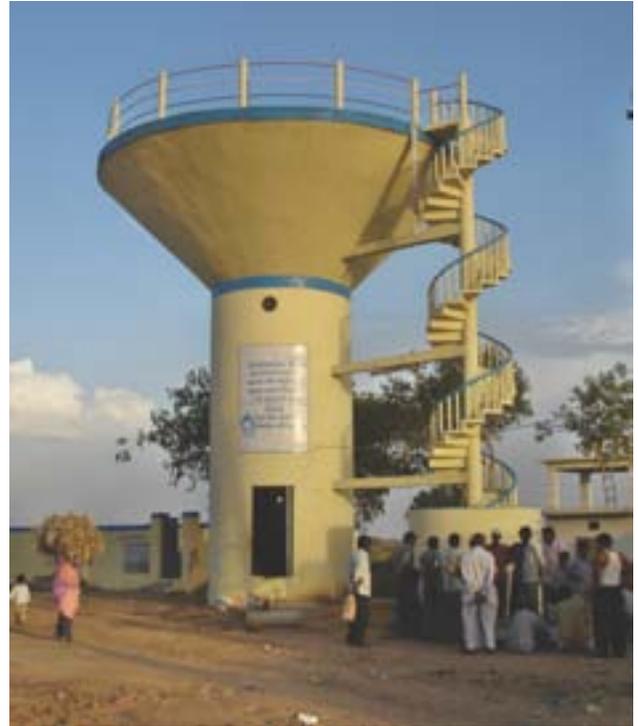


Photo: CEE Photo Bank

**Community-based rural drinking water facilities, Halvad block, Surendranagar district, Gujarat.**

### Objectives:

- Ensure permanent drinking water security in rural India.
- Ensure drinking water security through measures to improve/augment existing drinking water sources and conjunctive use of groundwater, surface-water and rain water harvesting based on village water budgeting and security plan prepared by the community/local government.
- Delivery of services by the system for its entire design period of quality of water in conformity with the prescribed standards at both the supply and consumption points.
- Enable communities to monitor and maintain surveillance on their drinking water sources.
- Ensure that all schools and *Anganwadis* have access to safe drinking water.
- Provide enabling environment for Panchayat Raj Institutions and local communities to manage their own drinking water sources and systems.
- Provide access to information through online reporting mechanism with information placed in public domain to bring in transparency, accountability and informed decision making.

### Achievements:

- Bringing awareness through Information, Education & Communication activities to address ownership of the systems, health hazards due to poor drinking water quality, hygiene, sanitary survey, importance of environmental sanitation, etc.
- Good institutional structure of State Water and Sanitation Mission, Rural Water Supply Dept., District Water and Sanitation Mission, Gram Panchayat, Village Water and Sanitation Committee and involvement of scientific institutions and civil society.
- Training 5 grassroots workers in each Gram Panchayat, who may be Accredited Social Health Activist, anganwadi worker, science teacher, high school girl child, Panchayat member, ex-serviceman, etc.
- Under the programme, provision of water testing kits for each Gram Panchayat was made. 100% financial assistance was provided to the states for this task.
- 86% of rural population have access to safe drinking water

About 1.15 million rural habitations are fully covered with access to safe and adequate drinking water

To meet the emerging challenges in the rural drinking water sector relating to availability, sustainability and quality, the components under the programme, activities therein and funding are as below:

No	Component	% of Funds allotted	Activities/Focus
1	Coverage	38%	For providing safe and adequate drinking water supply to un-served, partially served and un-served back habitations.
2	Water Quality	20%	Addressing water quality problems to enable rural community to have access to potable drinking water
3	Operation and Maintenance	10%	States/UTs on O&M of rural drinking water supply schemes
4	Sustainability	20%	Encourage States/ UTs to achieve drinking water security through sustainability of sources and systems. Implemented in the form of decentralized, community-managed, demand-driven programme on broad Swajaldhara principles wherein innovations will be encouraged
5	DDP Areas	5%	To tackle the extreme conditions of low rainfall and poor water availability. Can be used for bulk water transfer, treatment plants, distribution network in addition to in-village water supply infrastructure
6	Natural calamity	5%	Providing assistance to States/UTs to mitigate drinking water problems in the rural areas in the wake of natural calamities
7	Support	2%	Different support activities which will be required to be carried out in order to enable the rural communities to have access to assured availability of potable drinking water, use of advanced technology, viz. satellite data/ imageries; GIS mapping; MIS and computerization; etc.

### Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Department of Drinking Water Supply, Ministry of Rural Development
2	Area covered	National
3	Target group	Rural poor, Gram Panchayat ( local self government), line departments of State Governments
4	Programme period and status	Ongoing
5	Financing pattern	Varies as per the programme component
6	Funding	Department of Drinking Water Supply, Ministry of Rural Development - ₹ 197454.10 Million Approx. (USD 4387.87 Million Approx.) State Governments of all States of India – ₹ 387619.31 Million Approx. (USD 8613.76 Million Approx.) Total: ₹ 585073.41 (USD 13001.63)

**For more information:** [http://www.ddws.nic.in/popups/RuralDrinkingWater\\_2ndApril.pdf](http://www.ddws.nic.in/popups/RuralDrinkingWater_2ndApril.pdf)

# 8 National Project for Repair, Renovation and Restoration (RRR) of Water Bodies

## Summary:

- The National Project for Repair, Renovation and Restoration (RRR) of Water Bodies is implemented by Ministry of Water Resources, since January, 2005.
- Project emphasizes on de-silting in terms of quantum of silt to be removed, repair of conveyance system, strengthening of bund(s), repair of weirs and sluices, catchment treatment, command area development, soil erosion prevention works, quality control measures.
- The major benefits under this project is creation of additional irrigation potential, Increase in agriculture/horticulture/pisciculture production and productivity, increase in recharge of ground water, improvement in water use efficiency, increase in availability of drinking water, impact on water quality, promotion of tourism and culture.

*RRR as a state sector scheme aiming to upscale the gains from water bodies and create additional irrigation potential by repair, renovation and restoration of water bodies such as tanks, ponds and lakes.*

The Government of India sanctioned a Pilot Scheme for “National Project for Repair, Renovation & Restoration (RRR) of Water Bodies directly linked to Agriculture” in January, 2005 for implementation during the remaining period of Tenth Five year Plan (2002–2007) with the outlay of ₹ 3000 million to be shared by the Centre and the States in the ratio of 3:1. The scheme was sanctioned in respect of 1,098 water bodies in 26 districts of 15 states with a target to create 0.078 million ha of additional irrigation potential.

Keeping in view the success of the pilot scheme for RRR of water bodies and the need for a comprehensive programme to upscale the gains from water bodies, the Ministry has launched the scheme of RRR of Water Bodies as a State Sector scheme with domestic budgetary support, across the country.

The State may take up an RRR project for an individual or for a group of water bodies with sub-basin approach, having original irrigation culturable command area up

to 2000 ha or less, for drinking water, irrigation, pisciculture, tourism, ground water recharge or any other purposes. All public and community-owned water bodies may be covered under the project.

## Scope of Work

- De-silting in terms of quantum of silt to be removed,
- Repair of conveyance system,
- Strengthening of bund(s),
- Repair of weirs and sluices,
- Catchment treatment, command area development,
- Soil erosion prevention works
- Capacity building of implementing agencies aimed at sensitization of stakeholders, identification and selection of water bodies, preparation of Detailed Project Reports, monitoring and evaluation etc.

## Objectives:

- Comprehensive improvement of selected tank systems including restoration.
- Improvement of catchment areas of tanks.
- Community participation and self-supporting system for sustainable management for water bodies covered by the programme.
- Ground water recharge.
- Capacity building of communities, user groups standing committee for Panchayats and State Government/ Central Government Agencies concerned with the planning, implementation and monitoring of the project.
- Increase in storage capacity of water bodies.
- Improvement in agriculture/ horticulture productivity and increase in recharge of ground water in downstream areas of water bodies.
- Environmental benefits through improved water use efficiency, irrigation benefits through restoration of water bodies, supplementation of the groundwater use and promotion of conjunctive use of surface and ground water.
- Development of tourism, cultural activities, etc.
- Increased availability of drinking water.

## Convergence with other schemes

The project encourages convergence of the activities being undertaken with the efforts made under other programmes such as MGNREGS, watershed development programme, scheme of rural drinking water supply using common convergence guidelines or with the schemes of agriculture department aimed at generating additional irrigation potential and increasing water use efficiency; with schemes of ground water department and Central Ground Water Board aimed at ground water recharge, and with schemes of Drinking Water Supply Department of the State aimed at sustainability of drinking water sources.

## Implementation features:

The project lays high emphasis on local communities' participation at all stages: identification, planning, implementation and monitoring of RRR projects.

- Implementation of RRR projects is either by the local Panchayat or a Water Users' Association or a government agency identified by the District Level Implementing Agency.
- Project area, beneficiaries and capacity building components is decided by District Level Implementing Agency in consultation with concerned stakeholders including Panchayats at appropriate level.
- The Completion Plan is placed before the Gram Sabha and the Panchayati Raj Institution (PRI) concerned.
- The Standing/Sub-Committee of Gram Panchayat associated for the selection of works/site of the project and implementation of the project.
- Social audit of the project carried out by the Gram Sabha.

## Achievements:

- The project with external assistance will cover about 23,000 water bodies across the country with a culturable command area of 1.68 million ha.
- During 2009-10 the physical work for restoration has been completed in 1,054 water bodies in 15 states so far.
- The irrigation potential created subsequent to pilot project is approximately 0.173 million ha.
- The project of RRR of water bodies with domestic support envisages convergence with the Mahatma Gandhi National Rural Employment Guarantee Scheme of Ministry of Rural Development for which joint guidelines have been issued.
- Under the project of RRR of water bodies with external assistance, a World Bank Loan Agreement has been signed with Tamil Nadu for ₹ 21.82 billion to restore 5,763 water bodies having a Culturable Command Area (CCA) of 0.4 million ha.
- Under the project of RRR of water bodies with



**Restoration of water bodies in Banaskantha district, Gujarat.**

external assistance, a World Bank Loan Agreement has been signed with Andhra Pradesh for INR 8350 million for restoration of 3,000 water bodies with a CCA of 0.25 million ha.

- Under the project of RRR of water bodies with external assistance, a World Bank Loan Agreement has been signed with Karnataka for ₹ 2687.8 million

for restoration of 1,224 water bodies with CCA of 52,000 ha.

- Under the project of RRR of water bodies with external assistance, a World Bank Loan Agreement has been signed with Orissa for ₹ 4480 million for restoration of 900 water bodies having CCA of 0.12 million ha.

### Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Ministry of Water Resources, State Governments of States of Andhra Pradesh, Tamil Nadu, Orissa, West Bengal, Karnataka
2	Target group	Farmers, local communities
3	Project period and status	Ongoing
4	Financing pattern	25% central assistance and 75% state share. For North East states 90% central assistance and 10% states' share
5	Funding	Ministry of Water Resources – ₹ 10834 Million Approx. (USD 240.76 Million Approx.) World Bank Group (Loan) – ₹ 39142 Million Approx. (USD 869.82 Million Approx.) Total: ₹ 49976 Million (USD 1110.58 Million)

**For more information:** <http://mowr.gov.in/index2.asp?sublinkid=345&langid=1&slid=434>

# 9 The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)

## Summary:

- The National Rural Employment Guarantee Act (MGNREGA), notified on September 7, 2005 is implemented by Ministry of Rural Development.
- It is the first of its kind in the world where the Government is providing an economic safety net to 2/3 of the country's population, or 71.9 per cent India's rural poor with a legal guarantee to give work. Failing this, the person will be provided with a daily unemployment allowance (one third to one half of the minimum wage). If employment or compensation is not given, the concerned person has the right to seek judicial intervention to ensure his/her rights.
- It is a demand-driven scheme where local community can take charge of deciding the kind of eco-regeneration activities that they would like to take up in their villages, which would also provide employment for themselves.
- The choice of works suggested in the scheme addresses causes of chronic poverty like drought, deforestation, soil erosion etc so that the process of employment generation is on a sustainable basis.

***MGNREGS aims at enhancing the livelihood security of people in rural areas by guaranteeing hundred days of wage-employment in a financial year to a rural household whose adult members volunteer to do unskilled manual work. The Act also seeks to create durable assets and strengthen the livelihood resource base of the rural poor.***

The MGNREGS is a radical step that is expected to significantly reduce rural poverty and hunger. It guarantees one hundred days of employment at a certain minimum wage as a matter of right rather than as a privilege. This makes it much different from all previous employment generation programmes.

The MGNREGS requires every state government to formulate an “employment guarantee scheme” (EGS).

The Act ensures that there is decentralized planning. A perspective plan is to be prepared for the whole district, which would provide a shelf of projects to be maintained by the Programme Officer, based on proposals from Gram Panchayats/ Intermediate Panchayats/ District Panchayats. Each Gram Panchayat

proposal should have recommendation of the Gram Sabha. A list of permissible works is given in Schedule I of the Act. The Act includes various provisions for transparency and accountability, such as regular social audits by the Gram Sabhas, mandatory disclosure of muster rolls, public accessibility of all EGS documents, regular maintenance of job cards, etc.

### **Role of MGNREGS in combating desertification:**

MGNREGS possesses tremendous potential to initiate developmental works across various sectors. It also provides an opportunity to create durable assets and regenerate degraded ecological resources to enhance livelihood security within their own villages. The field level experiences from arid/semi-arid tracts in the

## Type of works permitted

1. Water Conservation and Water harvesting;
2. Drought proofing (including afforestation and tree plantation);
3. Irrigation canals including micro and minor irrigation works;
4. Provision of irrigation facility, horticulture plantation and land development facilities;
5. Renovation of traditional water bodies including desilting of tanks;
6. Land development;
7. Flood control and protection works including drainage in waterlogged areas;
8. Rural connectivity to provide all weather access; and
9. Any other work which may be notified by the central Government in consultation with the State government.

country reinforce the view that ecological restoration is the key to livelihood improvement in these regions.

Thus MGNREGS breaks the vicious nexus between poverty-pressure on natural resources and desertification. Examples are seen across India, especially in the tribal belt of central India, where earthen dams on common land have recharged wells of those poor farmers who earlier worked as

labourers to build these dams.

Looking at the inter-sectorality of the Act, convergence guidelines have been developed for MGNREGS and various programmes/projects on sustainable forest management, sustainable land management, sustainable agriculture etc aimed to combat desertification, by concerned ministries like Ministry of Environment and Forests, Ministry of Agriculture,



Photo: VIKSAT, Ahmedabad

**Wage employment through community asset building, Khedbrama block, Sabarkantha district, Gujarat.**

Ministry of Rural Development, Ministry of Water Resources.

### Achievements:

- MGNREGS has aided in enhancement of agricultural productivity (through water harvesting, check dams, ground water recharging, improved moisture content, land development, checking soil erosion and micro irrigation).

- MGNREGS has aided in the stopping of distress migration, increased access to markets and services through rural connectivity works, supplementing household income, increase in women workforce participation ratios, and the regeneration of natural resources.
- 1,882,000 water conservation works taken up during 2007-2010.



Photo: VIKSAT, Ahmedabad

**Water harvesting structure under MGNREGS, Khedbrama block, Sabarkantha district, Gujarat.**

Facts and Figures (2007 - 2010)		
1	Nodal/Implementing Agency	Ministry of Rural Development
2	Target group	Individuals - the unemployed person, rural poor Gram Pachayats (village local government)
3.	No of beneficiaries	64,249,000
4	Programme period and status	Ongoing
5	Funding	Ministry of Rural Development - ₹ 760566 Million Approx. (USD 16901.47 Million Approx.) All the State Governments – ₹ 84507.33 Million Approx. (USD 1877.94 Million Approx.)
•		Total: ₹ 845073.33 Million (USD 18779.41 Million)

**For more information:** [http://www.nrega.net/csd/convergence-guidelines/33\\_44.pdf](http://www.nrega.net/csd/convergence-guidelines/33_44.pdf)

# 10 Swarnjayanti Gram Swarojagar Yojna (SGSY) / National Rural Livelihood Mission (NRLM)

## Summary:

- Swarnjayanti Gram Swarojagar Yojna (SGSY) (Rural Self-employment Scheme) of Ministry of Rural Development aims to create self-employment through organizing the poor into Self Help Groups (SHGs). To bridge the gaps and build on the learning and best practices in SGSY has approved restructuring of SGSY as National Rural Livelihood Mission (NRLM) to be implemented across the country in a mission mode.
- NRLM endeavours, through its dedicated sensitive support structures and organizations at various levels, to reach out to all the rural poor households and take them out of poverty by building their capacities, financial muscle and access, and self-managed self-reliant institutions through placement in jobs, and/or nurturing them into remunerative self-employment and enterprises.
- NRLM also lays great emphasis on convergence with other programmes such as Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) or Integrated Watershed Management where the institutions of the poor built through NRLM would be facilitated towards their participation in those programmes and getting rightful entitlements.

*The core belief of NRLM is that the poor have a strong desire and innate capabilities to come out of poverty.*

The programmes directly target poor families for creation of assets and self employment started with Integrated Rural Development Programme (IRDP) in 1980, which was transformed into Swarnjayanti Gram Swarozgar Yojana (SGSY) in 1999. Through SGSY, out of 70 million rural households 25 million have been linked through SHGs, but still 45 million remain unlinked. Also, existing SHGs need further strengthening and more financial support. To achieve this SGSY has been restructured as National Rural Livelihood Mission (NRLM) in a mission mode:

“To reduce poverty by enabling the poor households to access gainful self-employment and skilled wage employment opportunities, resulting in appreciable improvement in their livelihoods on a sustainable basis, through building strong grassroots institutions of the poor.”

The mission mode enables a shift from the present allocation-based strategy to a demand-driven

strategy, enabling the states to formulate their own livelihoods-based poverty reduction action plans with a focus on targets, outcomes and time-bound delivery. It works on three pillars

- Enhancing and expanding existing livelihoods options of the poor;
- Building skills for the job market outside;
- Nurturing self-employed and entrepreneurs (for micro-enterprises).

## Achievements:

- Since inception 14.60 million beneficiaries of the programme.
- Since inception 3.80 million Self Help Groups (SHGs) supported.
- During 2007-10 year, 1,259,477 Self Help Groups were formed and 4,360,515 Self Help Groups were assisted.

## Guiding Principles:

- Social mobilization and building strong institutions of the poor is critical for unleashing the innate capabilities of the poor.
- An external dedicated and sensitive support structure is required to induce social mobilization, institution building and empowerment process.
- Facilitating knowledge dissemination, skill building, access to credit, access to marketing, and access to other livelihoods services underpins this upward mobility.

## Approach



## Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Ministry of Rural Development
2	Target group	Individual rural poor
3	Programme period and status	Ongoing
4	Funding	Government of India Consolidated Fund – ₹ 63790 Million approx. (USD 1417.56 Million Approx.) State Governments – ₹ 21263.33 Million Approx. (USD 472.52 Million Approx.) Total: ₹ 85053.33 Million (USD 1890.07 Million)

**For more information:** [www.rural.nic.in/latest/NRLM\\_lattest\\_13092010.pdf](http://www.rural.nic.in/latest/NRLM_lattest_13092010.pdf)

# 11 National Biogas and Manure Management Programme

## Summary:

- The National Biogas and Manure Programme is implemented by the Ministry of New and Renewable Energy.
- Originally in 1981 National Project on Biogas Development was initiated to satisfy the rural energy demand for clean fuel, which has been restructured as the current project.
- This programme lays special emphasis on meeting rural energy needs along with providing quality manure, by investing in setting up large scale and household scale biogas plants with possible Clean Development Mechanism (CDM) benefits.

*It seeks to involve multiple agencies such as Biogas-Fertilizer Companies/ Entrepreneurs, Banks, Indian Renewable Energy Development Agency (IREDA), financial institutions, Self-Help Groups, Cooperatives and NGOs in addition to State Government Nodal Departments/ Implementing Agencies and Khadi and Village Industries Commission.*

Diminishing forests and a burgeoning, mainly rural biomass-dependent population necessitates a coordinated effort of rural India to supply itself with a dependable and sustained source of energy. Biogas, the gas created as a product of anaerobic digestion of organic materials, is one such sustainable clean energy supply, especially for rural population dependent on agriculture and animal husbandry.

The programme also has provision for financial support towards maintenance of old biogas plants, and supporting Biogas Development and Training Centres for providing technical training, monitoring and evaluation, and preparation of technical booklets/ guidelines/ material support for quality implementation of biogas programme in addition to technology development. The programme strongly emphasizes on community participation in need identification for the plants and relies on biogas-fertilizer companies, entrepreneurs and turn-key workers for actual installation of plants, minimizing the role of state and nodal agencies to communication,

raising awareness, quality control and training.

## Some of the important benefits of biogas include:

- Energy for cooking and lighting substituting fuel wood, dung, electricity or diesel.
- Used to power engines, in a dual fuel mix with petrol and diesel.
- Residual slurry has superior nutrient qualities over the cattle dung.
- Human waste can also be utilized to produce biogas, which can be an economically and environmentally safe decentralized human waste disposal system.
- By providing an alternative to fuel wood biomass it can help in reducing pressure on degrading forest lands and village commons.
- In many rural communities, fuel wood collection makes up a considerable part of women's daily

workload, which can be reduced through biogas.

- A clean and particulate-free source of energy also reduces chronic diseases such as respiratory infections, ailments of the lungs, bronchitis, asthma, lung cancer etc.
- Significant reductions in emissions associated with the combustion of bio-fuels, such as sulphur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), carbon monoxide (CO), Methane (CH<sub>4</sub>) etc.



Photo: CEE Photo Bank

**Household level model of biogas plant, Ramgadh block, Alwar district, Rajasthan**

### Objectives:

- Provide clean fuel mainly for cooking purposes and also for other applications for reducing the use of LPG and other conventional fuels.
- Meet 'lifeline energy' needs for cooking as envisaged in 'Integrated Energy Policy'.
- Provide bio-fertilizer / organic manure to reduce use of chemical fertilizers.
- Mitigate drudgery of rural women, reduce pressure on forests and accentuate social benefits.
- Improve sanitation in villages by linking sanitary toilets with biogas plants.
- Mitigate Climate Change by preventing carbon and methane emissions.

### Achievements:

- Up to June 2010, over 4.3 million biogas plants have been set up since inception.
- The Ministry took up a new initiative for bottling of biogas to demonstrate an integrated technology package in an entrepreneurial mode on medium size (200-1000 cum/day) mixed feed biogas-fertilizer plants for generation, purification/enrichment, bottling and piped distribution of biogas.
- Eight mixed feed biogas-fertilizer plants (BGFP) projects with aggregate capacity of 5,700 cum/day have been sanctioned in the States of Bihar, Chhattisgarh, Gujarat, Haryana, Karnataka, Maharashtra and Punjab.
- 317,000 biogas plants installed during 2007-10

### Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Ministry of New and Renewable Energy
2	Target group	Rural communities and particularly rural women
3	Programme period and status	Ongoing
4	Funding	Ministry of New and Renewable Energy - ₹ 2320.08 Million Approx. (USD 51.56 Million)

**For more information:** [www.mnre.gov.in/adm-approvals/biogasscheme.pdf](http://www.mnre.gov.in/adm-approvals/biogasscheme.pdf)

# 12 Biomass Energy and Cogeneration (Non-bagasse) in Industry

## Summary:

- The Ministry of New and Renewable Energy is implementing a programme on “Biomass Energy and Cogeneration (non-bagasse) in Industries” for exploiting the vast potential of thermal energy and power for captive use in industry and captive electricity requirement of institutions.
- Simultaneous production of power and thermal energy from a single fuel source is termed as cogeneration. The power generated from such cogeneration plants can be used for meeting the captive requirements, and the surplus power produced can be exported to the grid.

*The programme encourage the deployment of biomass co-generation (non-bagasse) systems in industry for meeting thermal and electrical energy requirements and create awareness about the potentials and benefits of alternative modes of energy generation in industry.*

The industrial sector today consumes approximately 35% of total electricity generated in the country. In the absence of good quality and reliable power from the State Electricity Boards, they are increasingly generating their own power, largely through diesel generators or are meeting their thermal energy requirements through captive means utilizing fossil fuels such as coal, oil or natural gas. As fossil fuels are limited and have adverse environmental impacts the use of non-conventional energy sources including biomass resources from energy plantations or crop residues and agro-industrial wastes for generation of energy in industries is being encouraged for meeting their partial / total requirements for both electrical and thermal energy.

Several industries require electrical as well as thermal energy for their operations. These requirements can either be met through different energy sources, or from a single source which is capable of generating electricity as well as producing thermal energy. It has been estimated that there is a potential for generation of about 15,000 MW through co-

generation in various core industries in the country, including sugar industry. In particular, there is a significant potential in breweries, caustic soda plants, textile mills, distilleries, fertilizer plants, paper and pulp industry, solvent extraction units, sugar mills, rice mills, petrochemical plants, etc. Similarly, there is a good potential for deployment of gasifier systems for the generation of electricity / heat in various industries such as bakeries, food processing, silica / ceramics, rice mills, steel re-rolling / scrap, refractories, cold storages, etc. for meeting their captive energy requirement of both heat and power. The gasifiers can also be installed for meeting their captive electricity requirement.

The Ministry continued implementation of the programme on Biomass Energy and Cogeneration (non-bagasse) in India for exploiting the potential of thermal energy and power for captive use in industry and institutions by providing capital subsidy on reimbursement basis after commissioning of the projects ranging from ₹ 0.2 million to ₹ 1.5 Million per 100 KW project based on biomass gasifier systems,

## Objectives:

- Encourage the deployment of biomass co-generation (non-bagasse) systems in industry for meeting thermal and electrical energy requirements.
- Promote decentralized / distributed power generation through supply of surplus power to the grid.
- Conserve the use of fossil fuels for captive requirements in industry.
- Bring about reduction in greenhouse gas emissions in industry.
- Create awareness about the potential and benefits of alternative modes of energy generation in industry.

and ₹ 2 million per MW for biomass, co-generation projects (non-bagasse), depending upon the type of project.

There is a huge potential of cogeneration in bigger rice mills producing parboiled rice, and of replacing diesel by gasifiers using rice husk in small rice mills. These are in hundreds. A rice mill of one ton per hour capacity can save about 25,000 litres of diesel in a year. The Ministry is trying to take this up in a mission mode in Bihar, Orissa, eastern Uttar Pradesh and West Bengal. In addition to the above, eleven projects aggregating up to 50 MW capacity project are under

installation in Bihar, Haryana, Punjab, Uttar Pradesh and West Bengal.

## Achievements:

- A total of 1,411 MW biomass cogeneration (non-bagasse) projects have been set up in the country.
- 1060 MW generation capacity based on biomass was installed during 2007-10



Photo: [http://www.ashdenawards.org/media/international\\_photos/2009](http://www.ashdenawards.org/media/international_photos/2009)

**Biomass Gasifier**

## Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Ministry of New and Renewable Energy
2	Programme period and status	Ongoing
3	Funding	Ministry of New and Renewable Energy – ₹ 476.46 Million Approx. (USD 10.59 Million Approx.)

**For more information:** <http://mnre.gov.in/biomass-energyco.htm>

# 13 Biomass Gasifier Programme

## Summary:

- Biomass Gasifier Programme is implemented by the Ministry of New and Renewable Energy for
  - ◆ off-grid power projects for meeting un-met demand of electricity in electrified villages; and
  - ◆ grid interactive MW level power project with 100% producer gas engine.
- Biomass gasification is the process of conversion; through partial combustion of solid biomass feed material, into combustible gas. The technology may be regarded as fuel-switching to convert solid fuel to gaseous fuel.
- Gasification is achieved in the presence of heat and a limited supply of oxygen, resulting in incomplete combustion of the solid biomass material. The resulting combustible gas mixture can be burnt directly in an oven/burner for thermal applications or cooled, cleaned and fed into a diesel engine to generate electricity.

## *Programme aims to promote biomass gasifier systems for meeting un-met demand of electricity in villages*

In India, reaching a large number of scattered rural population, especially in the remote hilly areas, through conventional power grid is economically and environmentally expensive. At the same time maintenance and repair work is also difficult in such circumstances. Biomass gasifier can provide an economically viable and environmentally safe, community-driven decentralized option for electrification of those areas. Some of the major benefits of the programme include:

- Off-grid power for meeting un-met demand of electricity in electrified villages; and Grid interactive MW level power project with 100% producer gas engine with locally available woody and non-woody biomass resources.
- Meeting electricity needs for water pumping and other electrical applications on decentralized basis from various types of woody and non-woody biomass available in villages.

The programme is implemented through State Nodal Agencies with the involvement of Energy Service

Companies, Co-operatives, Panchayats, NGOs, manufactures or entrepreneurs etc. Central financial assistance is routed through State Nodal Agencies.

## Achievements:

- 125 MW capacity biomass gasifiers have been installed in various industries such as bakeries, die-casting and food processing units and also in the villages.
- 39.47 mega watt of installed capacity was achieved during 2007-10

## Objectives:

- Deploy biomass gasifier systems for meeting un-met demand of electricity in villages.
- Take up demonstration projects for 100% producer gas engine, coupled with gasifier for off grid and grid power operation.
- Support and enlarge activities, through awareness creation, publicity measures, seminars/workshops/ business meets/ training programme etc.

Photo: <http://www.ingvar.is/Plants/LeanFisly/Biomass/BiomassFiring.html>



**Biomass Gasifier**

<b>Facts and Figures (2007 - 2010)</b>		
1	Nodal/Implementing Agency	Ministry of New and Renewable Energy
2	Target group	Individual households and village community, Cottage industries, small scale industries, public utility etc.
3	Programmet period and status	Ongoing
4	Funding	Ministry of New and Renewable Energy - ₹ 392.40 Million Approx. (USD 8.72 Million Approx.)

**For more information:** [mnre.gov.in/press-releases/press-release-16022010.pdf](http://mnre.gov.in/press-releases/press-release-16022010.pdf)

# 14 Solar Photovoltaic (SPV) Programme

## Summary:

- The Solar Photovoltaic (SPV) Programme of the Ministry supports development of SPV technology in the country and helps in countrywide demonstration of various photovoltaic applications
- Solar Photovoltaic technology converts solar energy to electricity which can then be utilized to meet electricity requirements of community or industry as the case may be.
- The Indian SPV programme is one of the leading programmes in the world for decentralized applications of photovoltaic technology.

*It aims to promote the use of SPV systems for lighting and various other applications in the country, create awareness and demonstrate effective and innovative use of SPV systems for individual/ community/ institutional applications.*

India receives solar energy equivalent to over 5,000 trillion kWh per year. The daily average solar energy incident varies from 4 -7 kWh per square meter depending upon the location. There are about 300 clear sunny days in most parts of the country. Solar energy can be harnessed through two routes, namely solar photovoltaic and solar thermal, by direct conversion to electricity and heat energy respectively.

SPV technology converts sunlight into DC electricity without any moving parts and has been providing power for various applications including lighting, water pumping, computers, telecommunications, etc. Stand-alone SPV power plants in rural and other areas are providing power for electrification and running electrical equipments, which require reliable uninterrupted power supply. Grid connected SPV power-generating systems are being installed for augmenting the grid. SPV power plants have also been set up at the tail end of grid in rural areas to strengthen the rural grid. SPV roof top power plants are also being used for diesel savings in urban areas.

During the last three decades, the country has developed a strong research base as well as

indigenous production capabilities for the manufacture of solar cells, modules and a wide range of SPV systems. The Programme provides Central Financial Assistance to Implementing Agencies for deployment of SPV systems and related activities. Emerging SPV applications and new applications of SPV technology and specific joint projects with other Ministries/Departments, autonomous Government bodies and other organizations supported on case-to-case basis. The Ministry depending upon their utility also support SPV systems for community use in areas affected by natural calamities. Specific decentralized systems/ applications supported under the programme include,

- Solar Home Lighting Systems
- Solar Street Lighting Systems
- Traffic Signals
- SPV Blinkers
- SPV Illuminating Hoardings/Bill boards
- SPV Power Packs
- Stand-alone SPV Power Plants
- SPV Rooftop Systems for Diesel saving in Urban Areas

## Objectives:

- Promote the use of SPV systems for lighting and various other applications in the country.
- Create awareness and demonstrate effective and innovative use of SPV systems for individual/ community/ institutional applications.
- Save diesel for power generation in institutions and other commercial organizations.
- Support SPV promotional activities such as seminars, symposia, training, awareness campaigns, human resource development, etc.

## Achievements:

- Over 14 lakh SPV lighting systems, mostly in rural areas have been set up.
- 429597 numbers solar photovoltaic systems were established during 2007-10



Photo: CEE Photo Bank

Water lifting by solar photovoltaic system, Kakshala, Dang district, Gujarat.

## Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Ministry of New and Renewable Energy
2	Area Covered	Entire nation
3	Target group	Individuals, Institutes, Civic bodies and Communities
4	Programme period and status	Ongoing
5	Funding	Ministry of New and Renewable Energy – ₹ 173.78 Million Approx. (USD 3.86 Million Approx.)

**For more information:** : <http://mnre.gov.in/spv-prog.htm>

# 15 Desertification Monitoring and Assessment: Desertification Status Mapping

## Summary:

- To develop an action plan and for further micro-level planning to combat desertification, it is of critical importance to first understand the extent of desertification and monitor its rate across the country.
- Thematic Programme Network 1 (TPN-1), on 'Desertification Monitoring and Assessment', is one of the six thematic programme areas identified as part of Asian Regional Action Programme (RAC) under UNCCD. Space Applications Centre (SAC), Indian Space Research Organisation (ISRO), Ahmedabad has been the national focal organization to coordinate TPN-1 activities in the country.
- One of the mandatory tasks under TPN-1 was to prepare Desertification Status Mapping (DSM) at national and regional levels, which could be integrated to generate the desertification status map of the world.

*This is the first spatial inventory on desertification/land degradation carried out at national level for entire country giving information on various land degradation processes and their severity. It serves as a baseline data for future monitoring, including the impact of UNCCD implementation.*

The first pilot project on Desertification Status Mapping (DSM) at 1:50,000 scale funded by Ministry of Environment and Forests was carried out mainly to standardize the methodology, indication and classification system for the entire country, involving 15 different agencies. This second project followed with a nation-wide inventory of desertification status at 1:500,000 scale, using satellite data. It was funded by Department of Space, Ministry of Science and Technology.

This national task has been executed by Space Applications Centre in collaboration with several Science and Technology Institutions listed in following page.

## Methodology

The national classification system for DSM was evolved and standardized through a pilot project and adopted for final work. IRS-P6 (Resourcesat) AWiFS geo-coded False Colour Composite data were analysed using visual interpretation techniques to

generate DSM on 1:500,000 scale. Details of the methodology are described in the flow diagram (Figure 1).

Base maps prepared using the Survey of India topographical maps on 1:250,000 scale and the satellite images were used while analysing satellite data.

Base features like road, rail, habitation and drainage were taken from satellite imagery whereas forest boundaries were taken from topographical maps for preparing base maps.

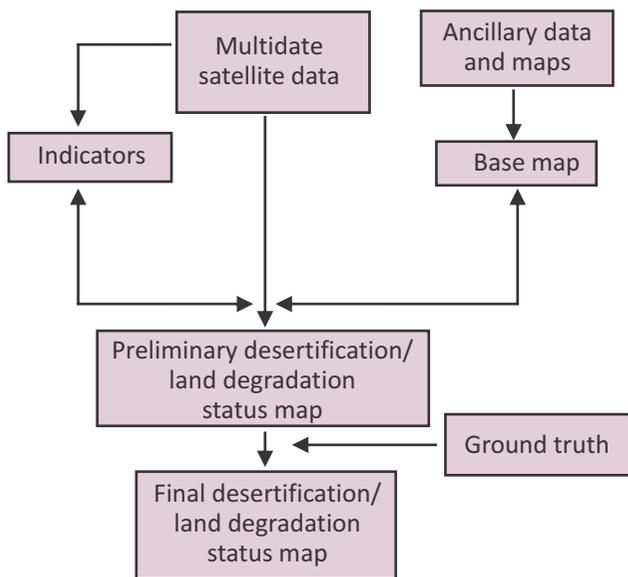
Ground truth data collected from various places spread throughout the country were used to finalize the maps.

The final DSM mylars were vectorized and put on a national spatial frame work. The seams were removed from adjacent map sheets to prepare seamless map for states and finally for the country. DSM prepared for India has been included in chapter

1 of this report. The map shows spatial distribution of land degradation along with land use/land cover classes for the entire country.

This study provided baseline data on desertification/land degradation for the country and will be useful for future monitoring of desertification. State wise digital data base has been prepared and is available for the desertification and land degradation status map for the entire India at MoEF website, and through National Resource Data Base, ISRO.

Through the execution of these projects a large number of scientists/research fellows/students have been trained on mapping and assessment of desertification. The skill developed by these people through the training and experiences received from the DSM project can be utilized for further mapping and monitoring desertification and land degradation in future.



Methodology for preparation of desertification status map

## Achievements:

- Desertification & Land Degradation Map of India and an Atlas published. The Atlas provides state wise information and is the baseline information on the whole country

- Establishing the end-to-end method of Desertification Status Mapping using satellite data, this can be followed by other countries to assess the state of desertification/land degradation in their respective states/provinces/country.
- This map will be used for future monitoring and determining the status of desertification as well as impact of implementation of the strategic objectives of UNCCD.

## Collaborating Agency

- Central Arid Zone Research Institute (CAZRI), Jodhpur;
- National Bureau of Soil Survey and Land Use Planning (NBSSLUP), Bangalore;
- All India Soil and Land Use Survey, Delhi;
- Remote Sensing Applications Centre of states of Madhya Pradesh, Uttar Pradesh, Jharkhand, Orissa, Arunachal Pradesh, Maharashtra and Bihar;
- Birla Institute of Technology, Mesra, Ranchi;
- Jammu University, Jammu;
- Jawaharlal Nehru University, New Delhi;
- University of Rajasthan, Jaipur;
- Institute of Remote Sensing, Anna University, Chennai;
- Directorate of Environment and Remote Sensing, Srinagar;
- Earth Observations System, ISRO, Bangalore,
- National Remote Sensing Agency, Department of Space; and
- Regional Remote Sending Centre, Department of Space.

Photo: Seva Mandir, Udaipur



**A vast patch of degraded forest land, Udaipur district, Rajasthan.**

<b>Facts and Figures (2007 - 2010)</b>		
1	Nodal/Implementing Agency	Space Applications Centre (SAC) - Indian Space Research Organisation (ISRO)
2	Area covered	Entire nation
3	Target group (involved in process)	State level Space Applications Centres; Universities and Research Institutes; State Govt. departments; Implementation agencies responsible for arresting land degradation and combating desertification
4	Project period and status	1 April 2001- 31 March 2008
5	Funding	Ministry of Environment and Forests – ₹ 13.80 Million Approx. (USD 0.31 Million Approx.) Department of Space – ₹ 2.60 Million Approx. (USD 0.06 Million Approx.) Total: ₹ 16.40 Million (USD 0.36 Million)

**For more information:** Space Applications Centre (SAC), Jodhpur Tekra, Ahmedabad – 380 015, Gujarat, India, Email: [pro@sac.isro.gov.in](mailto:pro@sac.isro.gov.in), Website- <http://www.sac.gov.in/index.html>

# 16 Arid Zone Research

## Summary:

- To arrest degradation process and for scientific and sustainable management of the resources in the arid zone, a Desert Afforestation Station was established in 1952 at Jodhpur. It was upgraded to Central Arid Zone Research Institute (CAZRI) in 1959 under the Indian Council of Agricultural Research (ICAR), Ministry of Agriculture.
- CAZRI operates through seven Divisions, located at the headquarters in Jodhpur. There are four Regional Research Stations located in different agro-climatic zones to work on location-specific problems.
- There are several technologies released for adoption. Some of the examples include sand dune stabilization, shelterbelt plantation, soil and water conservation, improved agro-forestry systems, management of cropland, pasture and range areas, management of saline-sodic soils, rehabilitation of mine spoils, wind erosion control, water harvesting, dryland farming, arid horticulture, other alternative land use strategies, pest management, livestock management and energy management, and disseminating the developed technologies to the stakeholders.

*Arid zone research contributes to the development of sustainable farming systems in arid ecosystems, with CAZRI being the repository of information on the state of natural resources and desertification process and its control, in the form of digital database and as a centre of learning for arid land management technologies.*

CAZRI is a unique multi-disciplinary institute that evolves solutions/ technologies to address the problems of arid region, demonstrates their viability through on-station as well as on-farm research, and trains/advises stakeholders for their large-scale adoption in the region.

CAZRI was the collaborating institute in Thematic Programme Network 1 (TPN-1), on 'Desertification, Monitoring and Assessment', which is one of the six thematic programme areas identified as part of the Asian regional action programme under UNCCD.

CAZRI is the nodal institution for implementation of TPN-2 and its Director is currently functioning as the Task Manager for facilitating establishment and functioning of TPN-2 "Agroforestry Management and Soil Conservation in Arid, Semi-arid and Dry Sub-

humid areas" in collaboration with four other institutions.

It also provides regular training and demonstration to farmers, state officials, NGOs and other stakeholders, for which it has a small Extension Wing and two Krishi Vigyan Kendras (KVK). The institute also hosts the Arid Ecosystem Directorate for a major network project of the country, called National Agricultural Technology Project, as well as the All India Coordinated Projects on rodents, arid legumes, etc., in which several institutes and agricultural universities of the hot and cold arid regions are effectively participating.

The various divisions of CAZRI are

- Natural Resources and Environment
- Integrated Land Use Management and Farming Systems

- Plant Improvement, Propagation and Pest Management
- Livestock Production Systems and Range Management
- Agricultural Engineering for Arid Production Systems
- Transfer of Technology, Training and Production Economics

### Regional Research Stations

1. Regional Research Station, Bikaner, was established during 1957 with the aim to act as a centre for demonstration, experimental afforestation, and soil conservation. The station was also given the responsibility of sand dune stabilization.
2. Regional Research Station, Kukma, Bhuj, was established in the year 1987.
3. Regional Research Station, Jaisalmer focusing on *Lasiurus sindicus* (Sewan grass)-based silvipastoral system, Khadin water harvesting system, water management (ground water and canal), Environmental Impact Assessment (EIA) and biodiversity conservation, and seed production of trees and grasses.
4. Regional Research Station, Pali focuses on management of saline/sodic water, R&D for location specific farming systems and seed production of grasses and trees.

CAZRI is also an ENVIS (Environmental Information System) Centre on 'desertification' by the Ministry of Environment and Forests, Govt. of India, New Delhi, in 1991. The main objectives are to build up a repository of information on desertification, establish linkages with all information agencies concerning desertification within and outside the country, disseminate information, respond to users' queries, especially of policy makers and planners, scientists, researchers and community members.

### Achievements:

- Research results of CAZRI in understanding desertification processes and developing mitigation technologies include mapping and monitoring of desertification in the arid lands of western India, notably for the first UNEP

Conference on Desertification in 1977, and also to coincide with the Earth Summit in 1992.

- The 2006 mapping for the first national map on land degradation shows that out of the 28.5 mha area in Rajasthan and Gujarat 87% area is degraded, mainly by wind (57%) and water (13%) erosion.
- CAZRI's technology on sand dune stabilization through vegetative means has been used by the State of Rajasthan to stabilize more than 400,000 ha area of menacing sand dunes.
- Technologies have also been developed for shelterbelts, border row plantation, and tree/shrub belts alternating with crop/grass rows to utilize local resources for food, fuel, fodder, fruits, and minor forest products like gum, etc.
- A number of diversified farming systems have been evolved for low-rainfall areas, which include agro-forestry, agri-horticulture and agri-silvi-pasture, to sustain livelihood during crop failure and to maintain livestock during droughts.

### Krishi Vigyan Kendra (KVK):

The idea of establishment of Krishi Vigyan Kendra (Farm Science Centre) was evolved in 1973 by ICAR. The first KVK, on a pilot basis, was established in 1974 at Pondicherry under the administrative control of the Tamil Nadu Agricultural University, Coimbatore. With the growing demand for more such KVKs were approved by ICRA. Currently there is a big network of KVKs managed by State Agricultural Universities, Central Agricultural University, ICAR Institutes, NGOs, State Governments, Public Sector Undertakings and other educational institutions. At present there are 571 KVKs established in the Country.

The mandate of KVK is Technology assessment, refinement and demonstration of technology /products. This is an excellent network for technology exchange and empowerment of farmers to enhance productivity and profitability.

Source: <http://www.icar.org.in/krishi-vigyan-kendra.htm>



**Improved variety of forage crop, Indian Grassland and Forage Research Institute, Jhansi, Uttar Pradesh.**

- Improved practices for pasture and rangeland management, especially through silvi-horti-pastoral systems and rotational grazing, and rehabilitation of mine spoils through vegetative means have been developed and are being propagated by R&D institutions and State departments.
- For water erosion control on arable lands, contour cultivation, graded bunding and bench terracing are adopted in conjunction with minimum tillage, cover crops, inter-cropping, strip cropping, contour vegetative barriers, etc.
- Check dam construction, gully plugging and stabilization of gully heads are advocated for non-arable lands, and appropriate land uses are integrated on catchment basis according to land capability. Rain water harvesting and efficient utilization are in-built in the watershed management programmes.

<b>Facts and Figures (2007 - 2010)</b>		
1	Nodal/Implementing Agency	Central Arid Zone Research Institute
2	Area covered	49.50 Million ha
3	Target group	Farming communities, State Govt. agencies for agricultural development and NGOs.
4	Programme period and status	Ongoing
5	Funding	ICAR, Ministry of Agriculture – ₹ 78.50 Million approx. (USD 1.74 Million Approx.)

**For more information:** Central Arid Zone Research Institute (CAZRI), Jodhpur - 342003, Rajasthan, INDIA, Email-director@cazri.res.in, Website-http://www.cazri.res.in

# 17 Identification and Demarcation of Degraded Watersheds in the Catchment Area for Macro Level Planning

## Summary:

- Identification and demarcation of degraded watershed in the catchment area is being carried out by the Soil and Land Use Survey of India (SLUSI), established in 1958 under Department of Agriculture and Cooperation, Ministry of Agriculture.
- SLUSI conducts various types of soil and land resource surveys and provides a soil-related database for the planning and implementation of programmes relating to soil and water conservation for the development of degraded lands.
- Development of degraded lands calls for their reclamation and proper management with specific information about their nature, extent, spatial distribution and magnitude of the problem. A detailed data base on degraded lands is crucial for planning purpose that necessitates scientific mapping.

*Sound and realistic data base on degraded lands being provided by this project is crucial for macro level planning purposes.*

Soil and Land Use Survey of India, has been established to develop detailed maps to create soil and land use database that can serve as a critical macro level and micro level planning tool for various programmes.

SLUSI with its seven centres located at Noida (Uttar Pradesh), Kolkatta (West Bengal), Bangalore (Karnataka), Nagpur (Maharashtra), Hyderabad (Andhra Pradesh), Ahmedabad (Gujarat) and Ranchi (Jharkhand) perform activities related to watershed surveys, soil mapping, training etc.

The mapping has been conceptualized as a four tier system consisting of delineation of major land use boundaries from topographical map and subsequent updating using remote sensing data followed by mapping of different kinds of degraded lands and severity of degradation. The legend of land degradation mapping has been developed considering the causative factors of land degradation viz., wind and water erosion, salt affliction, water logging, shifting cultivation, mining, etc

Four components considered for systematic mapping are:

- Kinds of Degradation
- Severity of Degradation
- Major Landform
- Major Land Use

During 2009-10, Rapid Reconnaissance Surveys of 15.6 mha, Detailed Soil Surveys (DSS) of 0.16 mha, and Soil Resource Mapping (SRM) of 16.146 mha were targeted. Against these targets, RRS of 8.061 million hectares, DSS of 0.04 million hectares and SRM of 3.75 million hectares were completed up to December 2009.

## Achievements:

- Database on priority watersheds with soil and land information will enable scientific planning to check soil erosion in the catchment area. Soil erosion control following a watershed approach is vital to maintain natural eco-systems.
- The data base will provide a platform to monitor and evaluate the watershed development programmes undertaken by various departments



PRA exercise in the Thandavarayan Sozhgan Pettai (T.S.Pettai) of Pichavaram area in Cuddalore district, Tamil Nadu.

### About SLUSI:

Established in 1958, Soil and Land Use Survey of India has seven centres. Its main activities are:

- Rapid Reconnaissance Surveys of watersheds of the catchments of river valley projects and flood prone rivers;
- Detailed Soil Surveys of selected very high and high priority watersheds to provide a sound database for the execution of soil conservation measures, as well as for scientific land use planning;
- Soil Resource Mapping;
- Development of a GIS-based web server;
- Organising short training courses on soil surveys and data use for the planning of watershed management; and
- Consultancy projects on soil mapping.

and ministries. It will help to develop Watershed Development Information System to avoid duplication of the watershed development programmes in the country.

### Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Soil and Land Use Survey of India (SLUSI), Department of Agriculture and Cooperation, Ministry of Agriculture
2	Area covered	207.37 ha Approx.
3	Target groups	State Government departments such as Agriculture, Forest and Soil Conservation.
4	Project period and status	Ongoing
5	Funding	Ministry of Agriculture – ₹ 518.42 Million Approx. (USD 11.52 Million Approx.)

**For more information:** Soil and Land Use Survey of India (Headquarter) IARI Buildings, PUSA, DELHI - 110 012, Email- [csso-slusi@nic.in](mailto:csso-slusi@nic.in), Website- <http://dacnet.nic.in/aislus>

# 18 Efficacy and Economics of Water Harvesting Devices in Controlling Run-off Losses and Enhancing Biomass Productivity in Aravalli Ranges

## Summary:

- Rajasthan is one of the driest states in India with annual average rainfall ranging from 100 mm in the western desert to 650 mm annually in the southeastern part of the state, located in arid and semi-arid region of India.
- Its 56 million people intermittently suffer moderate to severe water crises. Water harvesting structures can have a reviving impact on the overall ecology of the region and therefore can transform the economy of the people living there.
- The current project is implemented by Arid Forest Research Institute (AFRI), Jodhpur, India, State Forest Department, Rajasthan and Village Forest Protection and Management Committee, Guapada, Banswara District Rajasthan.

*It aims to scientifically study the impact of various water harvesting structures over about 700 m<sup>2</sup> area classified in 75 plots in slopes of 0-10%, 10-20% and >20% with a control plot, contour trench, gradonie, box trench and V-ditch rainwater harvesting treatment.*

The Aravali hills count among the oldest mountain ranges of the world and run across the State of Rajasthan from southwest to northeast. These hills cover about 30% of the state's area. Desertification and consequent land degradation is a common threat world over. The problem in this region is severe with extremes of weather condition, low and erratic rainfall (100-400 mm) and high evapotranspiration. Soils are immature, structureless, and very coarse in texture with low water holding capacity and poor nutrient status.

Scarcity of water and poor nutrient status are reflected in the form of poor vegetation cover and low productivity in the area. It is further aggravated by high population pressure. The average human and livestock population densities in Indian arid zone are 108 and 137 per square kilometre, respectively. This leads to crop intensification and changes in land use pattern.

Over-exploitation of existing vegetation and over-irrigation / use of saline ground water for irrigation

have resulted in land degradation as evidenced by the menace of sand drift and secondary salinization. The Division of Forest Ecology and Desert Development are mandated to work on some of the important aspects to combat desertification and increase productivity in the region.

Rajasthan has a rich tradition of water harvesting, which is diminishing with socio-economic changes that are taking place. Revival of this water harvesting structures or developing a proper system of water harvesting can actually help revive the complete ecology and therefore the economy of the people living in the region. A number of projects by Civil Society Organisations (CSOs) and some Government-aided projects in this area are aimed at this. The current project scientifically studied the impact of various water harvesting structures.

A hilly site was selected in Banswara forest division

## Observations based on Growth Data of various species

- Plants were taller and thicker in <10% slope area and decreased with increase in slope, *Holoptelia integrifolia* indicated highest growth.
- *Dendrocalamus strictus* and *Acacia catechu* lowest growth in 10-20% slope area.
- In V-Ditch area growth of *Dendrocalamus strictus*, *Azadirachta indica* and *Zyziphus mauritiana* was the best. In contour trench areas *Emblica officinalis* and *Holoptelia integrifolia* performed best.
- In box trench areas *Gmelina arborea* and *Acacia catechu* performed better.
- In terms of planting methods seed sown seedling of *Acacia catechu* outperformed the planted seedlings of *Emblica officinalis*, *Syzygium comini*, *Zyziphus mauritiana*.
- There were 80 herbs and grass species recorded in October 2008. The number of species increased downward from >20% slope (5.33 m<sup>-2</sup>) to <10% slope (6.25 m<sup>-2</sup>). In micro-sites, number of herbage species was highest down slope and lowest at mid slope position.

covering slopes of 0-10%, 10-20% and >20%. Rainwater harvesting devices are Contour Trench (CT), Gradonie (G), Box Trench (BT), V-ditches (V) along with a control plot. Seventy five plots (three slopes x five treatments x five replicates) of 700 m<sup>2</sup> area in completely randomised block design were laid. Seventy five run-off measuring devices along with flow control wall fitted with pipes were constructed to control water flow and collect run-off.

This project yielded some important observations in terms of impacts of different RWH devices on

1. Overall growth of different species
2. Nutrient concentration
3. Species diversity and herbage yield
4. Dry matter production.

Impacts on the overall growth of different species have been discussed in the adjoining box while some other observations are given below

- Soil Water Content (SWC) increased downward but Soil Organic Carbon (SOC), NH<sub>4</sub>-N and NO<sub>3</sub>-N were highest at mid position in a plot.
- SWC and SOC were highest in <10%, whereas, NO<sub>3</sub>-N and NH<sub>4</sub>-N concentrations were highest in >20% slopes.
- In RWH treated area, SOC and PO<sub>4</sub>-P were highest in CT plots; SWC and NO<sub>3</sub>-N were highest in G plots, whereas NH<sub>4</sub>-N concentration was highest in VD plots.
- Lowest availability of soil nutrients indicated greater diversity. Species diversity, richness and herbage yield increased downward, but species evenness was highest at mid position in a plot.
- Among different slopes, species diversity and species richness were highest in <10%, dry matter yield was highest in 10-20%, and species dominance and vegetation height were greatest in >20% slopes.
- In RWH treated area, species diversity and herbage yield were highest in CT plots; whereas, evenness, richness and vegetation height were greatest in VD plots. Lowest availability of soil nutrients indicated greater diversity.
- Dry matter production increased downward being highest at down slope position (567.8 g m<sup>-2</sup>). Dry matter production was 478.5g m<sup>-2</sup> in 10-20% to 439.2 g m<sup>-2</sup> in <10% slope.
- Among the treatment, dry matter production was 523.6 g m<sup>-2</sup> in contour trench plots as compared to 413.5 g m<sup>-2</sup> in control plots. It was significantly greater (458.8 g m<sup>-2</sup>) in treated area than untreated (244.9 gm<sup>-2</sup>) area of the site.

## Achievements:

- Rain water harvesting and conservation techniques and tree plantation on degraded hills has significantly reduced the runoff, improved soil moisture, biodiversity and carbon stock in the area.

- Grass and herbs species increased from 39 to 92 in the experimental plots within a period of 4 yrs.
- Increased water availability in wells longer period. Fodder and fuel wood availability increased.



Photo: CEE Photo Bank

Water harvesting structure in Bhindr block, Udaipur district, Rajasthan.

### Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Arid Forest Research Institute (AFRI), Jodhpur
2	Area covered	17 Hectors
3	Target groups	Village forest management Committees, adjacent villages around the Project Areas
4	Project period and status	1 April 2005 - 31 March 2011
5	Funding	State Forest Department, Rajasthan- ₹ 1.60 Million (USD 0.04 Million Approx.)

**For more information:** Arid Forest Research Institute, P.O. Krishi Upaj Mandi, Basni, New Pali Road, Jodhpur-342005 (Rajasthan) INDIA, Email- [dir\\_afri@icfre.org](mailto:dir_afri@icfre.org), Website-<http://www.afri.res.in>

# 19 Generation of Detailed Database on Soil and Land Characteristics for Degraded Watersheds

## Summary:

- Degradation of watershed and its rehabilitation are some of the most urgent natural resources management challenges.
- Comprehensive information on soil resources in terms of types of soils, their spatial distribution, and degradation is critical for addressing the processes of degradation and various issues relating to soil conservation such as rainfed farming, soil conservation in catchment areas, command area development, watershed management etc.
- Soil and Land Use Survey of India (SLUSI), Department of Agriculture and Cooperation, Ministry of Agriculture conducts surveys to generate Detailed Database on Soil and Land Characteristics for Degraded Watershed as one of its major activities.

***The necessary data on soil survey and assessment of land resources is generated by Soil and Land Use Survey of India (SLUSI) for preparation and implementation of projects concerning the development of degraded lands to facilitate planning of soil and water conservation in a selective mode and phased manner.***

The Soil and Land Use Survey of India (SLUSI) under Department of Agriculture and Cooperation, Ministry of Agriculture, is basically to provide necessary data on soil survey and assessment of land resources for preparation and implementation of projects concerning the development of degraded lands. It deals with mapping of degraded lands on district basis using remote sensing technique on 1:50,000 scale. It comprises pre-field interpretation of False Color Composite (Band 2,3,4) derived from IRS LISS II data based on spectral signatures, field work for ground verification and post field interpretation followed by random field checking and map finalization.

Detailed Soil Surveys deals with systematic detailed study of soils comprising morphological examination of soils in the field and mapping using 1:15,000 scale or larger aerial photograph or cadastral map followed by analysis of soil samples in the soil

laboratory and processing maps in the cartographic laboratory. Selected very high and high priority sub-watersheds are taken up for detailed soil survey to generate detailed data base on soils which are pre-requisites for formulation of village level plans. The data generated out of soil survey interpreted to derive base information on the use potential of land or various utilitarian purposes. It provides the following information which is essential for any land development programme.

- Proper diagnosis of soils
- Scientific land use planning
- Soil amendments for judicious use of chemical fertilizer
- Soil, land, water, crop and nutrient management
- Generation of soil health cards for dissemination of soil information to farming community

- Development of Soil Information System
- Optimal utilization of soil resources

SLUSI developed a methodology for prioritization of sub-watersheds in the catchment areas to facilitate planning of soil and water conservation in a selective mode and phased manner. The output of the survey is utilized both by Central and State Governments towards formulation of soil and water conservation working plan.

### Partner Organisations:

1. Soil and Land Survey of India, New Delhi.
2. National Bureau of Soil Survey and Land Use Planning (NBSS&LUP), Nagpur
3. Central Arid Zone Research Institute (CAZRI)(Arid Zone Mapping), Jodhpur
4. National Remote Sensing Agency (NRSA), Hyderabad
5. Regional Remote Sensing Service Centers, Bengaluru, Jodhpur, Kharagpur, Dehradun, Nagpur
6. Space Applications Centre (SAC), Ahmedabad
7. National Atlas and Thematic Mapping Organisation (NATMO), Kolkata

### Achievements:

- Sustainable soil and water conservation in degraded watersheds at micro level with scientific database. The database will allow effective planning of soil erosion control measure, rainwater

### Economic Utility of Soil Survey Data to Farming Community

The detailed soil database available with the organization has many economic and ecological benefits for farming community, such as:

- Proper diagnosis of soil for optimal utilization of soil resources;
- Judicious application of chemical fertilizer and irrigation water;
- Adoption of land use as per land capability class;
- Reduction of loss of top soil;
- Harvesting of rainwater as per soil hydrologic grouping;
- Soil and land reclamation prior to agriculture and other practices;
- Crop suitability based on soil potential;
- Nutrient management as per soil quality;
- Soil quality assessment;
- Maintenance and monitoring of soil health;
- Dissemination of soil information to the farming community in the form of soil.

harvesting, diagnostic measures to maintain soil health, diversification in land use practice, etc.

- State wise database of land degradation has been prepared.

### Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Soil and Land Use Survey of India. Department of Agriculture and Cooperation, Ministry of Agriculture
2	Area covered	13.58 Million ha. (Approx.)
3	Target groups	State Government Departments such as Agriculture, Forest and Soil Conservation
4	Project period and status	Ongoing
5	Funding	Ministry of Agriculture – ₹ 207 Million (USD 4.60 Million Approx)

**For more information:** Soil and Land Use Survey of India (Headquarter) IARI Buildings, PUSA, DELHI - 110 012, Email- [csso-slusi@nic.in](mailto:csso-slusi@nic.in), Website- <http://dacnet.nic.in/aislus>

## 20 Addressing the Issue of Land Degradation is a Component in some of the R&D Projects of the Institute

### Summary:

- Govind Ballabh Pant Institute of Himalayan Environment and Development (GBPIHED) is identified as a focal agency to advance scientific knowledge, to evolve integrated management strategies, demonstrate their efficacy for conservation of natural resources and to ensure environmentally sound development in the entire Indian Himalayan Region.
- The Institute was established in August 1988, at Kosi-Katarmal, Almora district of Uttarakhand, as an autonomous institute of the Ministry of Environment and Forests.
- The Institute has been recognized as a nodal agency for Research and Development (R&D) programmes in the Indian Himalayan region by the Planning Commission, the Ministry of Environment and Forests, Government of India, and many international organizations.

***All R&D activities are essentially multi-disciplinary in nature and based on a conscious effort to interlink natural and social sciences to promote sustainable development. In this effort, particular attention is given to the preservation of fragile mountain ecosystems, indigenous knowledge systems and sustainable use of natural resources.***

All R&D activities of the Institute are essentially multi-disciplinary in nature, and based on a conscious effort to interlink natural and social sciences to promote sustainable development. In this effort, particular attention is given to the preservation of fragile mountain ecosystems, indigenous knowledge systems and sustainable use of natural resources.

Apart from undertaking research and technology development and/or demonstration on its own, the Institute has established linkages with National and International Organizations committed to environment and development linked issues in the mountain regions.

### ***The R&D programmes are in the area of***

- Socio Economic Development
- Environmental Assessment & Management
- Watershed Process and Management
- Knowledge Product & Capacity Building

- Biodiversity Conservation and Management
- Biotechnology Applications

### **Mandates:**

- Undertake in-depth research and development studies on environmental problems of the Indian Himalayan Region.
- Identify and strengthen the local knowledge of the environment and contribute towards strengthening researches of regional relevance in the scientific Institutions, Universities/NGOs and Voluntary agencies working in the Himalayan region, through interactive networking.
- Evolve and demonstrate suitable technological packages and delivery systems for sustainable development of the region in harmony with local perceptions.

### Important area of work

- Development and demonstration of Sloping Watershed Environmental Engineering Technology package for rehabilitation of degraded lands in Himalaya.
- Demonstration of Integrated Watershed Management in Central and Eastern Himalaya focusing on agro-forestry models and low cost technologies.
- Land use changes and its environmental impacts in Cold Desert Environment.
- Data base of Glacier retreat, flow and suspended sediment pattern in Central Himalaya and analysis of climate variability.
- Impact of Anthropogenic Activities on Bio-resources in Cold Desert of the Lahaul
- Studies on Diversity and Conservation Status of plants in a Proposed Cold Desert Biosphere Reserve of Trans and North West Himalaya.
- Studies on the Diversity and Conservation Status of Forest

Vegetation in a Proposed Cold Desert Biosphere Reserve of Himachal Pradesh in North Western Himalaya

- Action Plan for Conservation of Biological Diversity of Indian Himalayan Region; and, Strategy and Action plan for Wild Plant Diversity of Indian.
- Capacity building of local inhabitants through promotion of ecotourism in Sikkim, establishment of Rural Technology Complex at HQs, trainings on hill-specific low cost technologies in NE region.
- Development of conventional and/or biotechnological methods for propagation of high value plants (e.g., multipurpose trees, endemic medical plants, bamboos, plantation crops) of IHR.

### Achievements:

- During April 2008 – March 2010 over 125 ha land brought under plantation of fodder, fuelwood, medicinal plants and other useful species (over 1 lakh saplings) across Indian Himalayan region. Soil and water conservation and soil fertility improvement measures are employed through participatory approach.

### Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	G B Pant Institute of Himalayan Environment and Development (GBPIHED), and Gram Panchayats, Regional Universities in the Indian Himalayan Region, Research Institutions, Indian Council for Agricultural Research, Forest Department
2	Area covered	125 ha
3	Target groups	Village Panchayats, Women Self Help Groups, Villagers-Individuals, Government Departments
4	Project period and status	1 April 2007 - 31 March 2012
5	Funding	Ministry of Environment and Forests – ₹ 3 Million (USD 0.07 Million Approx.) Lake Development Authority, Govt of Uttarakhand- ₹ 10 Million (USD 0.22 Million Approx.) World Bank Group - ₹ 15 Million (USD 0.33 Million Approx.) Katarmal Village (Wasteland Restoration) – ₹ 0.15 Million (USD 3333 Approx.) Total: ₹ 28.15 Million (USD 0.63 Million)

**For more information:** G B Pant Institute of Himalayan Environment and Development (GBPIHED), Kosi-Katarmal, Almora -263 643, Uttarakhand, India, Email-director@gbpihed.nic.in, Website-http://gbpihed.gov.in

# 21 Enhancing Productivity of Saline Wastelands in Kachchh- through Improved Tree Planting Techniques and Silvipastoral Study

## Summary:

- The project on Enhancing Productivity of Saline Wastelands in Kachchh through improved tree planting techniques and silvipastoral study was initiated in July, 2006 by Arid Forest Research Institute (AFRI), Jodhpur.
- The experimental area is located in Kordha, Sami Range in Patan of Gujarat state.
- Tree planting techniques of *Acacia bivenosa*, *A. ampliceps* with various treatments like Farm Yard Manure and Wheat Husk and its survival percentage, mean increment in height and crown diameter compared to other treatments for both the plant species was conducted.
- Research trial on change in pH values during winter and summer months was also carried out.

***The project aims to study the relationship between survival rates of different tree and grass species and plantation techniques with reference to highly saline areas.***

Forests have a major role to play in reversing desertification trends. Forests in these areas provide extremely critical ecological services such as soil and water conservation, providing fodder for livestock rearing, and helping to mitigate climate change impacts.

In arid zones agro-forestry practices help mitigate the consequences of irregular and unforeseen rainfall and of economic fluctuations through the regular and reliable supply of substitute products for man and livestock, reducing pressure on local resources and encouraging sustainable production.

But afforestation/tree plantation in this area is extremely difficult due to high salinity and extreme weather conditions. Growth is slower; survival rates are lower, and plant protection presents great difficulty. Therefore, holistic scientific knowledge on forest ecology in arid and semi-arid zones is necessary for combating desertification and mitigation of climate change impact in these areas.

### The Project:

Research trial for green weed-mass of halophytes and other salt tolerant species was conducted. Research

trials with four tree species (namely *Cordia gharaf*, *Prosopis cineraria*, *Ziziphus mauritiana*, *Colophospermum mopane*) and three grass species, (namely, *Cenchrus ciliaris*, *C. setigerus* and *Dicanthium annulatum*) were conducted in Randomized Block Design in three replications at Mochirai, Bhuj.

**Survival:** Plant species maintained more than 90% survival in both the experiments. Overall periodic percent survival recorded after 30 months of age was in similar range for *Cenchrus setigerus* 95.6%, and *Cenchrus ciliaris* 95.4% (almost no change between 24 and 30 months of growth period). However, survival of grass was higher in case of *C. ciliaris* (98.1%) compared to *C. setigerus* (92.0%). Species wise maximum survival was with *Prosopis cineraria* 94.9%, *Cordia gharaf* 99.5%, and *Zizyphus mauritiana* 93.5%.

**Height and Crown Diameter:** At the age of 26 months, tree species (*C. ciliaris* and *C. setigerus*) recorded 15.2 to 17.5 % and 12.2 to 28.7% mean height increment under control and with grass treatment, respectively, compared to their height at 14 months. The mean height and crown diameter of control trees were significantly more than trees grown with grass in case

Kachchh district of Gujarat state is spread over an immense, saline wasteland of 45,255 sq. km, constituting 24 percent of the land area of Gujarat. Bounded by desert to the north and the Arabian Sea to the south, Kachchh has an average annual rainfall of about 335 mm. However, rapid desertification and recurrent droughts have led to saline intrusion which has, in turn, affected the quality of land, soil and agricultural production. The rural economy is maintained principally on rainfed agriculture and livestock rearing.

of *C. setigerus*. However, the difference was insignificant for *C. ciliaris*. Within species, the height difference was highly significant, due to less height growth of *P. cineraria* compared to *Z. mauritiana* and *C. gharaf* which almost attained similar height with *C.*

*setigerus* and *C. ciliaris*. The incremental growth for crown diameter was 7.7 to 5.7 and 11.9 to 25.7 % respectively for various tree species with *C. ciliaris* and *C. setigerus*, respectively, between the growth periods 14-26 months. Low rainfall (287 mm) is the reason for less growth. The effect of grass growth significantly influenced the overall crown diameter only with *C. setigerus* at 14 and 26 months whereas it was 39 and 37.4 % more in control.

**Grass yield:** The year 2008 received very scarce rain, and the yield was one third of the year 2007. It was 0.66 and 0.17 kg/ha and 0.47 and 0.16 kg/ha as green and dry grass yield for *C. ciliaris* and *C. setigerus*. The reduction in mean green grass yield was 2.9 fold for *C. ciliaris* and 3.2 fold for *C. setigerus*. The conclusions so far are that *C. ciliaris* is the best grass species very closely followed by *C. setigerus*. Establishment of *D. annulatum* was poor. *Cordia gharaf* maintained

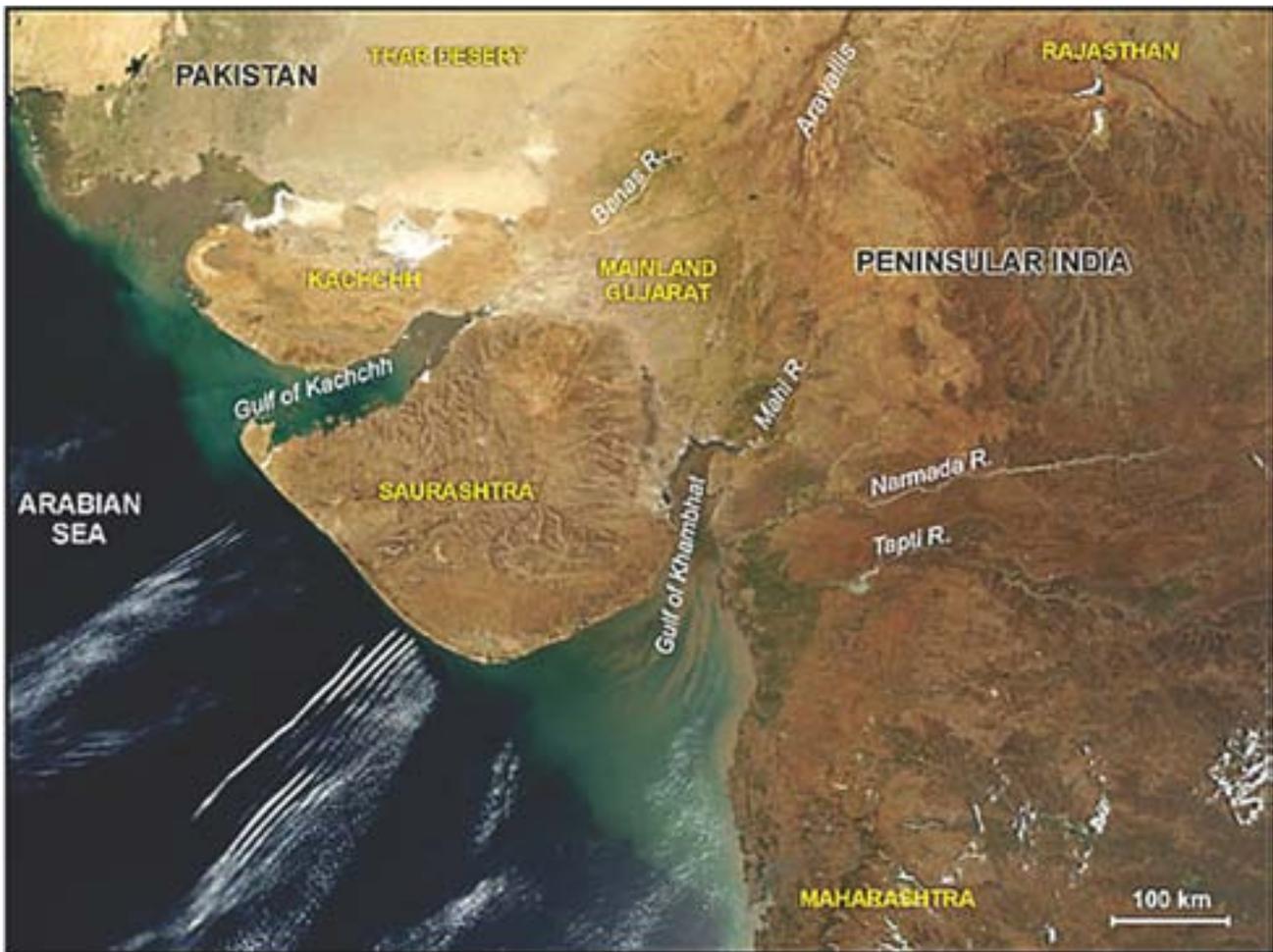


Photo: <http://www.portal.gsi.gov.in>

nearly 100 % survival and appreciable growth followed by *Z. mauritiana* among all the grass species.

**Weed Biomass:** Green weed mass was dominated by halophytes and other salt tolerant species. *Chloris virgata* was the most dominant species followed by *Sueada fruticosa*. Overall, 431 gm<sup>2</sup> yield was recorded. However, species wise variation was observed and it was 693.0 gm<sup>2</sup> for *A. bivenosa*, 375.5 gm<sup>2</sup> for *S. persica* and 224.1 gm<sup>2</sup> for *A. amplexipes*.

### Achievements:

- *Salvadora persica* proved to be the most hardy plant surviving the extremely harsh conditions of high salinity, heat stress and drought conditions suffering less casualties with mean survival of 92.8% after 2.5 years of planting followed by *Acacia bivenosa* (survival 77.3%) and *Acacia amplexipes* (survival 44.1%) at Sami Range in Patan, Gujarat.
- All the plant species displayed shrubby nature recording more crown diameter than height after two years of growth. *A. amplexipes* attained very high initial growth (161 cm height and 170 cm crown diameter). The plants flowered and produced viable seed within a year but after heat shock the growth reduced.
- Silvopastoral trials with *Cenchrus ciliaris* and *C. setigerus* as grass species in combination with four tree species, namely *Cordia gharaf*, *Prosopis cineraria*, *Ziziphus mauritiana* and *Colophospermum mopane*, were conducted in Bhuj in July 2006. The survival rate was more than 90%.



Photo: CEE Photo Bank

**Grasses of wastelands, Jasdan block, Rajkot district, Gujarat.**

- Biomass yield : With *C. setigerus* the mean biomass yield for *C. gharaf* was 6.15 kg/tree and for *Z. mauritiana* 2.8 kg/tree; with *C. ciliaris* ( at low seed rate) the biomass yield was 4.9 kg/tree for *Z. mauritiana* and 8.3 kg/tree for *C. gharaf*, respectively: at low seed rate grass sowing promotes tree growth.
- *C. gharaf* : *C. ciliaris* is the best silvipastoral system so far, closely followed by *Z. mauritiana* : *C. ciliaris* on sandy degraded soil

### Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Arid Forest Research Institute (AFRI), Jodhpur
2	Area covered	7 ha
3	Target groups	State Forest Department, Farmers, NGOs, Research Organizations
4	Project period and status	01 July 2006 - 31 July 2011
5	Funding	Arid Forest Research Institute (AFRI), Jodhpur – ₹ 0.77 Million Approx (USD 0.02 Million Approx.)

**For more information:** Arid Forest Research Institute, P.O. Krishi Upaj Mandi, Basni, New Pali Road, Jodhpur-342005 (Rajasthan) INDIA, Email- [dir\\_afri@icfre.org](mailto:dir_afri@icfre.org), Website-<http://www.afri.res.in>

## 22 Study of Characteristic Features Pertaining to Bio-drainage Potential of some Selected Tree Species

### Summary:

- The project is implemented by Arid Forest Research Institute (AFRI), Jodhpur. The Indian National Committee on Irrigation and Drainage (INCID) is also involved in the project.
- Bio-drainage is being considered as one of the economically effective and ecologically benign solutions to the twin problems of water logging and salinity in irrigated command area.
- Various drainage or traditional reclamation measures such as controlling the intensity of irrigation, providing drainage system, lining, improving natural drainage, preventing seepage or adopting modern technology for application of water are, more often than not, expensive. Therefore, the method of bio-drainage, which is an agronomic solution that provides natural means of drainage for excess water of the area through trees and plant, is considered very effective.

*The project aims to study characteristic features pertaining to bio-drainage potential of some selected tree species.*

This project is funded by the Ministry of Water Resources. It was initiated in 2004 with two field experiments in the Indira Gandhi Nahar Pariyojana (IGNP) and one in in-field non-weighing type of lysimeters (2 x 2 x 2 m<sup>3</sup>) at Jodhpur.

The experiment was to study bio-drainage potential of some selected tree species. Bio-drainage potential depends on various characteristics of the trees, e.g. a high degree of evapotranspiration from the canopy crown is appropriate for combating the problem considerably. The experiment studied tree characteristics such as crown spread and girth, transpiration and photosynthesis rate, overall survival and growth rate etc. Soil samples were also collected and analysed for pH, Electrical Conductivity (EC) and organic carbon to study the impact on soil salinity and fertility.

Among the tree species (*Eucalyptus camaldulensis*, *E. fastigata*, *E. rudis*, and *Corymbia tessellaris*) tried in the field, the performance of *E. rudis* has been found to be the best with respect to growth, biomass,

transpiration rate and overall bio-drainage potential. Soil working at the site resulted in heavy regeneration of *Eucalyptus camaldulensis*.

The regenerated plants were mostly concentrated between 6 and 10 m from the tree trunk of the mother trees situated at the edge of the experimental site. The number of seedlings varied from 13 to 36 per sq. m area.

Ground water table has receded from 25 cm to 145 cm depth as recorded in the observation pit resulting from the transpiration pull (bio-draining) of the growing vegetation. Apart from the planted ones, some species like *Prosopis juliflora*, *Tamarix dioca*, *Saccharum munja* and *Arundo donax* also have come up in the area. The number of *A. donax* has reduced gradually with recession of ground water table in the experimental plot. With the lowering of ground water level, other species started growing in the area as natural succession. Population of *S. munja* was highest followed by *P. juliflora* and *T. dioca*. The total biomass per tree in *P. juliflora* was recorded as 110 kg. The contribution of the roots to the total biomass was



**Demonstration of bio-drainage.**

25%. *S. munja* and *T. dioca* accumulated a total biomass of 76.5 kg and 73.25 kg per tree, respectively.

In the lysimeter experiment, water use by *E. camaldulensis*, *Acacia nilotica* and *Tamarix aphylla* and their growth have been affected by water logging and salinity treatments. The height and collar girth were the greatest in *E. camaldulensis*, whereas the crown growth was highest in *A. nilotica*.

Tree growth has been higher in treated waterlogged areas than the control where surface irrigation was applied - trees were taller. Water logging ranged from 1- 1.25 m soil depth in comparison to 0.5-.75 cm. Water logging at shallow depth may have restricted root growth resulting in lower growth.

Water use per day per tree was significantly affected

by salinity level and depth of water logging. Water use of *E. camaldulensis* was 32 ltr/day/tree in the month of October and November; however, it was at par with *A. nolotica* (29 ltr/day/tree) and *T. aphylla* (28 ltr/day/tree).

### Achievements:

- *Eucalyptus rudis* performed best with respect to growth and overall bio-drainage potential where ground water level receded by 145 cm within a period of 54 months.
- *Tamarix dioca* and *Saccharum munja* with recession of ground water table as natural succession contributed significantly to further lowering of the ground water table and to an increase in productivity.

Facts and Figures (2007 - 2010)		
1	Nodal/Implementing Agency	Arid Forest Research Institute (AFRI), Jodhpur Indian National Committee on Irrigation and Drainage (INCID)
2	Area covered	3 ha
3	Target groups	Farmers of canal command area in Indira Gandhi Nahar Project
4	Project period and status	1 April 2004 - 31 March 2010
5	Funding	Ministry of Water Resources - ₹ 4.5 Million (USD 0.10 Million Approx.)

**For more information:** Arid Forest Research Institute, P.O. Krishi Upaj Mandi, Basni, New Pali Road, Jodhpur-342005 (Rajasthan) INDIA, Email- [dir\\_afri@icfre.org](mailto:dir_afri@icfre.org), Website-<http://www.afri.res.in>

# 23 Policy and Institutional Reform for Mainstreaming and Upscaling Sustainable Land and Ecosystem Management (SLEM) in India

## Summary

The Sustainable Land and Ecosystem Management (SLEM) Programme is a joint initiative between the Government of India (GOI) and the Global Environmental Facility (GEF), under the latter's Country Partnership Programme (CPP). Under the SLEM Programmatic Approach, seven projects have been formulated, and are under various stages of implementation. One of the project, entitled "Policy and Institutional Reform for Mainstreaming and Scaling-up of the Sustainable Land and Ecosystem Management", led to the setting up of a Technical Facilitation Organisation (TFO), at the Indian Council for Forestry Research and Education (ICFRE), Dehradun to coordinate among the implementing agencies, draw learning experiences from the projects and mainstream the same into the policy environment in the country. This project is designed to strengthen the institutional and management functions of the Indian institutions responsible for the SLEM CPP.

*The project will enhance the institutional and policy framework for harmonization, coordination and monitoring of interventions in agricultural and natural resources management strategies. The aim is to promote sustainable land management and enhance agricultural productivity while minimizing environmental impacts.*

The overall objective of the SLEM partnership is to contribute to poverty alleviation in India by promoting enhanced efficiency of natural resource use, improved land and ecosystem productivity, and reduced vulnerability to extreme weather events, including the effects of climate change.

To ensure a smooth functioning across the SLEM Programme, a National Steering Committee (NSC) has been constituted. The NSC has due representation of all key stakeholders under the Chairpersonship of Addl. Secretary, Ministry of Environment and Forests (MoEF), Government of India to provide policy guidance. The committee is scheduled to meet at least once every year to guide and advise the Technical Facilitation Organisation (TFO) and various Projects in their activities.

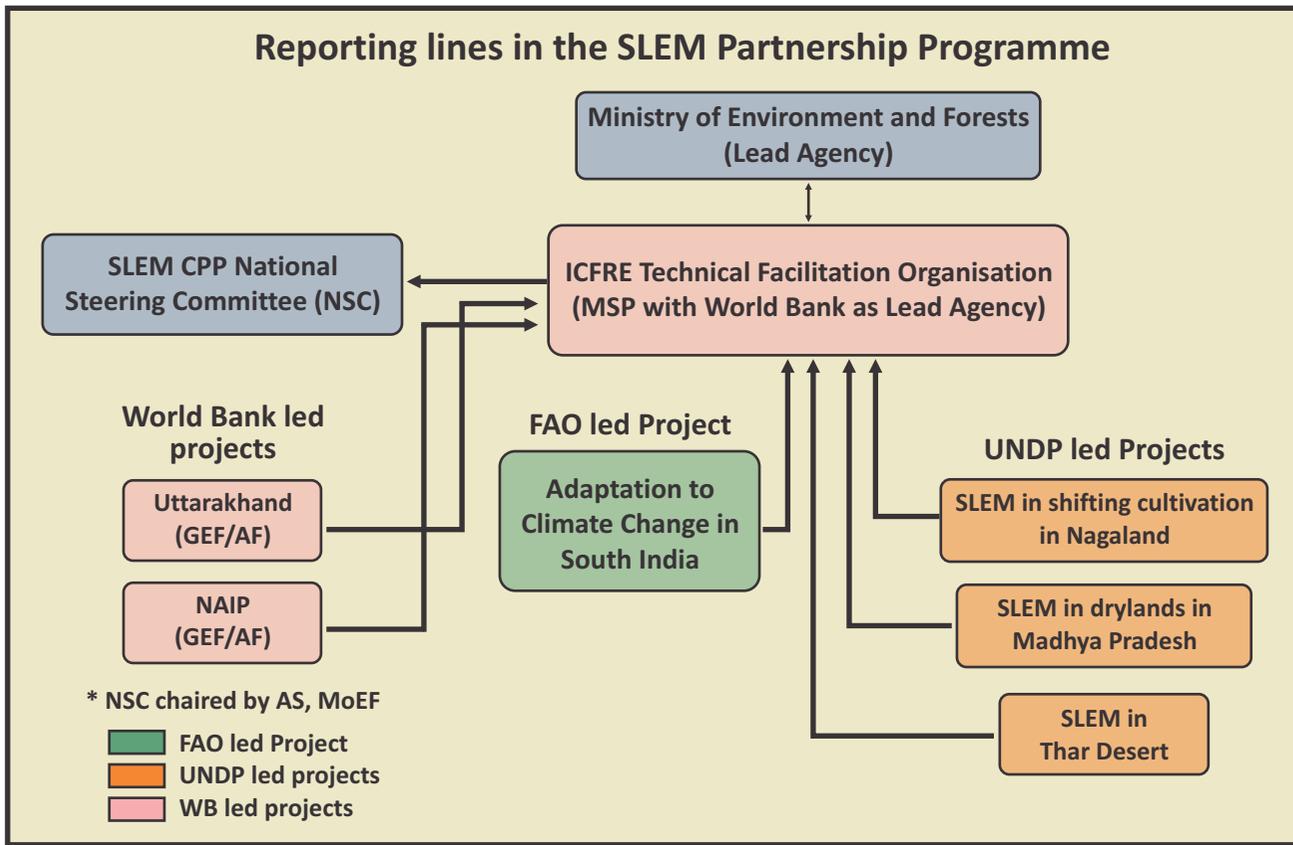
## Technical Coordination

Under the project "Policy and Institutional Reform for Mainstreaming and Up-scaling Sustainable Land and

Ecosystem Management in India", at ICFRE, a robust implementation, monitoring and oversight framework for the programme has been instituted, which is called Technical Facilitation Organization (TFO). Various divisions of the ICFRE Headquarters and Regional Forest Research Institutes provide the requisite technical support as and when required to SLEM projects located in different parts of the country.

The activities to be undertaken by the TFO include coordination, planning, cooperation, outreach, and implementation and monitoring and evaluation (M&E) functions of the program (each project under the program will have its own dedicated M&E function). The proposed implementation arrangements are designed to ensure that the lessons learnt from these projects are mainstreamed into institutional strategies and scaled up into land management policy.

TFO would collate information on knowledge system, best practice and that will enable to formulate



recommendations for policy, strategy and approaches for sustainable land and ecosystem management. The TFO will incorporate these into the programmes and disseminate to CSOs and others at large.

## Major activities:

### 1. Policy and Institutional Mainstreaming:

This includes development of the analytical baselines for harmonization of SLEM policy, and technical instruments to monitor the progress of mainstreaming SLEM into the existing policy environment and find a common niche in inter-sectoral planning systems. This component would also support an inter-institutional mechanism for SLEM policy coordination with the Ministry of Agriculture, Ministry of Rural Development, Ministry of Environment and Forests and other key Government of India agencies.

### 2. Monitoring and Evaluation:

The sharing of lessons learned and emerging

results tracked by monitoring and evaluation (M&E) form an integral part of each constituent project as well as of the programme as a whole to help the mainstreaming and up-scaling of project results. The M&E function of the programme will be built on the basis of the results from analytical processes. The M&E parameters will include GEF-specific aspects and draw upon GEF guidelines with regard to selecting M&E parameters. Monitoring at programme level would also contribute to the outreach, knowledge base, mainstreaming and up-scaling of successful policy initiatives and SLEM actions on the ground.

### 3. Up-Scaling of SLEM:

This includes inventorying of technical solutions and applicable practices for SLEM and establishing a database which will be accessible to sectoral organisations and the public at large. The technical base will be used for training and outreach activities.

Learning and experiences in the social dimensions of sustainable land degradation will also be gathered and applied to the development of state and national policy, strategy and approaches. Outreach activities will be conducted to include NGOs and multilateral agencies to participate in the program.

### Achievements:

- It is expected that there will be an inter-institutional mechanism for Sustainable Land and Ecosystem Management policy coordination with participation of Ministry of Agriculture, Ministry of Rural Development, Ministry of Environment and Forests and other key Government of India agencies.

**SLEM Programme :** Seven projects have been formulated under the SLEM-CPP. These include three projects each being executed by the World Bank and the UNDP and one project by the FAO. Currently all the seven projects are in various stages of implementation under the SLEM-CPP.

#### World Bank supported projects

1. Sustainable Land Water and Biodiversity Conservation and Management for Improved Livelihoods in Uttarakhand Decentralised Watershed Management. The project is being implemented by the Watershed Development Department, Uttarakhand.
2. Sustainable Rural Livelihood Security through Innovations in Land and Ecosystem Management. The project is being implemented by the Indian Council of Agricultural Research, Ministry of Agriculture, and the Ministry of Environment and Forests.
3. Policy and Institutional Reform for Mainstreaming and Up-scaling Sustainable Land and Ecosystem Management in India. This project is being implemented by the Ministry of Environment and Forests, through the TFO anchored at the ICFRE.

#### UNDP supported projects

4. Sustainable Land Management in Shifting Cultivation Areas of Nagaland for Ecological and Livelihood Security. The project is being implemented by the Ministry of Environment and Forests, the State Department of Soil and Water Conservation, Government of Nagaland and Village Council and Village Development Boards.\*
5. Integrated Land and Ecosystem Management to Combat Land Degradation and Deforestation in Madhya Pradesh. The project is being implemented by the Government of Madhya Pradesh.
6. Sustainable Participatory Management of Natural Resources to Control Land Degradation in the Thar Desert Ecosystem. The project is being implemented by the Ministry of Environment and Forests, Ministry of Rural Development, Government of Rajasthan and the Jal Bhagirathi Foundation (JBF).

#### FAO supported project

7. Reversing Environmental Degradation and Rural Poverty through Adaptation to Climate Change in Drought Stricken Areas in Southern India. The project is being implemented by Bharti Integrated Rural Development Society (BIRDS).\*

\* Projects are not reported in the National report as these were not in the implementation phase at time of reporting.

### Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Indian Council of Forestry Research and Education (ICFRE)
2	Target groups	Government of India State Governments and Policy Makers
3	Project period and status	10 August 2009 - 09 August 2012
4	Funding	Ministry of Environment and Forests, Indian Council of Forestry Research and Education (ICFRE) – ₹ 45.17 Million (USD 1 Million)

**For more information:** [www.icfre.org/UserFiles/File/Brochure/SLEM-Brochure\\_190310.pdf](http://www.icfre.org/UserFiles/File/Brochure/SLEM-Brochure_190310.pdf) and <http://moef.nic.in/modules/divisions/desertification-cell/contents/ICFRE.pdf>

# 24 Sustainable Rural Livelihoods Security through Innovations in Land and Ecosystem Management

## Summary:

- The project 'Sustainable Rural Livelihood Security through Innovations in Land and Ecosystem Management' is being executed by Indian Council for Agricultural Research (ICAR), Ministry of Agriculture.
- It focuses on promoting approaches and techniques for sustainable management of degraded coastal land and water, on conserving and sustainably using local biodiversity for agricultural intensification and livelihood security, and on enhancing community capacity to respond to climate change and variability in drought and flood prone areas.

*The project strives for sustained improvement in the incomes and well-being of farm families in the mainly rain-fed, hilly and mountain, dry land, tribal-dominated and coastal areas which have so far been left behind in the development process.*

This project is one of the seven 'Sustainable Land and Ecosystem Management (SLEM)' being implemented across the country. It is complementary to; 'National Agricultural Innovation Project (NAIP)' the parent project of ICAR. ICAR is the apex body for coordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country. With 97 ICAR institutes and 45 agricultural universities spread across the country, it is one of world's largest national agricultural systems in the world.

The NAIP is to facilitate accelerated and sustainable transformation of Indian agriculture in support of poverty alleviation and income generation by collaborative development and application of agricultural innovation by the public research organizations in partnership with farmers groups, the private sector, the civil society organizations and other stakeholders.

## NAIP- Components

### 1. *The ICAR as the Catalyzing Agent for the Management of Change in the Indian National Agricultural Research System (NARS)*

This component aims at bringing in organizational changes in the NARS so that it becomes a dynamic innovation system capable of responding to the present as well as future needs of Indian agriculture research and development. This component is supported as sponsored projects because the component needs to address identified problems for identified stakeholders i.e., the ICAR and the agricultural universities.

### 2: **Research on Production to Consumption Systems**

A Production to Consumption System (PCS) (a "value chain" system in popular parlance) is a system which involves the entire set of actors, materials, activities, technologies, services, and institutions involved from the stage of supply of inputs to harvesting of a particular commodity and transforming it into a usable product, and

storing/marketing the final product. Rural income augmentation and employment generation through post harvest processing and value addition, building of rural agro-industries, export promotion and import substitution and exploiting the market is given adequate emphasis.

### 3: Research on Sustainable Rural Livelihood Security

This component emphasis on research – on farm – for improving and developing the most suitable farming systems and allied off-farm activities in the less favorable environments, regions and groups so that the livelihood of the rural poor improves through assured food, nutrition, employment and income. Particular attention had given to the rainfed, hill and mountain, and, coastal and island eco-regions. Partnerships among all the stakeholders such as farm men and women, farm labourers, input suppliers, rural industry entrepreneurs or researchers, who will share their resources and knowledge and own the changes brought in.

### 4: Basic and Strategic Research in the Frontier Areas of Agricultural Sciences

A sustained flow of knowledge and innovations is essential to keep the technology development process responsive to the ever-changing needs of agriculture. This component aims at making investments in frontier science areas of agricultural research that are strategically important for Indian agriculture. The broad theme areas identified are

- Genetic Enhancement of Plants and Animals
- Natural Resource Management and Integrated Pest Management
- Novel value addition, processing and storage methods for agricultural products and by-products
- Development of state of the art animal disease surveillance and control systems.



Photo: SGP CEE

Innovative micro irrigation system in the villages of Jath block, Sangli district Maharashtra.

## Objectives:

- Support the development and implementation of innovations in agriculture in India through collaboration among farmers, private sector, civil society, and public sector organizations.
- Strengthen institutional and community capacity for sustainable land and ecosystem management through approaches and techniques that combine innovative and indigenous techniques for restoring and sustaining the natural resource base, including its biodiversity, while taking account of climate variability and change.
- Assist in strengthening the agricultural research and extension system, with efforts to promote demand-driven, decentralized public agricultural research and extension systems, greater public-private partnerships, and closer linkages with various domestic and international sources of technologies and knowledge.

## Achievements:

- Over 10,000 ha of agricultural land under sustainable land management practices; 2,500 farmers adopted coping mechanism for climate variability and change.
- Improved land and water management practices applied on 500 ha degraded coastal land; productivity in 90 ha of saline land enhanced through land shaping; innovative SLEM approaches and techniques in agriculture and aquaculture demonstrated on 65 ha; increased crop intensity by 20-30%, productivity 30-35%.
- Enhanced knowledge of crop landraces, animal breeds, fish species through characterization of available cultivated gene pool; improved genetic stock of farm animals; 3000 land holders using sustainable land management practices for optimizing biodiversity.
- Best practice notes, operational guidelines and other teaching and capacity building tools related to coping mechanism for climate change variability.
- At least 30 public and private organizations applying SLEM practices and policies to combat land degradation, increase utilization of indigenous biodiversity and adapt to climate variability and change.

### Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Indian Council of Agricultural Research (ICAR)
2	Area covered	10,000 Ha
3	Target groups	Farmers, public and private sector organizations
4	Project period and status	1 July 2010 - 30 June 2013
5	Funding	World Bank Group – ₹ 1125 Million (USD 25 Million) Global Environment Facility – ₹ 330.30 Million (USD 7.34 Million) Indian Central Government – ₹ 2700 Million (USD 60 Million) Indian Council For Agricultural Research – ₹ 135 Million (USD 3 Million) Total: ₹ 4290.30 Million (USD 95.34 Million)

For more information: <http://www.naip.icar.org.in>

# 25 Sustainable Land, Water and Biodiversity Conservation and Management for Improved Livelihoods in Uttarakhand Watershed Sector

## Summary:

- The project is implemented by Watershed Management Directorate, Government of Uttarakhand, India.
- Based on the positive experiences from the Integrated Watershed Development, in September, 2004 Uttarakhand Decentralized Watershed Development Project (UDWDP) was initiated, which yielded exceptionally good results. The current project aims at scaling up and mainstreaming the outcome of the activities under UDWDP and enhancing their sustainability by restoring and sustaining ecosystem functions and biodiversity while simultaneously enhancing income and livelihood opportunities.
- At the State Government level, a 'Secretary, Watershed' is in place to lead watershed developments in the state. A dedicated Watershed Management Directorate (WMD) is functioning as the nodal agency. Under the leadership of a Chief Project Director it is responsible for the overall implementation of the project including activities funded by Global Environment Facility (GEF), through the SLEM programme.

*The main objective of this project is to improve the productive potential of the natural resources and increase incomes of the rural inhabitants in selected watersheds through socially inclusive, institutionally and environmentally sustainable approaches.*

Uttarakhand is a mountainous Himalayan state in northern India known for its diverse eco-systems, rich faunal and floral diversity. The state is losing fertile soil at the rate of up to 10 times the national average each year. Growing human population and livestock population is resulting into increased demand for food, fuel wood, and fodder for livestock. Although agriculture is one of the core economic activities for over 80% of population the role of forest in sustaining the agriculture is immense. In order to abate soil erosion and loss of forest biomass that both lead to a decline in agricultural production and an expansion of the cultivated area accompanied by loss of biodiversity, it is necessary to increase agricultural productivity in the hills.

From the parent UDWDP which is spread over an area of 2,348 sq km, ranging from 700 mtr to 2000 mtr altitude in 76 selected micro watersheds and covering a population of 254,000 in the middle Himalayas, the

current project will focus on the treatment in 20 micro-watersheds (MWS)

### The project encompasses three themes:

- (i) Community participation in watershed development and management aimed at integrating land-water use with the objectives of moisture retention and biomass production, while simultaneously enhancing incomes and livelihood options;
- (ii) Strengthening administrative capacity of Gram Panchayats to manage project financial resources, implement sub-projects, deliver legally mandated service, and to sustain those services beyond the duration of the project;
- (iii) Ensuring equitable participation by all groups, especially the landless and women who rely disproportionately on common resources for fodder, fuel, and other forest products.

## Objectives:

- Sustainable watershed management mainstreamed into local governance plans including parts of watershed for which two or more Gram Panchayats have shared governance responsibility.
- Implementation of alternative technologies and approaches for enhancing water availability for agriculture and other domestic use.
- Reduction in community dependence on forest for fuel wood.
- Marketing opportunities for medicinal and aromatic plants.
- Improved knowledge of the impact of climate change on mountain ecosystems translated into coping strategies.
- New and innovative techniques and approaches for sustainable land and ecosystem management up-scaled within the Uttarakhand state.

## Activities:

- 1. Watershed planning through community participation:** This component involves integration of Gram Panchayat level watershed plans at the micro-watershed level.
- 2. Controlling land degradation through the SLEM approach at watershed level:** The component involves implementation of 20 MWS plans. Activities prioritized by the community including soil conservation works on arable and non arable land, forest regeneration, pasture development, silvi-pasture development, soil erosion bunds, vegetative barriers, fire management, and water augmentation activities would be taken up.
- 3. Reduce pressure and dependence on the natural resource base through fostering markets for NTFPs:** Under this component, up-scaling of the pilot introduction of Chir pine briquette making. The utilization and conversion of chir pine needle biomass

into briquettes can produce fuel for meeting household and other energy requirements of the community. In addition, pine briquette making is a viable income generating activity by vulnerable groups or SHGs functioning in the project area.

- 4. Enhance biodiversity conservation and management through watershed planning and community participation:** Under this component, domestication and cultivation of at least 5 local medicinal and aromatic plants by communities in 20 micro watersheds would be undertaken. A cluster approach will be adopted so as to be able to produce marketable quantum with viable linkages.
- 5. Improve adaptation to climate change in natural resource-based production systems:** Under this component, a study for enhancing understanding of the impacts of climate change on natural resource-based mountain economies and preparation of adaptation strategy is carried out.
- 6. Documentation of best practices to share them within the state as well as through the SLEM partnership-** Documentation of innovative practices is being carried out also being disseminated through a number of different media (print as well as audio-visual).
- 7. Project management, monitoring and capacity building:** Project management includes operating cost and the monitoring and evaluation of the project.

## Achievements:

- Twenty MWS management plans completed; 10% increase in livelihood opportunities in treated areas;
- Sustainable watershed management mainstreamed into 20 Gram Panchayat (GP) plans including parts of watersheds for which two or more GPs have shared governance responsibility;
- Twenty per cent of the area in selected MWS under improved SLEM techniques; increase in availability of water in the dry season by 5% in the treated MWS; 10% increase in tree and other vegetative cover in the 20 MWS;
- Implementation of 5 to 10 alternative technologies and approaches for enhancing water availability for agriculture and other domestic use;

## Global Environment Facility (GEF) area



- Reduction in dependence of 2,000 households on forest for fuel wood; at least 20% of the targeted households enter market with pine briquettes; 10% increase in opportunities for sustainable alternative livelihoods;
- Increase in direct and indirect evidence of the presence of key species of flora and fauna in 20 MWS; 50% reduction in incidence of fire in treated MWS; cultivation of at least 5 local medicinal and aromatic plants by communities in 20 MWS;
- Improved knowledge of the impact of climate change on mountain ecosystems documented and translated into coping strategy; at least 5 to 10 new and innovative techniques and approaches documented, disseminated and up-scaled within Uttarakhand state.

### Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Watershed Management Directorate, Govt. of Uttarakhand, India
2	Area covered	20 micro-watersheds in Uttarakhand
3	Target groups	Farmers and village level institutions
4	Project period and status	15 April 2009 - 30 June 2013
5	Funding	Indian State Institutions – ₹ 900 Million (USD 20 Million) World Bank Group- ₹ 3150 Million (USD 70 Million) Global Environment Facility: ₹ 337.05 Million (USD 7.49 Million) Total: ₹ 4387.05 Million (USD 97.49 Million)

**For more information:** <http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=P112061>

# 26 Integrated Land and Ecosystem Management to Combat Land Degradation and Deforestation in Madhya Pradesh

## Summary:

- The project is being implemented by Ministry of Environment and Forests and Madhya Pradesh Forest Department, Minor Forest Produce Federation, Rajiv Gandhi Mission for Watershed Management (RGMWM), Agriculture Department, and Animal Husbandry Department, as part of Sustainable Land and Ecosystem Management (SLEM) programme.
- The project strategy is to focus on removing barriers such as institutional, economic and financial; knowledge and technological barriers in promoting sustainable rural livelihoods that are ecologically sustainable and to provide a broader range of livelihood options for the tribal/rural poor.
- Activities related to forest management, farm management, watershed management, support of natural resource-based small and medium enterprises, afforestation initiatives to lessen the pressure on forests for fuel wood and fodder, and related capacity building in support of all these will be promoted as an integrated package in the four districts.

*The project aims to promote community-driven sustainable land and ecosystem management at the landscape level through integration of watershed management, joint forest management, and sustainable livelihoods development so as to balance ecological and livelihood needs.*

Madhya Pradesh (MP), a state in central India has about 24.4 % of its land area covered with diverse types of forest.

The project area is primarily located in dry deciduous zones with rich biodiversity. Two National Parks, three Sanctuaries and Panchmarhi Biosphere Reserve are part of the project area. These forests are also basic source of livelihood for about 5.5 million people living in 4 project districts of which 70% is classified as poor and 90% of population living in tribal rural areas. The rural landscape is highly susceptible to soil erosion, surface soil run-off, and seasonal floods.

Thus restoring this eco-system and its sustainable management is key to provide sustainable livelihood

sources for rural and tribal population of the state. It provides ecosystem services beyond its borders such as water and climate regulation, and provides some of the last remaining habitats for India's threatened biodiversity.

### **Project activities focus around three main themes:**

1. Creation of an enabling environment for SLEM in Madhya Pradesh
2. Demonstration and up-scaling of innovative approaches for sustainable land and ecosystem management
3. Developing adaptive capacity

## Strategy and objectives :

- Address the regulatory and institutional constraints to mainstreaming of biodiversity conservation into agricultural activities surrounding protected areas and integration of biodiversity and land degradation concerns into national level policies and regulatory.
- Contribute to enhanced resilience of land and forest ecosystems and reduced vulnerability of local communities to climate variability and change.
- Strengthen tribal and rural residents, village leadership and communities to take community-based initiatives for the use of their local natural resources, and demonstrate the income-generating potential of sustainable land, forest, and agricultural practices.
- Demonstrate and up-scale innovative community-based and climate resilient approaches to SLEM, such as bamboo regeneration, water harvesting, adjustment of timing of agricultural operations and tillage practices, crop and livestock breed improvement to enhance drought resistance, and the promotion of alternative sources of fuel wood.



Photo: CEE Photo Bank

**Afforestation site, Forest Department , Madhya Pradesh**

## Achievements:

- Sustainable land and ecosystem management demonstrated on 3,000 hectares of forest land and 14,500 hectares of degraded bamboo area within forest land
- 10% increase in Net Primary Productivity and land productivity over baseline at project demonstration site
- 3-5% improvement in forest cover on the project districts
- Climate-resilient, biodiversity-friendly, SLEM guidelines integrated into state's agriculture, animal husbandry, forest, watershed, and tribal welfare policies within 5 years.
- 2,000 government staff, CBO representatives trained in climate-resilient SLEM

## Facts and Figures (2007 - 2010)

1	Nodal/Implementing Agency	Ministry of Environment and Forests, Madhya Pradesh Forest Department, Minor Forest Produce Federation, Rajiv Gandhi Mission for Watershed Management (RGMWM), Agriculture Department, and Animal Husbandry Department
2	Area covered	17,500 ha in 4 districts of Madhya Pradesh
3	Target groups	Forest dwellers, village communities, Non Timber Forest Produce (NTFP)-based small and medium enterprise owners
3	Project period and status	01 July 2008 - 30 June 2012
4	Funding	Global Environment Facility- ₹ 259.34 Million (USD 5.76 Million) Madhya Pradesh Forest Department- ₹ 1447.09 Million (USD 32.16 Million) Minor Forest Produce Federation- ₹ 182.25 Million (USD 4.05 Million) Total: ₹ 1888.67 Million (USD 41.97 Million)

**For more information:** [http://undp.org.in/?q=environment\\_and\\_energy/project-documentation](http://undp.org.in/?q=environment_and_energy/project-documentation)

# 27 Sustainable Participatory Management of Natural Resources to Control Land Degradation in Thar Desert Ecosystem

## Summary:

- The project is part of the Sustainable Land and Ecosystem Management (SLEM) programme being implemented by Rajasthan State Government, UNDP and Jal Bhagirathi Foundation (JBF), Jodhpur, Rajasthan.
- In recognition of the need to address the poverty-land degradation-biodiversity-climate change nexus, the government has developed the India SLEM Programme.
- This project focusing on the Thar Desert region contributes towards meeting the objective of the SLEM to realize sustainable land and ecosystem management.

*The programme supports the poor and vulnerable communities, living in rural areas of the Thar Desert and depending on land for their survival, through integrated conservation and management of common property land, water and livestock resources. The project seeks to overcome critical barriers, thus helping current and future baseline actions achieve their intended benefits.*

The Thar, world's seventh largest and one of the most densely populated deserts, covers 12 districts of Rajasthan. The climate is extreme -temperatures ranging from near-zero in the winter to more than 50° C in the summer with a mere 100-500 mm precipitation.

High density of human and livestock population is leading to degradation of land and water resources. Biodiversity is threatened as a result of over grazing of pastures, encroachment and over-harvesting of forests.

Traditional natural resource management in Rajasthan is characterized by community managed lands, consisting of

- Agors (A) which is areas that traditionally served as catchments for water bodies;
- Gouchars (G) are areas that served as community grazing lands; and
- Orans (O) that are areas that served as community forests.

Community managed AGO lands are repositories of biodiversity and the source of multiple products such as grass, fodder, fuel wood, timber and non-timber tree products. Protection and management of AGOs are fundamental to the survival of agro-ecosystems in desert areas, as well as maintenance of ecosystem stability, integrity, functions and services in the face of climate change.

In three project districts, community managed AGOs which constitute a traditional system of Natural Resource Management cover 50% of the geographical area. Over the years, the total land area under community managed AGO lands has declined and the level of degradation of remaining AGOs has greatly intensified.

The project aims to support an alternative approach to the management and use of land resources. On the ground, interventions for climate-resilient SLEM

Photo: <http://travel4awareness.blogspot.com/2010/09/bikaner-day-1-i-well-spent-chasing-camels.html>



**Thar Desert Ecosystem, Bikaner, Rajasthan.**

practices is demonstrated in selected clusters of villages in four ecosystem blocks of the Thar Desert in Rajasthan covering approximately 2,488 sq. km. in three districts: Agolai and Luni in Jodhpur district, Panchapadra in Barmer district, and Rohat in Pali district. These 3 districts cover approximately 249,000 hectares, and the project target 75 villages within these districts spanning 6,000 hectares. Rain fed agriculture along with livestock rearing is the dominant livelihood activity in this region.

Some key elements of the project are

- A decentralized approach to natural resource management, that ensures capture of and integration of climate change variables into natural resource management;
- Integrated land-water-livestock planning and management with special attention to climate risks;
- Development and adoption of sustainable use / harvesting / management practices of pastures

## Objectives:

- Help arrest land degradation that is compromising the functions and service of the Thar Desert ecosystem and the livelihoods of its inhabitants.
- Decrease the trend and severity of degradation in AGO lands, improve the condition of biodiversity, improve resilience to climate change including variability, and enhance the carbon stored at above-ground and below-ground levels.
- Provide local benefits to the community in the form of enhanced water storage capacity of land, enhanced grass productivity, and indirectly enhance the cash economy of the otherwise subsistence economy.
- Address climate change adaptation strategies for enhancing water availability in the AGO lands through structural interventions that are mostly grounded in community participation and screened in accordance with climate change resilience. To achieve this, the project will work towards removing the barriers - clustered under policy and regulatory; institutional capacities; and capacities at the community level.

and forests that are climate resilient;

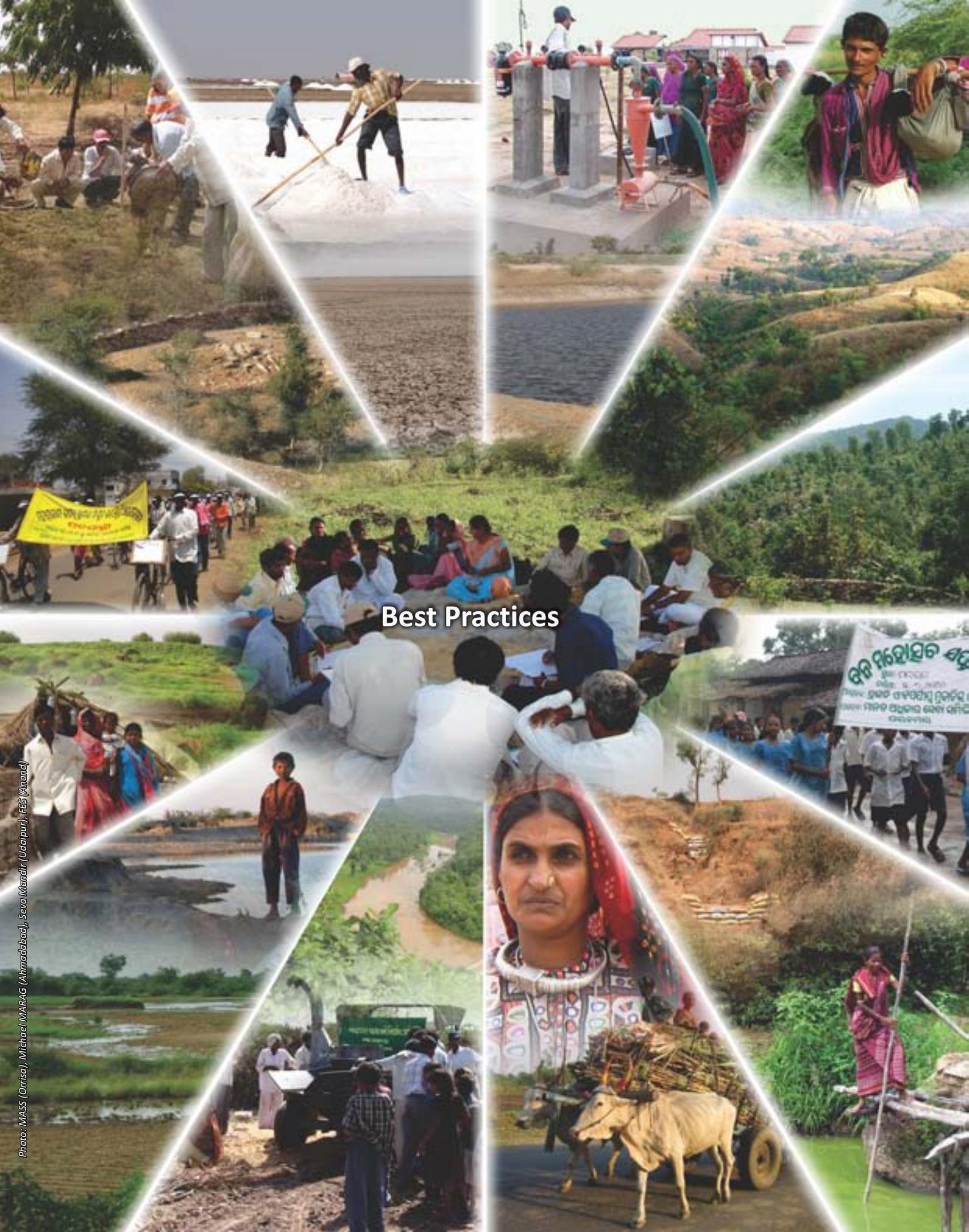
- Empowerment and participation of local communities, particularly women;
- Promotion of livelihoods and equitable sharing of benefits, particularly focusing on women;
- Empower people through the creation and strengthening of village level institutions.
- Community and institutional capacity development for climate resilient SLEM
- Participatory climate resilient SLEM demonstration
- Enhanced knowledge management system for replicating good practices in integrated and climate resilient management of community land resources.

## Achievements:

- Creation of an enabling environment for climate resilient, sustainable land and ecosystem management (SLEM)

Facts and Figures (2007 - 2010)		
1	Nodal/Implementing Agency	Government of Rajasthan and UNDP
2	Area covered	75 villages in three districts of Rajasthan State
3	Target groups	Village communities
4	Project period and status	October 2009 - October 2012
5	Funding	United Nations Development Programme – ₹ 31.50 Million (USD 0.70 Million) Government of Rajasthan- ₹ 630 Million (USD 14 Million) Global Environment Facility- ₹ 40.91 Million (USD 0.91 Million) Total: ₹ 702.41 Million (USD 15.61 Million)

**For more information:** [http://undp.org.in/?q=environment\\_and\\_energy/project-documentation](http://undp.org.in/?q=environment_and_energy/project-documentation)



Best Practices

Photo: MAASS (Orissa), Michael/MARAC (Ahmadabad), Seva Mandir (Udaipur), FES (Anand)

# Best Practices

In the context of the UNCCD, best practices are measures, methods or activities that are considered successful in terms of achieving desired outcomes (good performance) and contributing to expected impacts formulated in the 10-year strategic plan and framework to enhance the implementation of the Convention (The Strategy). In this segment, there are 11 Best Practices, including the work undertaken by both, UNCCD accredited CSOs and also non- accredited CSOs. There are other Best practices emerging from the various programmes of ministries and departments implemented at the local level, that couldn't be incorporated due to paucity of time and resources.

## Soil & Water Conservation

1. Sand drift control and sand dune stabilization
2. Ravine reclamation
3. Revival of Nala (stream)/river

## Land-use Planning

4. Sustainable land-use planning at village level for management of natural resources and livelihoods enhancement

## Securing Livelihoods: Multi-focal approach

5. Comprehensive environmental management through holistic development
6. Drought Proofing in perennially drought prone villages
7. Restoring village common land for sustainable livelihoods
8. Organic Wadi Development – an integrated approach for the livelihood enhancement of tribal community

## Knowledge Management

9. *Prosopis cineraria* based agroforestry
10. Community Forest Rights
11. Rural Knowledge Centre

# 1 Sand drift control and sand dune stabilization

Arid Forest Research Institute, (AFRI) situated at Jodhpur in Rajasthan (India) , is one of the institutes of the Indian Council of Forestry Research & Education ( ICFRE ) working under the Ministry of Environment & Forests, Government of India. The objective of the Institute is to carry out scientific research in forestry in order to provide technologies to increase the vegetative cover and to conserve the biodiversity in the hot arid and semi arid region of Rajasthan, Gujarat and Dadara & Nagar Haveli union territory.

## Summary:

**Objective:** Sand drift control and sand dune stabilization by using *Calligonum polygonoides* with *Cassia angustifolia*.

**Location & Area:** shifting dune, semistabilized dune and inter dune plane in Gadwala Forest Block, Bikaner Division, Rajasthan, 3 ha.

**Project Area information:** Land is arid, major occupations are agriculture and animal husbandry in this region

**Problem:** Sand drift due to overgrazing, faulty agricultural practices and destruction of natural vegetation. Moving sand encroach agricultural field, human habitation, canal, road and railway tracks.

**Best Practice:** *C. polygonoides* with *C. angustifolia* is the most suitable option which provides better microenvironment and helpful in developing effective surface vegetation to control sand drift. Introduction of under shrubs and grasses (leguminous and/or non leguminous effects positively in controlling sand reactivation and drift as well as improve soil organic matter particularly nitrogen.

**Organizations involved:** AFRI, State Forest Department of Rajasthan, and Ministry of Rural Development Government of India.

**Technical Details of the experiment:** The experiment was laid out in a split plot design with three replications. Three plant species viz. *Acacia tortilis*, *Prosopis juliflora*, and *C. polygonoides* of about about 20 cm, 40 cm and 15 cm in height were planted in September 1996 at a spacing of 5 m X 5 m. 75 species per tree were planted.

### Conditions/Approaches that led to success:

- Introduction of surface vegetation does not leave soil.
- Surface bare hence control sand drift effectively.
- *C. angustifolia* remains green even during summer

when maximum sand drifts takes place and most of the vegetation dries out.

- Thus this practice is helpful in developing effective surface vegetation to control sand drift in addition to improve biodiversity and ecology of the arid areas.

### Lessons learnt:

- Involvement of under shrubs and grasses as the surface vegetation along with the planted tree species provided beneficial effects in controlling sand reactivation and drift, particularly, at the time when planted seedlings attain the size of a tree.
- *Dactyloctenium indicum* grass competes with and



**Efforts for sand dune stabilization, Badmer district, Rajasthan.**

### Connection to the UNCCD theme

- DLDD and SLM monitoring and assessment/research.
- Knowledge management and decision support.

affects the growth and biomass of planted seedlings that requires management in the form of weeding and/ or soil working to reduce competition and enhanced the growth in flat land.

- Harvesting of leaves of *C. angustifolia* and fodder from *Cenchrus ciliaris* grass can increase income.

Benefits of the practice		
Environmental	Economic	Social
<ul style="list-style-type: none"> <li>● Increase in carbon stock like 3.72 tones C/ha with <i>A. tortilis</i>, 5.24 tones C/ha with <i>P. juliflora</i> and 5.66 tones C/ha with <i>C. polygonoides</i>.</li> <li>● Increase in diversity and land productivity.</li> <li>● Adult neighbouring plants are helpful in developing effective surface vegetation to control sand drift. They are also helpful to improve biodiversity and ecology of the arid areas by enhancing soil fertility.</li> </ul>	<ul style="list-style-type: none"> <li>● <i>C. polygonoides</i> produced the highest biomass in form of fuel wood utilizing minimum amount of soil water.</li> <li>● <i>C. polygonoides</i> was sold with market cost of ₹ 12/kg.</li> <li>● From <i>C. angustifolia</i> leaves a farmer can get ₹ 16720 ha/year as compared to ₹ 9120 ha/year from <i>A. tortilis</i> based system.</li> </ul>	<ul style="list-style-type: none"> <li>● Reduced time in fodder collection and diversion of children towards education.</li> <li>● Increased social status.</li> </ul>

**For more information:** Arid Forest Research Institute (AFRI), Rajasthan, India, Email: [dir\\_afri@icfre.org](mailto:dir_afri@icfre.org), Website: [www.afri.res.in](http://www.afri.res.in)

## 2 Ravine reclamation

Foundation for Ecological Security (FES) is a Gujarat based NGO working towards ecological restoration and conservation of land and water resources, in the uplands and other eco-fragile, degraded and marginalized zones in the country. This project describes its work under GEF, UNDP SGP program, for reclamation of ravine areas in the common lands of the village Khorwad situated on the banks of river Mahi in the state of Gujarat.

### Summary:

**Objective:** Restoration and stabilization of ravines along the banks of Mahi River through appropriate soil and water conservation measures and improve the vegetative cover to aid ravine reclamation and provide long term solution.

**Location & Area:** Village Khorwad, Block Umareth, Dist Anand, Gujarat; 55ha common lands and replicated in over 100 acres areas.

**Duration:** 1995-2005.

**Project Area information:** Total population 3,094 mostly below poverty line, major occupations are Animal Husbandry, Agriculture, Farm and other daily labor works.

**Problem:** Ravine and gullies formation due to severe soil erosion in village common lands which can extend to culturable land resulting in loss of productivity and livelihood.

**Best Practice:** A comprehensive treatment plan prepared with community participation. The plan was overlaid on cadastral map on the village map; ravines were marked on the digitized map and based on this soil and moisture works were planned for the marked area.

**Organizations involved:** FES, Soil and Water Conservation Research and Training Institute, Vasad, unit of ICAR & Khorwad Tree Growers Cooperative Society (TGCS).

### Activities:

Soil and moisture work was planned according to ridge to valley approach starting with the farmlands on the plains above the riverbank and proceeding to the common lands on the banks of the river. Some of the technological measures taken include,

- Regeneration of the native species and the succession patterns were worked out;
- Grass seeding and pitching were done on large scale;
- To control soil erosion lower order streams

identified and treated using earthen check dams;

- Soil bag check dams inter spread to reduce the head ward expansion of the ravines in to the farmland.

Village level TGCS was formed and common land was leased to it for tree growing and ravine reclamation. Specific bye laws were evolved to decide about the process and participation in different activities, benefits sharing and protection mechanism for the common land developed.

**Conditions/Approaches that led to success:**

- Ecological Planning and Restoration matching/ supporting livelihood requirements.
- Strengthening and crafting village level institutional mechanisms based on democratic principles and securing legal tenure arrangements for the communities over the common land.
- Networking with other organisations to share and facilitate discussions and action on issues of governance and sustainable management of natural resources and for such intervention at a larger scale.

**Lessons learnt**

- Village institutes learnt the importance and methods of maintaining accountability and transparency.
- To treat small gully the best option was construction

of hybrid gully plugs (locally known as bori bandh). It is very effective to treat gully alternatively by hybrid gully plugs and vegetative gully plugs.

- Natural regeneration from existing rootstock should be promoted. Enrichment should be done through seeding and plantation of native species. Difficult-to-grow species raised in the decentralized nurseries for enrichment in the ravines lands.

**Connection to the UNCCD theme**

- Capacity-building and awareness-raising.
- Knowledge management and decision support.
- Policy, legislative, institutional framework.
- Participation, collaboration and networking.

Benefits of the practice		
Environmental	Economic	Social
<ul style="list-style-type: none"> <li>● 1, 11,039 saplings planted.</li> <li>● Patch budding of improved variety of wild and local varieties of jujube produced good results.</li> <li>● Species like sandalwood (endangered in Gujarat), came up naturally.</li> <li>● Enhanced vegetative cover marked by presence of about 72 diverse species increase in the green weight by 183 Mt/Ha.</li> <li>● CO<sub>2</sub> sequestration increased by 55 Mt/Ha.</li> <li>● The soil fertility and nutrition has also gone up.</li> </ul>	<ul style="list-style-type: none"> <li>● Approximately 509 metric tones of fodder distributed in the last few years.</li> <li>● Villagers also collect other minor tree produce like pods of Acacia species and leaves and twigs of Neem during the summer months when there is tremendous shortage.</li> <li>● Contribution to the livelihood efforts of entire communities by increasing access of marginalized groups to grazing land and water holes for cattle and other livestock.</li> </ul>	<ul style="list-style-type: none"> <li>● Formation of a village institution for managing the commons has led to increase in collective feeling of the village and has proved to them that common property can be managed together for the benefit of all.</li> <li>● Rules developed for the protection of natural resources, distribution of fodder and fuel and other minor tree produce from the common land.</li> <li>● Employment opportunities and income to the community from this is instrumental in reducing migration.</li> </ul>

**For more information:** Foundation for Ecological Security (FES), Anand, Gujarat, India;  
 Email: [ed@fes.org.in](mailto:ed@fes.org.in); Website: [www.fes.org.in](http://www.fes.org.in)

### 3 Revival of Nala (stream)/river

Kamalnayan Jamnalal Bajaj Foundation (KJBF) is a non government organization initiated in 2009. The major emphasis of its work is on integrated water resource development and management, agriculture development, livestock development, women empowerment and training and capacity building through participatory approaches.

#### Summary:

**Objective:** Restoration or revival of silted nala/river in Deoli block of Wardha district, Maharashtra.

**Location & Area:** Block Deoli, Dist. Wardha, Region Vidarbha, Maharashtra; 1,250ha of area.

**Project Area information:** Total population 2,090 with largest scheduled caste population in the district, major occupation is agriculture.

**Problem:** Encroachment and silt deposition in the river catchment area has reduced water holding capacity. This led to flooding of the agricultural fields and in absence of natural drainage cultivable land is rendered fallow.

**Best Practice:** The silted nala/river was widened & deepened with the help of JCB machine and the banks were raised to certain level to pass runoff safely as suggested by the community.

**Organizations involved:** Kamalnayan Jamnalal Bajaj Foundation along with CBO, Village Development Committee and user groups.

#### Activities:

- Participatory Rural Appraisal, small group discussions, village meetings were used to assess needs and arrive at a solution, decide community contributions and develop an appropriate plan.
- Village Development Committee (VDC) representing volunteers from different sections of community was formed who played a crucial role in motivating farmers, building consensus, collecting community contribution and taking the overall implementation process further.
- As suggested by community the silted river was widened and deepened and the banks were raised to certain level to pass runoff safely. 12.5 km stream has been widened and revived.

- Check dams constructed over revived river.

#### Conditions/Approaches that led to success:

- Highly motivated and active participation of local leaders (Gram Panchayat).
- Farmers organized themselves in a structure to work (VCD).
- This practice has transparent execution, monitoring and financial management system.

#### Lessons learnt:

- The activity costs reduced due to people's participation and long term sustainability created through people's institutes.
- Water harvesting structure can be constructed

## Connection to the UNCCD theme

- DLDD and SLM monitoring and assessment/research.

after one year of completion of revival of river. For better results this activity should be executed from the origin of river towards the end.

- Simple low cost measures planned strengthening capacities and knowledge base of communities.
- The activity is suitable to be adopted under governmental programmes such as MGNREGS.



Photo: FES, Anand

**Boribandh treatment for ravine reclamation, Dunggripura, Savli block, Baroda district, Gujarat**

Benefits of the practice		
Environmental	Economic	Social
<ul style="list-style-type: none"> <li>● Removal of silt from the river led to exposure of hard murrum level which helps recharging water fast.</li> <li>● Construction of check dams led to increased water level in near wells and also supported irrigation.</li> <li>● Soil degradation was reduced resulting in conservation of top fertile layer of soil.</li> <li>● 2100 acres of agricultural land was saved from flooding and water logging. 145 acres of fallow land brought under cultivation.</li> </ul>	<ul style="list-style-type: none"> <li>● 75 acres of cropland near river was protected from flood which in turn increased crop yield. This improved living condition of the people.</li> <li>● Income level of the farmers can be increased due to increased land availability for cultivation land and water holes for cattle and other livestock.</li> </ul>	<ul style="list-style-type: none"> <li>● Increased income of the farmers improved the condition of their families.</li> <li>● Provided community with plenty of water which they can use for various purposes.</li> <li>● This practice gave an opportunity to the marginal community to take part in planning process.</li> <li>● Reduced drudgery for women as less time needs to be spent on fuel wood collection.</li> </ul>

**For more information:** Kamalnayan Jamnalal Bajaj Foundation (KJBF), Wardha, Maharashtra, India, Website: [www.bajajfoundation.org](http://www.bajajfoundation.org); Ph: +91-7152-250867

## 4 Sustainable land-use planning at village level for management of natural resources and livelihoods enhancement

Society for Promotion of Wasteland Development (SPWD) is a non governmental organization which assists local grassroot NGOs and community to improve their environmental regeneration initiatives, reverse and prevent degradation. It helps them planning, formulation and implementation of field studies related to watersheds, land use management and natural resource preservation.

### Summary:

**Objectives:** To assess degradation of resources by mapping current status of land, water and forest resources; identify opportunities for sustainable livelihoods and Formulate a plan for sustainable management of local resources.

**Location & Area:** Jaisamand catchment, Dist. Udaipur, Rajasthan; 185,787ha.

**Project area information:** Total population 1,183,369; major occupations are Animal Husbandry, Agriculture, Agriculture labor works; 50% households are below poverty line and 2/3 of the households are tribal.

**Problem:** Steady drought spell resulted in decline of water table, increased dependency on animal husbandry and increased migration. Overexploitation of resources led to decline in forest or vegetative cover and increase in wastelands.

**Best Practice:** SPWD along with the local community by mapping land, water and biotic resources ecologically characterized Jaisamand catchment and identified the major ecological issues associated with each major livelihood system in the area. After analyzing the caring capacity of the community, a sustainable management plan with various developmental programmes was prepared by identifying and prioritizing actions for development of resources.

**Organizations involved:** SPWD, local NGOs like Prayatna Samiti, Bambora; Hanuman Van Vikas Samiti, Sakroda and Jagran Jan Vikas Samiti, Vali.

### Activities:

Local government was responsible for implementation of the sustainable management plan developed. Various government departments, NGOs and technical institutes pooled in their resources and expertise for this whole process. Some of the activities and initiatives are,

- Mapping of land water and biotic resources, ownership/use and access pattern analysis of the resources and estimating carrying capacity of the village resources.
- Scoping exercises for optimal uses of resources and developing intervention plans for restoration and development of village resources.
- Compilation of plans and bringing synergy in various programmes.
- Several self help groups formed and arranged themselves in clusters.
- Establishment of resource centers which performs the function of design and delivery of services.

### Connection to the UNCCD theme

- Capacity-building and awareness-raising
- DLDD and SLM monitoring and assessment/research
- Funding or resource mobilization

### Conditions/Approaches that led to success:

- Integration of the government scheme like National Rural Employment Guarantee Programme proved helpful to implement the plan.
- Role of local governance institutions is very important to realize the plans and implement them properly.
- Organisation of local communities and their participation in assessment, visioning, planning, implementation and management of interventions are crucial.

### Lessons learnt:

- Communities require facilitation for understanding current situations, opportunities and plan accordingly. They may organize for common concerns if they realize significance of the same.
- Use of modern science can reduce planning cost significantly. Communities can use modern technologies when exposed and trained. Use of GIS and remote sensing can help in understanding spatial and temporal patterns of degradation restoration of resources. Impact assessment of developmental interventions can be done more accurately with its help.
- A separate provision for planning should be made under any developmental programme. Planning with technical back stopping can help in prioritizing interventions based on social, financial and ecological considerations.

### Benefits of the practice

Environmental	Economic	Social
<ul style="list-style-type: none"> <li>● Degraded areas reclaimed and Ecologically fragile areas were restored through developmental programmes.</li> <li>● Production from common and private land improved.</li> <li>● Various plans developed have the component of enhancing vegetative cover and biomass in the village to sustain livelihoods of communities and eco restoration.</li> <li>● Increased vegetation cover will contribute in carbon sequestration.</li> </ul>	<ul style="list-style-type: none"> <li>● The river basin level assessment cost around ₹ 6/- per hectare, while village level assessment, perspective building and planning exercise cost around ₹ 35/- per hectare. Thus owing to local initiatives, community participation and networking the process becomes cost effective.</li> <li>● Marginal groups got opportunities to improve their livelihoods by creation of durable assets.</li> </ul>	<ul style="list-style-type: none"> <li>● Participation of marginal groups ensured at all the levels.</li> <li>● Helped bridging the gap between local communities and government by articulating the common aims and objectives of both the stakeholders.</li> <li>● Promoted use of modern science and technology knowledge among local communities and brought synergy between modern sciences and indigenous knowledge at grass root level.</li> </ul>

**For more information:** Society for Promotion of wasteland development (SPWD), Udaipur, Rajasthan, India; Email: [spwdudpr@yahoo.com](mailto:spwdudpr@yahoo.com), Website: [www.spwdindia.org](http://www.spwdindia.org)

## 5 Comprehensive environmental management through holistic development

Watershed Organization Trust (WOTR) a NGO founded in 1993 believes that land degradation and water scarcity are the most intense and commonly felt needs of a village community that can bring different groups of people together to begin their development process. Community restoration of the natural environment makes sustainability happen. Community-led efforts help combat and adapt to climate change and mitigate the impacts.

### Summary:

**Objective:** Empowering communities to take charge of their own development through collective action for sustainable natural resource management.

**Location & Area:** Wankute village located at the foothills of the Sahyadri ranges in Ahmednagar ; 1486 ha.

**Project Area information:** Estimated population is approximately 1,377 with about 70% population living below poverty line. Agriculture, livestock rearing and labor are the main occupations.

**Problem:** Fuel wood, fodder and water scarcity, lack of management of catchment, land degradation, & inequitable resource distribution.

**Best Practice:** Village Development Committee (VDC) involving every section of community including 49-51% women representation was formed. WOTR helped the community to first form a vision for their village. Issues were identified and various groups were formed to address issues. Inter-linkages were created with relevant government departments, financial institutes, SHGs, village institutes and academic institutes to provide all-round support to the activities. Wealth ranking was done to obtain contribution in equitable manner and share benefits with the poorest.

**Organizations Involved:** Misereor, Community Action for Poverty Alleviation, Swiss agency for Development and Cooperation, forest department, International Livestock Research Institute, Agricultural Department and Minor Irrigation Department funded the led initiative by WOTR along with Jai Malhar Village Watershed Committee, District Animal Husbandry, agriculture and forestry department, Mahatma Phule Agricultural University, District Central Co-operative Bank.

**Activities:** VDC conducts various activities with community participation including,

- Promote the mechanisms to negotiate improved fodder access in public (wastelands) and private grazing areas.
- Participatory Net Planning to study each plot of land and design its treatment together with the land owner/farmers.
- Plantation, construction of drinking water wells, farm bunds, continuous contours, horti-pasture, nala bunds, check dams etc. was done through 'shramdan' or volunteer labour. Organic farming, micro farming, Kitchen gardens and soak pits, drip irrigation, water budgeting.
- Work is in progress for agro-met stations which will help farmers plan their agricultural activities.

### Connection to the UNCCD theme

- Capacity-building and awareness-raising.
- DLDD and SLM monitoring and assessment/research.
- Policy, legislative, institutional framework.
- Funding/resource mobilization.
- Participation, collaboration and networking.

- Training, exposure visits to the neighbouring villages, farmer to farmer extension, experience sharing workshops and gatherings are conducted.
- Linking up with DRDA for complimentary programmes.

#### Approaches that led to success:

- Wasundhara approach is a local initiative which helped local community members to take up the activities. Participatory approach of the project

ensured the community's continuous support.

- Addressing the issue of equitable distribution of benefits and involving community to distribute benefits to the poorest of the poor.
- Village envisioning helped villagers to see their future and design their own path for development.

#### Lessons learnt:

- For management of natural resources the whole village must come together and manage it together. All communities must be given their equitable space and representation to voice their demands.
- Communities can create and manage funds transparently when capacitated for the same.
- A systematic ridge to valley approach and detailed Participatory Net Planning is important as peoples' participation is a must for success for watershed projects. Village envisioning creates a sense of accountability, responsibility and ownership.

### Benefits of the practice

Environmental	Economic	Social
<ul style="list-style-type: none"> <li>● Wasteland reduced from 300 ha pre-watershed to 55 ha post-watershed.</li> <li>● As a result of women's initiative, the village now has 160 solar lamps, 15 smokeless chulhas and 32 hot water chulhas, reducing use of bio-mass for fuel.</li> <li>● 110,000 saplings planted on wastelands and mountains helped increasing ground water level.</li> <li>● Convergence approach adopted for fodder management is being spread to other WOTR project areas in its Climate Change Adaptation Project.</li> </ul>	<ul style="list-style-type: none"> <li>● Increases land use area from 600 ha to 800 ha for Khariff crops, from 30 ha to 400 ha for Rabbi and from 0 ha to 10 ha for summer crops.</li> <li>● Increase in per acre production of rice from 10-12 bags to 20 bags (1 bag=100 kgs).</li> <li>● Round the year fodder availability even with excess that is sold out to generate extra income.</li> <li>● Reduction of wasteland helped in increased productivity, growth through innovative, sustainable practices and knowledge.</li> <li>● Increased revenue.</li> </ul>	<ul style="list-style-type: none"> <li>● Wasundhara approach led to incentives for the VDC, women self help groups and PRIs. This demonstrated a positive discrimination in the favour of the disadvantaged.</li> <li>● Kitchen gardens and soak pits are being promoted to address the strategic needs of women.</li> <li>● Villagers constructed individual latrines, anganwadi (child care centre), high school, roads, public health care centre.</li> <li>● Women empowerment through training educational programs, personality development, personal care advisories.</li> </ul>

**For more information:** Watershed Organization Trust (WOTR), Pune, Maharashtra, India;  
Email: [ahmednagar@wotr.org](mailto:ahmednagar@wotr.org); Website: [www.wotr.org](http://www.wotr.org)

## 6 Drought proofing in perennially drought prone villages

Manav Adhikar Seva Samiti (MASS) is a NGO which works with poor, tribal and underprivileged sections of the society in the resource rich but economically poor state of Orissa. MASS in partnership with GEF UNDP SGP, CEE and local communities initiated its work in drought prone Paikmal block of Bargarh district.

### Summary:

**Objectives:** To increase soil fertility and water retention capacity of the village; promote sustainable agriculture and land management practices; create awareness and build institutional capacities.

**Location & Area:** Paikmal block of Bargarh district in Western Orissa; 250 ha. The area is at the foothills of Gandhamardan hill ranges, one of the biological hot spots on the Eastern Ghats.

**Duration:** 1 July 2002 - 31 December 2003.

**Project Area Information:** Population aprx. 4000, Agriculture is the main source of income while timber and non timber forest produce are also important source of income.

**Problem:** Drought vulnerability leading to reduced yield, loss of livelihood, and migration; disruption of traditional water harvesting system due to sheer negligence; disempowerment of people, gender bias and exploitation; rapid loss of forest and vegetative cover leading to soil erosion and land degradation.

**Best Practice:** Through PRA village resource maps were prepared; Citizens' groups and forums were built who then in partnership with other NGOs, and Government departments conduct capacity building programmes and sustainable resource management activities with community participation.

**Organizations involved:** MASS, Lok Bikash Manch, Jay Nursingh Biparjay Mukabila Mahasangha, Pragati Mahasangha, Gandhamardan Mahila Sachaya Samiti Mahasangha (people's federation), Farmers clubs (periphery villages of the operational village) and Migration Information Centre. Western Orissa Rural Livelihood Project (WORLP), Watershed and Agriculture Department of the block.

**Activities:** After series of community consultations, villagers came up with a plan addressing various issues and problems. Some of the activities conducted under the best practice include,

- Netting irrigation systems, land leveling, bund strengthening, gully plugging.
- Water harvesting at crop field level, renovating different types of traditional water bodies.
- Preparation of organic manure, seeds conservation

and preservation, seed bank formation.

- Institutional arrangements to manage and distribute water from common property resources.
- Women self help groups formed under this project saved some money and were successful in carrying our small scale business.

### Conditions/Approaches that led to success:

- The continuous drought condition in an area where drought was not seen before had already made

people so much vulnerable that they were extremely receptive to solutions.

- Forest protection was traditionally well accepted concept hence it was easily adapted to combat desertification.
- Traditional water harvesting and management techniques have been a rich heritage of the community hence its revival and linkages with other government programmes encouraged people's morale and participation.

**Lessons learnt:**

- Human resource, with appropriate knowledge, skills, abilities and aptitudes, is very crucial for effective implementation and sustainability of programmes. Thus people and their institutes to represent every

**Connection to the UNCCD theme**

- Capacity Building and awareness raising.
- Participation, collaboration and networking.

section of community were involved in the project.

- Promoting low cost technologies that the people themselves can manage has been a good experience.
- Using local technologies bring back confidence level in the poor farmers while reviving traditional models of sustainable development. If such technologies can be developed and promoted widely they could successfully integrate into local technology to arrest the process of desertification and can help mitigate climate change.

Benefits of the practice		
Environmental	Economic	Social
<ul style="list-style-type: none"> <li>● Land based netting irrigation system in farming land led to maximum rain water to field.</li> <li>● 400 ha of land restored and brought back to productive agriculture.</li> <li>● Water retention capacity of traditional water harvesting structures increased by at least 40 per cent.</li> <li>● Some local streams, which were on the verge of extinction have started flowing again.</li> <li>● Wild life species, especially bird species have re-emerged in the area with increased forestry and water coverage.</li> <li>● This practice forms cushioning impact through combination of different efforts coping with rising temperature and drought impacting directly on the forest and soil productivity due to climate change.</li> </ul>	<ul style="list-style-type: none"> <li>● By use of forest, improving land, human resource and skills, about 1000 families have got alternative income avenues under farm and non-farm sectors.</li> <li>● Decreased migration resulting in higher manpower led to increased production in crop fields by 50%.</li> <li>● Increased employment opportunity for at least 200 unemployed youth.</li> <li>● 50 women self help groups have been able to save six lakh rupees and have been successful in carrying out small scale business.</li> <li>● Access to various schemes like NREGS, old age pension, Indira Awas Yojana, forest development, water public distribution etc.</li> </ul>	<ul style="list-style-type: none"> <li>● Decreased migration.</li> <li>● 300 women benefited directly from the self help group.</li> <li>● Peripheral villages of the project area have taken similar efforts in other parts of the block and the model has got widespread media coverage including a recent special feature in national television programme.</li> </ul>

**For more information:** Manav Adhikar Seva Samiti (MASS), Sambalpur, Orissa, India

## 7 Restoring village common land for sustainable livelihoods

Paryatna Samiti (PS) is a civil society organization working on community development and natural resource management. The current practice is being developed with support from Global Environment Facility (GEF), UNDP under Small Grants Program (SGP).

### Summary:

**Objective:** Restoration of degraded area and preparing community for self management of resources.

**Location & Area:** Bori, Village Sagatadi, Block Girwa, Dist Udaipur, Rajasthan; 79ha.

**Duration:** The programme started in 2005- 2011.

**Project Area information:** Total population 356 more than 50% below poverty line, major occupations are animal husbandry, wage labour and agriculture.

**Problem:** Uncontrolled grazing, tree felling, resource access and use related conflicts, lack of any management system, reduction in vegetation cover, increased soil erosion contributed to degradation of village common land particularly grazing lands.

**Best Practice:** Villagers identified the land for work and set up management systems. The community was prepared for the self management of the resources. Local community was sensitized about common resources, their roles and responsibilities.

**Organizations involved:** Praytana Samiti, Forest Department, Society For Promotion of Wasteland Development and Revenue Department.

### Activities:

- Villagers contacted the Forest Department to get their help for the plans. The villagers were involved with physical work, such as fencing, pit digging, trench, boundary wall and plantation of local species.
- Developed pasture land in 79 ha and constructed water harvesting system.
- By using revenue records and clearing ownership issues community and inter-village conflicts ere resolved.
- Construction of a protection wall to address encroachment, participatory planning for soil &

water conservation and regeneration of biomass.

### Conditions/Approaches that led to success:

- Active participation of villagers and highly motivated stakeholders contributed towards success of this activity.
- Collectiveness of the villages and equal participation in execution and management also played crucial role towards success of the project.

### Lessons learnt:

- People's institutions and participation enhance local ownership.
- As the productivity of the land increases, stakeholder participation increases. Positive

### Connection to the UNCCD theme

- DLDD and SLM monitoring and assessment/research.
- Capacity-building and awareness-raising.
- Knowledge management and decision support.
- Participation, collaboration and networking.

association of stakeholders thus ensures sustainability.

- People's contribution in cash/kind is very essential for sustainability.
- Measures and Norms need to be jointly agreed between stakeholders so as to build the long term vision, innovativeness and benefits.



Photo: CEE Photo Bank

**Integrated water harvesting system, Gira river, Dang district, Gujarat.**

Benefits of the practice		
Environmental	Economic	Social
<ul style="list-style-type: none"> <li>● 79 ha of degraded land converted in to pasture land which helped to reduce soil erosion.</li> <li>● Reduced run off leading to protection of top soil layer.</li> <li>● Land productivity increased.</li> <li>● Tree canopy area increased which provided habitat for birds.</li> <li>● Due to enhanced vegetative cover heat reflections from bare rocks reduced.</li> <li>● Water conservation increased due to harvesting structures.</li> </ul>	<ul style="list-style-type: none"> <li>● After one year 2000 pullas (bundles) of grass fodder produced which increased to 9480 pullas after 3 years and currently the land produces 24,000 pullas per annum.</li> <li>● Community saved the money which they used to spend on fodder. Each family saved almost Rs. 1000 per year.</li> <li>● Increased interest in animal husbandry increased the milk productivity.</li> </ul>	<ul style="list-style-type: none"> <li>● Prepared the community for the self management of the resources.</li> <li>● Resolved community and inter village conflict using revenue land records and clearing the right or ownership.</li> </ul>

**For more information:** Prayatna Samiti, At. Bhambora, Gudli, Udaipur-313706, Rajasthan, India  
Ph: +91-144-2702452

## 8 Organic Wadi (Orchard) development – an integrated approach for the livelihood enhancement of tribal community

National Livelihood Resource Institute was established by Gramin Vikas Trust (GVT). GVT works to enhance sustainable livelihood development for poverty reduction and empowering communities to manage resources in rural and tribal areas. Focus along with land development is on institutional development, women empowerment, labour support and micro enterprise development.

### Summary:

**Objective:** Effective utilization of available land, water and manpower resources and value chain development under certified organic production system for perishable crops like seasonal vegetables and fruits, which helps in enhancing livelihoods of the under privileged tribal community; to promote village institutions for farmers' development.

**Location & Area:** Block Bajna, Dist Ratlam, Madhya Pradesh; 17, 201 ha of land.

**Project Area information:** Population 43500; Livelihood pattern of the community members can be classified as small and marginal agriculture labour and migrants. Small section of the community is engaged in ancillary activities or small businesses like sell of poultry birds, goats and non forest produce.

**Problem:** Soil erosion, lack of involvement of tribal, poor, scheduled community in village development and planning process. Plowing along the slop, continuous mono cropping of maize causes soil erosion. This results in reduced productivity of the land. Hence it forms lack of assured source of livelihood.

**Best Practice:** The participating houses spare one acre of land for plantation. Effective utilization of available land, water and manpower resources of selected tribal families through participatory approach is done.

**Organizations involved:** National Livelihood Resource Institute, Gram Vikas Trust (GVT), National Bank for Agriculture and Rural Development.

### Activities:

- Initiatives to conserve soil and water various activities like field bunding, gully plug, gabion etc and effective water management by use of water tank through gravity system were undertaken.
- Orchards were developed by use of cultivable waste land. Multiple cropping is done according to land class.
- Various steps like providing input of organic matter to the crops, vermi composting, use of organic

manure/compost in the field were taken. Soil testing is done to improve or maintain the quality of soil.

### Conditions/Approaches that led to success :

- GVT's rich experience in tribal areas of community based natural resource management project helped implementing this project successfully.
- GVT had good rapport in the project area due to successful implementation of previous project in neighbouring area.



**Preparation for composting, Rural Knowledge Centre, Halvad, Surendranagar district, Gujarat.**

- Availability of consistent and sustained funding supported these initiatives.

**Lessons learnt:**

- Community may organize for common concerns if they realize significance/relevance of the same are involved in the process of planning and implementation.
- In order to build capacity of the community member from a village as a para professional and

**Connection to the UNCCD theme**

- Capacity-building and awareness-raising.
- DLDD and SLM monitoring and assessment/research.
- Participation, collaboration and networking.

community organizer requires a series of efforts for long term vision.

- Local community leadership needs to be always encouraged through meetings, exposure visits and skills enhancement for better implementation of program.
- Organic farming reduces the input cost of the farming system compared to conventional farming and provides farmers with consistent source of income. WADI infact can provide alternate source of sustainable livelihood.
- Peoples' institutions at village level and apex federation helps to resolve the grassroot level problems, marketing of produces, input supply.
- Planning and technical backstopping can help in prioritizing interventions based of social, financial and ecological considerations.

Benefits of the practice		
Environmental	Economic	Social
<ul style="list-style-type: none"> <li>● It maintains and increases long term fertility and productivity of soil. It increases the micro nutrient in the soil, improves quality of soil.</li> <li>● Land and water pollution reduced.</li> </ul>	<ul style="list-style-type: none"> <li>● Improves the economic status of the farmer through value chain development under certified organic production system for perishable crops like seasonal vegetables and fruits.</li> <li>● It is perceived that in fifth year and later on production and productivity will increase significantly.</li> </ul>	<ul style="list-style-type: none"> <li>● The small and marginal community got opportunities in planning of project and decision making.</li> <li>● Better access to credit by women through bank enhances their status.</li> <li>● Women get special attention and got involved in various activities that improved their livelihood by creation of durable assets.</li> </ul>

**For more information:** National Livelihood Resource Institute, Gram Vikas Trust (GVT), NOIDA, Uttar Pradesh, India; Email: [info@gvtindia.org](mailto:info@gvtindia.org); Website: [www.gvtindia.org](http://www.gvtindia.org)

## 9 *Prosopis cineraria* based Agroforestry

Arid Forest Research Institute (AFRI) is one of the research institute under Indian Council of Forestry Research and Education (ICFRE), with a mandate to increase the vegetative cover and to conserve the biodiversity in hot arid and semi arid regions of India.

### Summary:

**Objective:** To promote agroforestry and study the impact of trees (specifically of *P. cineraria*) on soil quality and overall crop production.

**Location & Area:** Experimental farm of AFRI, Jodhpur city, western part of Rajasthan; 5 ha common land.

**Project Area information:** Major occupations are agriculture and animal husbandry.

**Problem:** Scarcity of fodder and fuel wood, land degradation, low production & erosion.

**Best Practice:** Crops are grown in the interspaces of *P. cineraria*. Facilitating effects are observed on the crop yield because of increased nutrient availability and a balanced resource sharing between the tree and associated crops.

**Activities:** AFRI conducts research in its experimental block on its campus or forest lands as in the present practice. If the research is successful then they it to disseminate the practice to the community facing the problems. Various government department including forest department help to disseminate the practice. Dissemination process of AFRI is through field trails and laying demonstration trials. AFRI's division on 'Agroforestry & Extension' has demonstration plots that involve community members. Training is provided to the beneficiaries.

*Prosopis cineraria* is a hardy, leguminous desert tree grown on the farmers' fields of the region since ages due to its multipurpose uses – food, fuel wood, fodder, soil fertility enhancing ability and observed symbiotic impact on associated crop yield. The current project focused on studying its impact on local agriculture.

### Conditions/Approaches that led to success:

- Agroforestry system is prevalent in the region for the ecological and socio-economic benefits.
- *P. cineraria* is a multipurpose tree. It provides food, fodder and medicine.
- *P. cineraria* does not compete with crops on the field.

### Connection to the UNCCD theme

- Capacity-building and awareness-raising.
- DLDD and SLM monitoring and assessment/research.
- Knowledge management and decision support.



*Prosopis cineraria*

Benefits of the practice		
Environmental	Economic	Social
<ul style="list-style-type: none"> <li>● Total increase in production per unit.</li> <li>● Increased land productivity in the form of improved soil status.</li> <li>● Increase in carbon stock both in soil and vegetation. Thus there is an increase in concentrations of soil organic matter and NH<sub>4</sub>-N in 0-25 cm soil layer.</li> <li>● Tree integration improves the soil health, nutrient and carbon dynamics which further conserves natural resources helps to and improve the biodiversity of the region.</li> <li>● Increased production of fodder and fuel wood as <i>P. cineraria</i> provides utilizable biomass of 19.96 tones/ha including leaf fodder of 0.85 tones/ha/year at 12 year age (208 tree/ha).</li> </ul>	<ul style="list-style-type: none"> <li>● Increased landscape value.</li> <li>● Increased fuel wood supply.</li> <li>● Increased agricultural production.</li> <li>● Increased income through fodder and fuel wood.</li> <li>● <i>P. cineraria</i> improves soil condition and helps increasing crop yield by 11.1%.</li> </ul>	<ul style="list-style-type: none"> <li>● Reduced time in fuel wood collection and diversion of children to education.</li> <li>● Improvement in social status.</li> <li>● Improvement in education and health.</li> <li>● Increased income facilitate social status and promote education.</li> </ul>

**For more information:** Arid Forest Research Institute (AFRI), Rajasthan, India, Email: [dir\\_afri@icfre.org](mailto:dir_afri@icfre.org), Website: [www.afri.res.in](http://www.afri.res.in)

## 10 Community forest rights

Seva Mandir is a non government organization which does various activities like afforestation – on both private, common and forest lands; developing water resources for agricultural, livestock and human needs; promoting sustainable agricultural practices to improve crop productivity and diversity; and engaging in policy advocacy and networking to share lessons and insights with the rest of the development sector.

### Summary:

**Objective:** use the Forest Rights Act to get the village their forest area's tenure rights and in the process capacitate stakeholders to ensure effective management and ecological restoration of the same.

**Location & Area:** 75 Villages, District Udaipur, Rajasthan.

**Project Area information:** Most of the population below poverty line, major occupations are agriculture, livestock rearing and unskilled labor.

**Problem:** With little or no control of village community over its forests and its produce, a section of the community is left with no choice but to overuse the land produce. Overgrazing, and encroachment, land use and ownership conflicts are some other issues.

**Best Practice:** Seva Mandir along with the local community used the Forest Rights Act to get the village their forest area's tenure rights. The tenure right will give the community a tool for management and protection of their respective forest areas over which they have only rights and concessions. Seva Mandir builds their capacity for Joint Forest Management.

**Organizations involved:** Seva Mandir, Van Utthan Sansthan (VUS).

### Activities:

Seva Mandir and Van Utthan Sansthan impart knowledge to the villager about Forest Rights Act and its provision. Hold capacity building and knowledge dissemination workshop with all stakeholders including forest department officials for operationalisation of the act. All these processes are directed towards getting people to take interest in regeneration of the forest through Joint Forest Management (JFM).

Seva Mandir followed the procedure as given in the Forest Right Act to get the tenure right. This involves holding Gram Sabha in the village plus verification of

the site with patwari and Forest Department. The common lands are protected from encroachment and degradation. Regeneration of forest is done through plantation and protection.

### Conditions/Approaches that led to success:

- Use of Forest Right Act for conservation of the restored areas.
- Highly motivated and active participation of local communities led to success of this practice.

Photo: Seva Mandir, Udaipur



**A joint forest management site, hadol block, Udaipur district, Rajasthan.**

### Connection to the UNCCD theme

- Capacity-building and awareness-raising.
- DLDD and SLM monitoring and assessment/research.
- Policy, legislative, institutional framework.
- Participation, collaboration and networking.

### Lessons learnt:

- Building on experiential knowledge of the community and at the same time making communities aware regarding laws and policies related to their land resource is essential. Also it is equally important to build capacity of community members to deal with governmental matters.
- Seva Mandir provides financial assistance to the federation and in turn asks for accountability and transparency. This financial system allows both the parties to engage more with each others work.
- Seva Mandir provides technical support to VUS member. The systems are in place to ensure its transparency.

### Benefits of the practice

Environmental	Economic	Social
<ul style="list-style-type: none"> <li>● Increased forest cover.</li> <li>● Regeneration of forest through plantation and protection will lead to carbon sequestration.</li> </ul>	<ul style="list-style-type: none"> <li>● Provided community with sustainable income.</li> <li>● Long term green cover created with increased productivity and resources for institutions and people.</li> </ul>	<ul style="list-style-type: none"> <li>● Conflict resolution.</li> <li>● Fostering community cohesion as well as sensitization about the right to ownership.</li> <li>● Learning towards constructive activism to stave off dangers that come when the responsibilities of the community are being ignored.</li> </ul>

**For more information:** Seva Mandir, Udaipur, Rajasthan, India; Email: [info@sevamandir.org](mailto:info@sevamandir.org); Website: [www.sevamandir.org](http://www.sevamandir.org)

# 11 Rural Knowledge Centre (RKC)

Centre for Environment Education (CEE) is a non government organization working towards environment education and sustainable development. After 2001 earthquake, community from the Halvad region approached CEE to help them with rehabilitation. To rehabilitate community CEE initiated long term sustainable development initiatives, through empowering communities, facilitating partnerships and creating local decision-making structures directed towards building community assets.

## Summary:

**Objective:** To share knowledge and information towards empowerment of community for sustainable development by being a networking and information hub; support developing symbiotic relationship between protected area of this desert fragile ecosystem and local community, and support local CBOs and governance structures.

**Location & Area:** Halvad, Surendranagar District, Gujarat.

**Duration:** This practice was initiated in 2006 - ongoing.

**Project Area information:** Population 26000; Main source of income are agriculture, animal husbandry and salt farming. Halvad region is bordering to Little Run of Kutchh.

**Problem:** Increasing land degradation due to mono culture, soil erosion, increasing desertification, lack of knowledge, lack of assured sources of livelihood and lack of involvement of poor community and women.

**Best Practice:** Rural Knowledge Centre (RKC) provides training and demonstration on technologies and practices to combat desertification and generate sustainable livelihood; allows specialized knowledge and provide assistance to make contact with government agencies, voluntary bodies and individuals in the development field.

## Activities:

- Various groups like Farmer Field Schools (FFS), Federation of Self Help Groups (FSHG) and village level community and teachers committees were formed to address various issues identified by stakeholders and promote locally driven, need based sustainable development.
- FFS promotes advanced learning related to agricultural areas and spread the knowledge. FSHG established saving credit systems and increased the member's loan worthiness.
- Demonstrations on desertification and climate change adaptation. Generating alternative livelihood opportunities through micro enterprise with reference to the local economy and biodiversity.
- RKC introduced time tested sustainable NRM practices such as composting, use of bio pesticides, drip irrigation, reuse of agriculture waste, soil moisture conservation practices etc.

- It supported multiple methods to increase biomass and reuse of bio mass as farmyard manure.

**Conditions/Approaches that led to success:**

- Efforts of multi disciplinary dedicated field staff at grass root level.
- 'Think globally act locally' approach trying to translate global thinking in local actions.
- Profound and sound understanding of the region.

**Lessons learnt:**

- Developing a cadre of community entrepreneurs, with an understanding about adult learning principles is the most effective and sustainable approach for human resource development.

**Connection to the UNCCD theme**

- Knowledge management and decision support.

- The team within the RKC needs to be multi disciplinary to multi task and take on different approaches and arenas for best practice.
- Financial systems and procedures should be transparent. Cost Benefit analysis on agriculture or other livelihood related purchases should be done with thorough understanding and knowledge regarding the same.
- When the proposal for new technology is considered, local socio- economic issues, cultural practices etc should also be taken in account.

Benefits of the practice		
Environmental	Economic	Social
<ul style="list-style-type: none"> <li>● Encouraged mixed cropping ; increased crop diversity and biodiversity which helps tackling land degradation.</li> <li>● Composting and soil moisture conservation practices helped in improving soil fertility.</li> <li>● Multiple methods to increase biomass and reuse of bio mass as farmyard manure.</li> <li>● Willingness to use environmental friendly solutions - certain Agarya community members agreed to use and install wind generated energy pump instead of diesel pumps in salt farming process.</li> </ul>	<ul style="list-style-type: none"> <li>● People started cultivating other crops along with cash crops.</li> <li>● Increased productivity of the land led to increased income.</li> <li>● Credit saving system and micro enterprise has provided community with improved incomes and access to credits.</li> <li>● Utilizing time tested practices like drip irrigation, composting etc which helps in soil quality, helps saving resources and money which in turn increases the productivity of the land.</li> </ul>	<ul style="list-style-type: none"> <li>● Minority groups such as women, vulnerable and marginalized communities are involved at various levels in all programmes.</li> <li>● Agariya community (salt pan workers) of the region are now more aware of their rights as labour and are organizing towards earning fair wages and better work conditions.</li> <li>● Increased resource literacy of the local community with regards to various issues like water, salinity, desertification etc.</li> <li>● Empowers and help community to adapt to local knowledge and unbiased information which helps them lead to sustainable lifestyle and livelihood.</li> </ul>

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**Annexure-1: State-wise statistics of the processes of desertification/ land degradation (ha).**

Processes State	Water Erosion	Vegetal Degradation	Eolian	Frost Shattering	Salinity/ Alkality	Mass Movement	Water Logging	Rocky/ Barren	Others	Total
Andhra Pradesh	2084611	2546819	13054	0	136977	0	10654	59552	17236	4964792
Arunachal Pradesh	174467	1060423	0	581798	0	0	0	0	0	1816688
Assam	846611	1526454	0	0	0	0	46021	0	0	2419086
Bihar	108490	104812	0	0	9466	0	188070	3646	299	414783
Chhatisgarh	707382	1894274	0	0	647	0	521	14834	17634	2635292
Goa	1172	0	0	0	0	0	0	5073	0	6245
Gujarat	6790469	2737866	543322	0	3294079	0	0	23521	25951	13415208
Haryana/Delhi	0	0	112304	0	72063	0	0	50643	0	235010
Himachal Pradesh	97232	1918629	259	741783	0	4843	0	0	0	2762746
Jammu & Kashmir	207905	313304	618344	7903008	0	4447429	0	0	7428	13497418
Jharkhand	1160878	641235	0	0	0	0	3321	11357	2095	1818886
Karnataka	683450	934861	4537	0	56621	0	0	12883	384	1692736
Kerala	28775	60691	0	0	0	0	0	411	0	89877
Madhya Pradesh	1314276	2083423	0	0	2053	0	333	61990	3283	3465358
Maharashtra	9251593	4034749	0	0	45014	0	0	8371	19450	13359177
Manipur	309038	1179151	0	0	0	0	8517	0	0	1496706
Meghalaya	94256	781036	0	0	0	0	1606	0	0	876898
Mizoram	1036	1664017	0	0	0	0	0	0	0	1665053
Nagaland	0	0	1065578	0	0	0	0	0	0	1065578
Orissa	3206507	2011038	1202	0	0	0	242838	2544	5107	5469236
Punjab	6049	4331	0	0	0	0	0	0	0	10380
Sikkim	20649	152924	0	154776	0	0	0	0	0	328349
Rajasthan	3840503	2138495	15203070	0	364643	0	4108	1383473	31875	22966167
Tamil Nadu	94794	345226	3090	0	1565	0	0	0	6353	451028
Tripura	0	667122	0	0	0	0	14721	0	0	681843
Uttar Pradesh	648939	167697	0	0	1272238	0	131428	12919	4282	2237503
Uttaranchal	82473	2073049	0	827279	811	0	0	0	0	2983612
West Bengal	1789721	618557	0	275	0	0	240480	0	11634	2660667
Total	33551276	31660183	17564760	10208919	5256177	4452272	988507	1651217	153011	105486322

Source: Desertification & Land Degradation Atlas of India. 2007. Space Applications Centre, Indian Space Research Organisation (ISRO), Department of Space, Government of India.

## Annexure-2: Financial outlay table

Sr. No	Programme/Project Name	Funded by	In ₹ Million	Financial Outlay	
				Programme wise total in ₹ Million	In USD Million
1	Integrated Watershed Management Programme (IWMP)	Department of Land Resources, Ministry of Rural Development	39204.20	47669.27	1059.32
		Department of Land Resources, State Governments	8465.07		
2	National Afforestation Programme (NAP)	Ministry of Environment and Forests	10567.20	10567.20	234.83
3	Soil Conservation in the Catchment of River Valley Project and Flood Prone River	Ministry of Agriculture, Department of Agriculture of all states	3570.96	3570.96	79.35
4	National Watershed Development Project for Rainfed Areas (NWDPPRA)	Ministry of Agriculture and Dept of Agriculture	7672.69	7672.69	170.50
5	Fodder and Feed Development Scheme- component of Grassland Development including Grass Reserves	Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture	295.24	295.24	6.56
6	Command Area Development and Water Management (CADWM)	Ministry of Water Resources	10151.30	20302.60	451.17
		State Governments	10151.30		
7	National Rural Drinking Water Programme (NRDWP)	Department of Drinking Water Supply, Ministry of Rural Development	197454.10	585073.41	13001.63
		State Governments of all States of India	387619.31		
8	National Project for Repair, Renovation and Restoration (RRR)	Ministry of Water Resources	10834.00	49976.00	1110.58
		World Bank Group (Loan)	39142.00		
9	The Mahatma Gandhi National Rural Employment Guarantee	Ministry of Rural Development	760566.00	845073.33	18779.41
		All the State Governments	84507.33		
10	Swarnjayanti Gram Swarojagar Yojna (SGSY) / National Rural Livelihood Mission (NRLM)	Government of India Consolidated Fund	63790.00	85053.33	1890.07
		State Governments	21263.33		

Sr. No	Programme/Project Name	Funded by	In ₹ Million	Financial Outlay	
				in ₹ Million	In USD Million
11	National Biogas and Manure Programme	Ministry of New and Renewable Energy	2320.08	2320.08	51.56
12	Biomass Energy and Cogeneration (Non-bagasse) in Industry	Ministry of New and Renewable Energy	476.46	476.46	10.59
13	Biomass Gasifier Programme	Government of India	392.40	392.40	8.72
14	Solar Photovoltaic (SPV) Programme	Government of India	173.78	173.78	3.86
15	Desertification Monitoring and Assessment: Desertification Status Mapping	Ministry of Environment and Forests	13.80	16.40	0.36
		Department of Space	2.60		
16	Arid Zone Research	ICAR, Ministry of Agriculture	78.50	78.50	1.74
17	Identification and Demarcation of Degraded Watersheds in the Catchment Area for Macro Level Planning	Ministry of Agriculture	518.42	518.42	11.52
		State Forest Department, Rajasthan	1.60	1.60	0.04
18	Efficacy and Economics of Water Harvesting Devices in Controlling Run-off Losses and Enhancing Biomass Productivity in the Aravalli Ranges	Ministry of Agriculture	207.00	207.00	4.60
19	Generation of Detailed Database on Soil and Land Characteristics for Degraded Watersheds	Ministry of Environment and Forests	3.00	28.15	0.63
		Lake Development Authority, Govt of Uttarakhand	10.00		
		World Bank Group	15.00		
		Katarmal Village (Wasteland Restoration)	0.15		

Sr. No	Programme/Project Name	Funded by	Financial Outlay	
			In ₹ Million	Programme wise total in ₹ Million In USD Million
21	Enhancing Productivity of Saline Wastelands in Kachchh- through Improved Tree Planting Techniques and Silvopastoral Study	Arid Forest Research Institute (AFRI), Jodhpur	0.77	0.77 0.02
22	Study of Characteristic Features Pertaining to Bio-drainage Potential of some Selected Tree Species	Ministry of Water Resources	4.50	4.50 0.10
23	Policy and Institutional Reform for Mainstreaming and Upscaling Sustainable Land and Ecosystem Management (SLEM) in India	Indian Council of Forestry Research, Ministry of Environment and Forests	45.17	45.17 1.00
24	Sustainable Rural Livelihoods Security through Innovations in Land and Ecosystem Management	World Bank Group	1125.00	4290.30 95.34
		Global Environment Facility	330.30	
		Indian Central Government	2700.00	
		Indian Council For Agricultural Research	135.00	
25	Sustainable Land, Water and Biodiversity Conservation and Management for Improved	Indian State Institutions	900.00	4387.05 97.49
		World Bank Group	3150.00	
		Global Environment Facility	337.05	
26	Integrated Land and Ecosystem Management to Combat Land Degradation and Deforestation in Madhya Pradesh	Global Environment Facility	259.34	1888.67 41.97
		Madhya Pradesh Forest Department	1447.09	
		Minor Forest Produce Federation	182.25	
27	Sustainable Participatory Management of Natural Resources to Control Land Degradation in Thar Desert Ecosystem	United Nations Development Programme	31.50	702.41 15.61
		Government of Rajasthan	630.00	
		Global Environment Facility	40.91	
		<b>Total</b>	<b>1670786</b>	

## Annexure-3: UNCCD Strategy (leaflet)

### UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION

#### The 10-year strategic plan and framework

*To enhance the implementation of the Convention (2008–2018).*

#### THE VISION

To forge a global partnership to reverse and prevent desertification/land degradation and to mitigate the effects of drought in affected areas in order to support poverty reduction and environmental sustainability.

#### UNCCD

Developed as a result of the Rio Summit, the United Nations Convention to Combat Desertification (UNCCD) is a unique instrument that has brought attention to land degradation in the drylands where exist some of the most vulnerable ecosystems and people in the world. Ten years after its coming into force, the UNCCD benefits from universal membership (193 Parties) and is increasingly recognized as an instrument which can make a lasting contribution to the achievement of sustainable development and poverty reduction globally.

As the Convention enters its second decade, the Parties unanimously adopted the 10-year strategic plan and framework to enhance the implementation of the Convention for 2008-2018 (The Strategy) at COP8, held in Madrid in September 2007. The Strategy provides a unique opportunity to address some of the Convention's key challenges, to capitalize on its strengths, to seize opportunities provided by the new policy and financing environment, and to create a new, revitalized common ground for all UNCCD stakeholders.

The Strategy contains the “strategic objectives” to be achieved over the 10 years, and the “operational objectives” that guide the actions of short and medium-term effects

#### STRATEGIC OBJECTIVES AND EXPECTED IMPACTS:

##### 1. To improve the living conditions of affected populations

**Expected impact 1.1.** People living in areas affected by desertification/land degradation and drought to have an improved and more diversified livelihood base and to benefit from income generated from sustainable land management.

**Expected impact 1.2.** Affected populations' socio-economic and environmental vulnerability to climate change, climate variability and drought is reduced.

##### 2. To improve the condition of affected ecosystems

**Expected impact 2.1.** Land productivity and other ecosystem goods and services in affected areas are enhanced in a sustainable manner contributing to improved livelihoods.

**Expected impact 2.2.** The vulnerability of affected ecosystems to climate change, climate variability and drought is reduced.

##### 3. To generate global benefits through effective implementation of the UNCCD

**Expected impact 3.1.** Sustainable land management and combating desertification/land degradation contribute to the conservation and sustainable use of biodiversity and the mitigation of climate change.

##### 4. To mobilize resources to support implementation of the Convention through building effective partnerships between national and international actors

**Expected impact 4.1.** Increased financial, technical and technological resources are made available to affected developing country Parties, and where appropriate Central and Eastern European countries, to implement the Convention.

**Expected impact 4.2.** Enabling policy environments are improved for UNCCD implementation at all levels.

#### **OPERATIONAL OBJECTIVES AND EXPECTED OUTCOMES:**

##### **1. Advocacy, awareness raising and education**

*To actively influence relevant international, national and local processes and actors in adequately addressing desertification/land degradation and drought-related issues.*

**Outcome 1.1:** Desertification/land degradation and drought issues and the synergies with climate change adaptation/mitigation and biodiversity conservation are effectively communicated among key constituencies at the international, national and local levels.

**Outcome 1.2:** Desertification/land degradation and drought issues are addressed in relevant international forums, including those pertaining to agricultural trade, climate change adaptation, biodiversity conservation and sustainable use, rural development, sustainable development and poverty reduction.

**Outcome 1.3:** Civil society organizations (CSOs) and the scientific community in the North and the South are increasingly engaged as stakeholders in the Convention processes and desertification/land degradation and drought are addressed in their advocacy, awareness-raising and education initiatives.

##### **2. Policy framework**

*To support the creation of enabling environments for promoting solutions to combat desertification/land degradation and mitigate the effects of drought*

**Outcome 2.1:** Policy, institutional, financial and socio-economic drivers of desertification/land degradation and barriers to sustainable land management are assessed, and appropriate measures to remove these barriers are recommended.

**Outcome 2.2:** Affected country Parties revise their national action programmes (NAPs) into strategic documents supported by biophysical and socio-economic baseline information and include them in integrated investment frameworks.

**Outcome 2.3:** Affected country Parties integrate their NAPs and sustainable land management and land degradation issues into development planning and relevant sectoral and investment plans and policies.

**Outcome 2.4:** Developed country Parties mainstream UNCCD objectives and sustainable land management interventions into their development cooperation programmes/projects in line with their support to national sectoral and investment plans.

**Outcome 2.5:** Mutually reinforcing measures among desertification/land degradation action programmes and biodiversity and climate change mitigation and adaptation are introduced or strengthened so as to enhance the impact of interventions.

##### **3. Science, technology and knowledge**

*To become a global authority on scientific and technical knowledge pertaining to desertification/land degradation and mitigation of the effects of drought.*

**Outcome 3.1:** National monitoring and vulnerability assessment on biophysical and socio-economic trends in affected countries are supported.

**Outcome 3.2:** A baseline based on the most robust data available on biophysical and socio-economic trends is developed and relevant scientific approaches are gradually harmonized.

**Outcome 3.3:** Knowledge on biophysical and socio-economic factors and on their interactions in affected areas is improved to enable better decision-making.

**Outcome 3.4:** Knowledge of the interactions between climate change adaptation, drought mitigation and restoration of degraded land in affected areas is improved to develop tools to assist decision-making.

**Outcome 3.5:** Effective knowledge-sharing systems, including traditional knowledge, are in place at the global, regional, sub regional and national levels to support policymakers and end users, including through the identification and sharing of best practices and success stories.

**Outcome 3.6:** Science and technology networks and institutions relevant to desertification/land degradation and drought are engaged to support UNCCD implementation.

#### 4. Capacity-building

*To identify and address capacity-building needs to prevent and reverse desertification/land degradation and mitigate the effects of drought.*

**Outcome 4.1:** Countries which have carried out the national capacity self assessment (NCSA) implement the resulting action plans to develop the necessary capacity at the individual, institutional and systemic levels<sup>2</sup> to tackle desertification/land degradation and drought issues at the national and local levels.

**Outcome 4.2:** Those countries which have not previously undertaken capacity needs assessments engage in relevant assessments processes to identify capacity needs for tackling desertification/land degradation and drought at the national and local levels.

#### 5. Financing and technology transfer

*To mobilize and improve the targeting and coordination of national, bilateral and multilateral financial and technological resources in order to increase their impact and effectiveness.*

**Outcome 5.1:** Affected country Parties develop integrated investment frameworks for leveraging national, bilateral and multilateral resources with a view to increasing the effectiveness and impact of interventions.

**Outcome 5.2:** Developed country Parties provide substantial, adequate, timely and predictable financial resources to support domestic initiatives to reverse and prevent desertification/land degradation and mitigate the effects of drought.

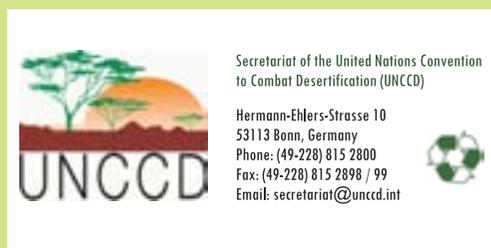
**Outcome 5.3:** Parties increase their efforts to mobilize financial resources from international financial institutions, facilities and funds, including the GEF, by promoting the UNCCD/Sustainable land management (SLM) agenda within the governing bodies of these institutions.

**Outcome 5.4:** Innovative sources of finance and financing mechanisms are identified to combat desertification/land degradation and mitigate the effects of drought, including from the private sector, market-based mechanisms, trade, foundations and CSOs, and other financing mechanisms for climate change adaptation and mitigation, biodiversity conservation and sustainable use and for hunger and poverty reduction.

**Outcome 5.5:** Access to technology by affected country Parties is facilitated through adequate financing, effective economic and policy incentives and technical support, notably within the framework of South-South and North-South cooperation.

#### THE MISSION

To provide a global framework to support the development and implementation of national and regional policies, programmes and measures to prevent, control and reverse desertification/land degradation and mitigate the effects of drought through scientific and technological excellence, raising public awareness, standard setting, advocacy and resource mobilization, thereby contributing to poverty reduction.



*Desertification is land degradation in arid and semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities.*



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सत्यमेव जयते



जहाँ है हरियाली ।  
वहाँ है खुशहाली ॥

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