APRIL - JUNE 2015

Volume 17 (2)

# DESERT ENVIRONMENT NEWSLETTER

ENVIS Centre on Combating Desertification

CAZRI

## In this issue :




**Hosted by**
Central Arid Zone Research Institute
Jodhpur

**Supported by**
Ministry of Environment, Forests and Climate Change
Government of India

**Published by**
ENVIS CENTRE
on Combating Desertification

# From the Desk of Co-ordinator

In this issue, we take you to a journey through a variety of sand dunes with spectacular shape, awesome size and bewildering orientations that have attracted the attention of common man and researchers alike. These landforms are not only merely bewitching, they also play a greater role as drivers of global climate cycle on one hand and pose hazards of erosion driven sand on the other hand. Natural plant of these habitats, like *Clerodendrum phlomidis,* therefore, finds place in our 'Know your desert plant' column. Sand dune stabilization as a proven technology and details of CAZRI will also interest you all. Related item on National Landuse Policy and Role of Botanical Gardens in conserving biodiversity will make a useful reading. Besides, details provided in all other normal columns make the story complete. Wish you a happy and informed reading.

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# Know Your Desert

## Sand dunes : The spectacular landforms of Thar Desert in western Rajasthan

Be it high altitude terrain of Leh-Ladakh or Nubra valley in the north, or the Great Indian Desert of India (The Thar) in the west or the 7500 km long coastal belts of India, sand dunes are the major attractions to all kinds of people including tourists, artists and researchers. A dune is a hill of sand which occurs in different shapes and sizes, formed by interaction with the flow of air or water. There are also some alternate names; for example, a "dune field" is assigned to an area covered by extensive sand dunes. Large dune fields are known as ergs. A sand ridge would have a long narrow natural elevation or striation while seif will have a long sand dune with a sharp crest (mainly found in Sahara desert).

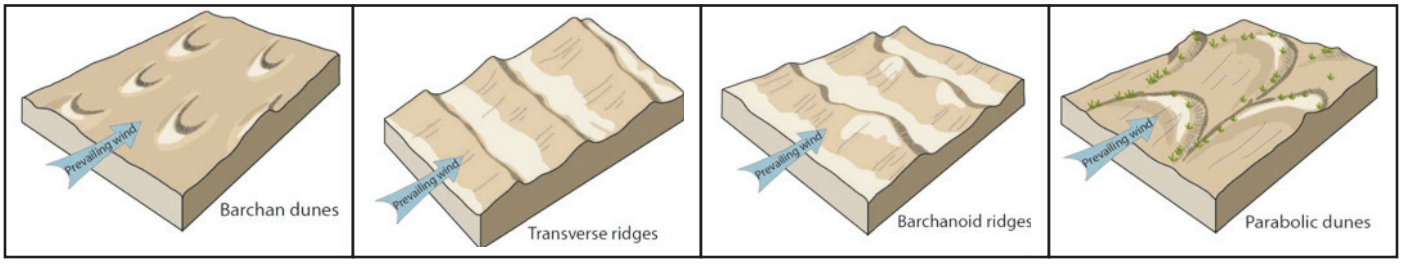



**Fig.1: Sketches describing the formation of sand dunes**

Western part of Rajasthan has a dominantly dry environment, with a mean annual rainfall of about 500 mm along its eastern margin to about 150 mm along the western border and has 48% area under various types of sand dunes.

Morphologically and on the basis of their origin, sand dunes are divided into old and new dune systems. Longitudinal, transverse, parabolic are the dunes of old system while barchans, shrub-coppice dunes and nebkhas belong to new dune systems. There are also two more sand dunes; dune complex (in areas where the form is a result of complex wind pattern) and dissected dune complex (where the dune slope has numerous gullies). Some sketches describing the formation of sand dunes are also explained here (Fig.1).

**Barchans** occur as small and big sandy forms. Because of their unique morphology, such landscapes are places of tourist importance in many parts of Rajasthan. In the west and south-west of Jaisalmer, especially between Shahgarh and Dhanana, they are mostly 15 to 40 m high, coalesced, and occur in long chains within the longitudinal dune field known also as megabarchanoids (Fig.2). These mega forms occur in less than 100 mm rainfall zone.

Small barchans (1-5 m high) occur in many parts of the desert. These dunes have higher mobility. One can see their occurrence in the crop fields, in barren plain areas and also in places having small mounds of shrubs or grasses. Rainfall wise, Barchans and Barchanoids occur mostly to the west of the 200 mm isohyet.

**Transverse dunes** mainly occur to the west of Bikaner, north west of Jaisalmer, and in parts of Ganganagar and Hanumangarh districts (Fig.3). The dunes generally occur in 1-5 km long chains with narrow inter dune plains. In Bikampur-Karanpur area the dunes are 20-40 m high, but those in the east are mostly 8-15 m high. Two sub-types are identified.

**Parabolic dunes** with two arms in the upwind direction and a curved nose downwind, constitute the major dune type in Thar Desert. These dunes are also called vegetated dunes and are also utilized for agriculture. Their major occurrences are in Barmer, Jaisalmer, Jodhpur and Bikaner districts (Fig.2). The dunes usually occur in chains of 4 to 8, or more and their heights would range from 10 m to 30 m. In the west, their arms are 5-8 km long, which gradually shorten eastward to about 1 km or less.

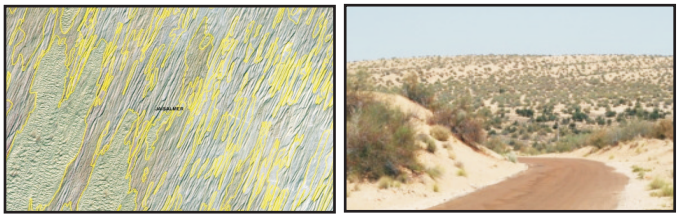
**Dune complex** consisting of several dune types, occur especially in the north and north-eastern part, in Churu

and Jhunjhunu districts (Fig.4), where the dunes are so closely spaced and differently oriented that it is difficult to delineate them individually. These dunes are 12 m to 20 m high with narrow inter dune plains.

**Major obstacle dunes** are found along the high Aravalli hill ranges in the east, where they are highly dissected. Many of the windward obstacle dunes here are climbing dunes. Obstacle dunes also occur on the isolated hills within the desert.

**Network dunes** are irregular sinuous dunes in the north in Ganganagar and Hanumangarh districts or large parabolic forms with networks which cover vast areas in the north, but have received scant attention. A less energetic wind regime, greater directional variability of the wind and increased vegetation cover could be some of the controlling factors for their formation.

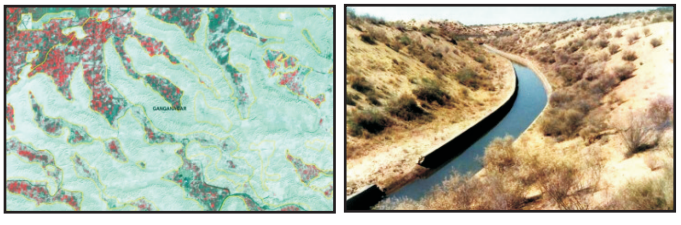
Surprisingly, sand dunes are also dominated by rainfed croplands now and not by open rangelands. Even irrigated croplands (tube well irrigation) have encroached upon the sand dunes. This is especially true in parts of Hanumangarh, Jhunjhunun, Churu, Sikar, Bikaner and Jodhpur districts.



**Longitudinal dunes : SW of Jaisalmer District in Dhanana-Longewala sector**

**Simple and compound parabolic dunes-vegetated : Barmer District**

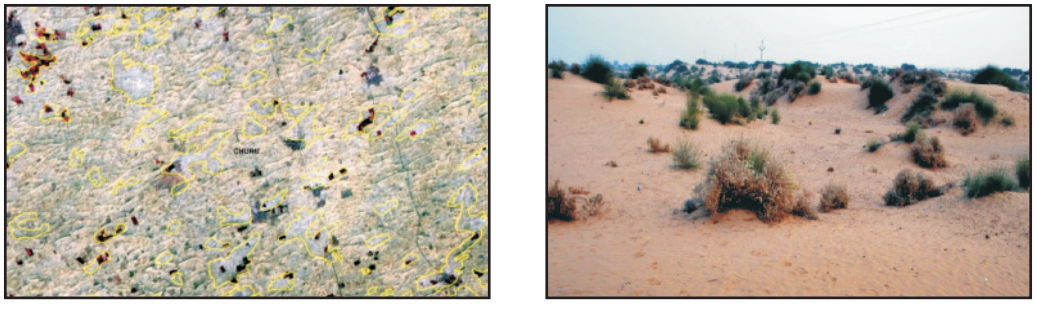
**Fig.2: Types of dunes- Longitudinal, Simple and Compound**



**Network dunes in IGNP area of Suratgarh and Hanumangarh towns**

**Barchan and low dune formation in the croplands in Ganganagar and Hanumangarh District**

**Fig.3 : Types of dunes- Network and Barchans**



**Dune Compex : Churu District**

**Fig.4 : Types of dunes- Compex dunes**

**- P.C. Moharana**
CAZRI, Jodhpur

# Know Your Desert Plants

## *Clerodendrum phlomidis* : A multipurpose shrub of dry regions

*Clerodendrum phlomidis* Linn. f. [syn. *Clerodendrum multiflorum* (Burm.f) O.Kuntze *Volkameria multiflorum (Burm f.)* ] belongs to family Verbenaceae. It is commonly known as *Clerodendrum* or wind killer in English and has several vernacular names in India. It is known by the name of Arni, Piron, Pirun or Urni in Hindi and Arno or Anno in Marwari.

*C.phlomidis* is common shrub of arid regions, lower hills, and tropical desert. It is distributed throughout drier parts of India i.e. Rajasthan particularly in north western parts, Gujarat, Haryana, Andhra Pradesh, Madhya Pradesh, Punjab, Maharashtra, Bihar, Orissa, Tamil Nadu, West Bengal, Pakistan (Sindh, Baluchistan, North western Provinces), Sri Lanka, Myanmar and south east Asia. However, its density is now diminishing due to farm mechanization especially due to deep ploughing. It is highly resistant to drought and moisture stress as it goes to dormancy in the event of water stress. It makes best use of monsoon rains by completing growth, flowering and fruiting during the period of moisture abundance. Thereafter it undergoes a period of dormancy with the beginning of summer due to depletion of soil moisture. During dormancy it sheds the leaves and looks dried all through the summer season. This is inbuilt adaptation to evade water stress. It starts sprouting and picks up vigorous growth with the onset of monsoon.

**Botanical description :** It is 1.5-3 m tall; stem ashy-grey, branches velvety. Leaves are opposite, ovate to rhomboid-ovate, 1.5-5 cm long, 1-3 cm broad, entire to wavy-toothed, pointed to blunt. Leaf-stalks are up to 2.5 cm long. Flowers small, creamy-white or pale yellowish, about 1.5 cm across. Inflorescence axillary cyme forming rounded terminal panicles. Flower-stalks are 5-10 mm long, densely hairy, bracts ovate leafy. Calyx is bell-shaped, hairless, pale or somewhat yellowish green, inflated, 5-lobed, sepals are 4-5 mm long, ovate-triangulate, flower-tube is 2-2.5 cm long, much narrower than the calyx, velvety outside. Petals are 5, nearly

**Fig.5: A branch, inflorescence and opened flowers of *C.phlomidis***

equal, ovate-elliptic, 7-8 mm long, blunt. Corolla white with long tube 5 lobed, unequal, obtuse veined, stamens 4, didynamous, ovary, glabrous, style slender, stigma, bilobed (Fig.5). Fruits drupe is ovoid, 8-12 mm long, black, wrinkled, usually 4-lobed, enclosed by the persistent calyx, seeds oblong, white. Flowering occurs from July to February.

**Ethno medicinal Uses :** *C. phlomidis is* one of the highly traded medicinal plants of tropical forests as the leaves and roots are used in folklore, Ayurveda, Sidha and Unani medicine. It is sold under the name of Arnimul (Leaf and root).The Ayurvedic properties of *C. phlomidis* are: Rasa (Taste)-Tikta (bitter), katu (pungent/acrid), Kashaaya (astringent) and Madhura sweet, Guna (quality)-Rooksha (nonunctuous) and laghu (light; Veerya (potency)-Ushana (heat); Vipaka (transformation) with digestion. Due to its bitter and pungent nature it is considered to normalize the vitiated Kapha and Vat dosa. It is a constituent of a number of Ayurvedic formulations indicated for digestive disorder, acidity, gas, diarrhoea, laxative, liver tonic and general health. Root is a bitter tonic and given in convalescence of measles. Juice of leaves is alterative and given in neglected syphilitic complaints.

The root is given as a demulcent in gonorrhoea, and decoction of the plant is considered as an alternative. It helps cure stomach troubles and swellings in cattle.

**Agricultural Importance :** In arid region of Rajasthan Arni is widespread on sandy to sandy loam soils. It can be seen on farm boundaries where it protects agricultural land from soil erosion as it forms very dense canopy and does not allow the winds to pass easily thus creating favorable microclimate for crops (Figs. 6,7). During the

**Fig.6 : A hedge of *C.phlomidis* along farm boundary in arid region of Rajasthan**

**Fig.7: Natural spread of *C.phlomidis* in farmland in western Rajasthan**

period when high velocity winds blow, the fertile soils are deposited towards leeward side. It has been observed that crop growth is very good on such deposited soil during kharif season. Its wood has great value to the farming community. The wood is very strong and hard and is used for agricultural implements. The wood and branches are very useful for preparation of rural houses (Jhopra) and also for preparation of protective thick fence around the houses called tati in local language. This is erected by putting a thick layer of woody branches of *C.phlomidis* vertically and supported by tying the thin branches of same plant horizontally with the help of iron wire. A small gate of the same material is prepared for entry into rural dwellings and farmland (Fig.8). The wood is a very good fuel as it lasts longer during burning process. In this way the *C.phlomidis* has proven to be very useful species for combating desertification provided it is conserved in its natural forms. Its leaves are very good fodder for goat and camel. Many of its medicinal and other properties are not known to the people in general, though the species is of much value to farming community. Though this species extensively occurs on different habitats and not yet categorized as endangered ones, but its existence is now getting threatened due to subdivision and fragmentation of farm holdings, acquisition of more and more agricultural land by the government for highways/railways/residential purposes due to urbanization and use of tractors in farming that is exerting pressure on its existence.

**Fig.8: Use of *C.phlomidis* twigs for fencing purposes**

**-P.R. Meghwal**
CAZRI, Jodhpur

# Technological options

## Sand dune stabilization

Sand dune stabilization by providing vegetation cover in checkerboard method is a popular wind erosion control technology in the desert (Fig.9). Planting suitable vegetation on denuded dune surface results in decreasing surface wind speed, prevention of scouring action and amelioration of soil conditions, which ultimately lead to improved micro-climatic condition of the area. In view of the limited water, high percolation, high ambient temperature and more evapotranspiration in arid region, it is important to select such plants having adaptive edge to survive in such demanding situations. Of the many criteria, the ones to be taken care of in sand dune stabilization are that these should be able to survive in (i) extreme temperature conditions, (ii) a variety of salinity conditions, (iii) variable wind speed and direction, (iv) severe sand storm events, (v) very low soil moisture condition, and (vi) biotic stress situations.

In order to be able to have above mentioned adaptive qualities, the selected plant species should be (i) able to put out root system rapidly; (ii) succession facilitator; (iii) able to multiply rapidly over time and space; (iv) enhancing and ameliorating soil conditions; (v) able to grow after grazing or complete leaf removal or leaf fall; (vi) prolific seeder so that it builds seed bank; (vii) possessing staggered dormancy and longer duration viability of the seeds; (viii) able to grow both as commensals and as a nurse plant; (ix) having some economic value; (x) resistant to pest and diseases. Detailed study of sand dunes have revealed that lower depths of unstabilized sand dunes have considerable moisture (2-5%) even in the peak evaporation months of May-June due to low capillarity and formation of surface crust that further prevents evaporative losses. Thus, this offers a conductive moisture zone underneath for root growth ensuring success of the plantation.

## Agroforestry for sand dune stabilization

The CAZRI technology for sand dune stabilization involves following steps:

**Fig.9: Wind erosion control on dunes through checkerboard method**

1. Fencing – either mechanical or vegetative such as *Prosopis juliflora, Euphorbia caducifolia*
2. Establishing micro windbreaks in checker board pattern or parallel rows across wind to stop surface creep and save saplings from sand abrasion by way of brush wood from *Ziziphus nummularia*, twigs *of Prosopis cineraria, P. juliflora, Crotalaria burhia, Aerva persica, Leptadenia pyrotechnica and Calotropis procera.* Of late, live plants of *Cassia angustifolia* have emerged successful as micro windbreaks.
3. Transplantation of suitable trees and shrubs species like *Acacia trotilis, Prosopis cineraria, Prosopis juliflora, Calligonum polygonoides, A. nubica, Cordia rothii and P. cineraria.* Intervening species are planted/seeded with grasses like *Cenchrus ciliaris, Panicum turgidum, Lasiurus sindicus, Citrullus colocynthis* and *Saccharum bengalensis.*

Attempts have also been made to do direct seeding of sand dunes through air craft. A mixture of seeds of trees, shrubs and creepers along with grass seeds in soil pellets were aerially broadcast on sand dunes in Bikaner during post-monsoon season of 1982-83. The germination and growth of *Acacia tortilis* and *Lasiurus sindicus* was maximum. The risks involved in this exercise were (i) drifting of seeds by wind during the broadcast (ii) falling of seeds and its trapping in the existing bushes and being lost (iii) rolling of seeds on the slope resulting in uneven distribution of saplings (iv) burial of seeds under sand thus preventing its germination (v) loss of seeds by zoochory and (vi) grazing of emerging saplings by both wildlife and livestock. Despite so many risks, aerial seeding can be extremely useful in areas receiving low rains and are inaccessible for ground based human assisted rehabilitation of sand dunes. The pellets of soil (clay + FYM + sand) in the above exercise were replaced with a polymer called 'Jalashakti' in a separate experiment. Seeds were treated with 'Jalashakti' @ 2 kg/100 kg seeds of different species. The survival in Jodhpur conditions after three years was 25% in *Colophospermum mopane*, 20% in *Acacia tortilis,* 15% in *A. bivenosa,* and 5-10% in all other species. The untreated seeds showed 1-10% survival. Thus, polymer treated seeds in direct broadcast for dune stabilization do have a potential. Such stabilization of dunes not only prevents sand drift, it can also be turned into an economic activity by way of providing 15-20 t/ha of wood after five years of plantation. Benefits in terms of fuel wood yield and pods in different plantation densities at different locations are assured. While a B:C ratio of 1.83 to 3.58 has been estimated depending upon locality, such plantation of, for example, dune by *C.mopane* was shown to improve soil organic carbon (SOC) from 0.03 to 0.10%; total N from 0.007 to 0.012%; available N from 87.5 to 190 kg/ha; available $P_2O_5$ from 5.85 to 11.70 kg/ha and available $K_2O$ from 200 to 220 kg/ha.

**Compiled by: Suresh Kumar and P. Santra**

CAZRI, Jodhpur

## ENVIS Jodhpur News in Media

काजरी व आफरी में संगोष्ठी

जोधपुर। पत्रिका. विश्व पर्यावरण दिवस के मौके पर केंद्रीय शुष्क क्षेत्र अनुसंधान संस्थान (काजरी) और शुष्क वन अनुसंधान संस्थान (आफरी) में संगोष्ठी का आयोजन किया गया, जिसमें पर्यावरण संरक्षण और उसके बचाव को लेकर जागरूकता का आह्वान किया गया।

काजरी में आयोजित संगोष्ठी में प्रभारी निदेशक डॉ. आलोक भट्ट ने कहा कि जल्द ही जलवायु में परिवर्तन हो रहा है तथा बदलाव प्रकृति का नियम है, लेकिन प्रकृति के साथ संतुलन एवं सामंजस्य बिठाने की जरूरत है। प्रधान वैज्ञानिक डॉ. एके शर्मा ने जैविक खेती पर बल दिया। मुख्य वन एवं वन्यजीव संरक्षक डॉ. जीएस भारद्वाल ने थार रेगिस्तान की वनस्पतियों, प्रकृति, वन्य जीवों, पेड़-पौधों, झाड़ियों के बारे में जानकारी दी। मरुस्थलीय पर्यावरण सूचना केन्द्र के प्रभारी डॉ. सुरेश कुमार, डॉ. प्रवीण कुमार और डॉ. बालू पुरोहित ने भी अपने विचार रखे।

आफरी में हुए कार्यक्रम में निदेशक एनके वासू ने पर्यावरण संरक्षण को देश के प्रत्येक नागरिक का कर्तव्य बताते हुए सोच में बदलाव की जरूरत की। डॉ. तरुणकांत, उप वन संरक्षक (वन्य जीव) महेंद्र सिंह राठौड़, समूह समन्वयक शोध भैरूंदार भादू, उपाशा पीपाणी और भावना शर्मा ने भी अपने विचार रखे। पर्यावरण दिवस के मौके पर आफरी में स्वच्छता अभियान भी चलाया गया।

Sat, 06 June 2015
epaper.patrika.com/c/5845545

विश्व पर्यावरण दिवस पर वृक्ष बंधु पुरस्कार समारोह आज

काजरी में विश्व पर्यावरण दिवस का आयोजन

विश्वविद्यालय द्वारा पर्यावरण दिवस का आयोजन होगा

**Source:Tarun Rajasthan, Jodhpur, June 6 , 2015**

**Fig.15: News of Events by ENVIS CAZRI in Newspapers**

# Know Your Institutions

## Central Arid Zone Research Institute

Central Arid Zone Research Institute, Jodhpur (Fig.10), a Premier organization of the Indian Council of Agricultural Research (ICAR), is an autonomous organization under the Department of Agricultural Research and Education, Ministry of Agriculture, Government of India.

**Origin :** To arrest the degradation process and for scientific and sustainable management of the resources in Indian arid region, Desert Afforestation Station was established in 1952 at Jodhpur. This was later expanded into Desert Afforestation and Soil Conservation Station in 1957, and finally upgraded to Central Arid Zone Research Institute (CAZRI) in 1959 under Indian Council of Agricultural Research, New Delhi. The CAZRI operates through Six Divisions, located at the headquarters in Jodhpur. There are five Regional Research Stations located at Pali, Jaisalmer and Bikaner (Rajasthan); Bhuj (Gujarat) and Leh (J&K) in different agro-climatic zones to work on location-specific problems.

**Mandate :** • To undertake basic and applied research that will contribute to development of sustainable farming systems in the arid ecosystem • To act as repository of information on the state of natural resources and desertification process and its control, in the form of digital database • To develop livestock-based farming systems and range management practices for the chronically drought affected areas • To utilize high and precision technologies in production systems • To provide scientific leadership and to develop collaboration with State Agricultural Universities, State line departments and other national and international agencies for generating location-specific technologies and transfer of the technologies • To act as a center of learning for arid land management technologies • To provide consultancy and other services

**Infrastructure :** Headquarter and Regional research stations are well equipped with laboratories, research farms, field laboratories and office facilities. An auditorium (114 sitting capacity), two conference rooms, a museum, an international hostel, one training hostel and one farmer's hostel are the other facilities available at headquarter. Two Krishi Vigyan Kendras (Jodhpur and Pali) have training and residential facilities for farmers, lend additional support to the transfer of technologies and outreach programs of the Institute. Institute has a wide collection of books (23072) and journals (56900 back volumes) in its library named after Dr. P.C. Raheja at head quarter. The Environment Information System (ENVIS) Centre on combating desertification is also placed in this library. All the Regional Research Stations are linked with Consortium for e resources in Agriculture (CeRA) by static ID.

**Some of the Technologies Developed :**

- CAZRI has developed sand dune stabilization technique in checker board pattern.
- Five-row or three-row shelterbelts with staggered planting and in pyramidal shape, has been recommended by CAZRI for reducing soil erosion.
- Techniques of (I) micro-wind breaks of castor and *Lasiurus sindicus;* (ii) strip cropping of grass with crop and (III) shelterbelts of trees are recommended by CAZRI for controlling wind erosion in croplands.
- CAZRI has standardized the technology of gypsum application to soils @ 50 % of gypsum requirement for ameliorating the soil degraded with high residential sodium carbonate (RSC).
- Soil moisture calculator was developed by CAZRI for efficient use of scarce water resources in arid region.

- Improved designs of tanka (cistern), nadi (pond) and khadin or runoff farming system were developed by CAZRI.
- Integrated Land Management techniques of arid watershed have been developed for multiple use of water in rainfed and irrigated farming systems and for higher productivity from Khadins.
- CAZRI has developed improved varieties of various crops. In *Cenchrus ciliaris CAZRI-75, C. setigerus, CAZRI-76, Lasiurus sindicus,CAZRI-30-5, Pearl millet, CZP-9802 & CZP-IC-923, Moth bean, CAZRI-Moth-1, CAZRI-Moth-2, CAZRI-Moth-3, Clusterbean, Maru-Guar and in Horse gram, Maru-Kulthi-1* have been developed. Similarly in fruit crops e.g. *Ber,* improved cultivars *Gola, Seb and Mundia* have been identified.
- Silvi-pastoral and agri-pastoral systems have been evolved to provide production stability under uncertain rainfall and frequent droughts of arid region.
- Using low-cost ingredients, CAZRI has prepared multi-nutrient feed blocks for livestocks.
- A 3-furrow (6-row), tractor-operated seed-cum-fertilizer drill with a provision for pressing device, hand operated single/ double slot weeder have been designed and developed by CAZRI.
- A manually operated ber grader has been designed and developed, which grades ber into three sizes of <25 mm, 25-35 mm and >35 mm diameter.
- A solar cooker for preparation of animal feed has been designed and developed by the Institute for boiling of 10 kg of animal feed per day.
- CAZRI has developed a simple technique for increasing gum exudation from the tree by injecting ethephon.
- Methodologies for preservation of food products e.g. squash, jam, jelly etc and production of Aloe crack cream, Aloe shampoo and Aloe moisturizer have also been standardized by the Institute.
- Products from goat milk : The institute has developed methodology to remove the foul odour of got milk to prepar paneer, kulfee and whey drinks.

CAZRI dreams of a well-managed and climate-resilient arid land, where the vast rural communities can derive livelihood support from sustainable agriculture under a symbiotic relationship with the nature.


**Fig.10: Central Arid Zone Research Institute, Jodhpur**

**Compiled by ENVIS Team**
CAZRI, Jodhpur

# Know Policies and Programmes Related to Combating Desertification

## National Land Use Policy

There is no policy on Land Use and Land Management per se. A 19- point National Land Use Policy Outline (NLUPO) was prepared by the Ministry of Agriculture in 1988 and circulated to all States. Since land is a State subject, land use policy and the supporting regulatory framework requires to be framed by States for effective implementation of land related issues. The following issues need to be taken up with regard to land use planning with the States in the context of conservation of land and land resources: -

Preparation of legislation for land use policy since land is a State subject, on all aspects of landuse planning, would require -

- Inventory, characterization and monitoring of natural resources, as adequate information is lacking on characterization of soil and water resources and climatic parameters at micro-level, which is very essential for efficient landuse planning and resource allocation.
- Development of efficient and sustainable landuse plans for each agro-ecological zone or sub-zones of the country, considering their resource base, potential productivity, risk factors, and social acceptability at micro-level. This would help in creating essential infrastructure to support the system for yield maximization and its commercialization without adverse impacts to ecology.
- Development/reclamation of degraded lands (including permanent and current fallows) to bring additional area under cultivation in order to meet the increasing demands of food.
- Development of institutional mechanism of people for sustainable land use.

The National Land Use and Conservation Board (NLCB) located in the Ministry of Agriculture is the main Body to serve as policy planning, co-ordination and monitoring at the national level for issues concerning health and management of land resources. The creation of the National Land Use Conservation Board (NLCB) and the corresponding State Land Use Boards at the State level (SLUBS) has not created a major impact. All States were asked to prepare perspective plans for next 25 years (2025) through the SLUBs keeping in view the demands for food, fuel, fodder and industrial needs. This requires to be followed up and Plans prepared by the States require being dove-tailed with the central planning and specific schemes prepared for meeting food-fuel-fodder-industrial requirements.

Source: India Nation Action Programme to Combat Desertification

**Compiled by : Ritu Purohit**

CAZRI, Jodhpur

# Role of Botanical Gardens in Biodiversity Conservation

In the era of unprecedented loss of biological diversity, conservation of plant diversity has assumed greater importance. It is estimated that about 60,000 plant species out of known 2, 87,655 species in the world are facing the threat of extinction. As per revised 1994 IUCN Red List Categories, out of 11,824 species which were evaluated for their threat status, 8,321 species are now on the IUCN Red List 2004. Oldfield *et al.* (1998) reported that over 7300 tree species are globally threatened and about 1665 of these threatened species are maintained in different Botanical Gardens of the world. There are over 1800 Botanical Gardens and arboreta located in 148 countries which are maintaining over 4 million living plants belonging to more than 80,000 species of vascular plants. The Botanical Gardens and other Plant Conservation Centers in the world thus play a very crucial role as a center for rescue, recovery and rehabilitation of threatened plants and other valuable plant genetic resources.

Botanical Gardens serve as a referral center and spearhead conservation of threatened and endemic species of different phyto-geographic regions of the country through *ex-situ* conservation of identified species, research and capacity building and generation of knowledge products. They play important role in education and as centers of training in areas such as taxonomy, horticulture, gardening, landscaping, *ex-situ* conservation and environmental awareness. Through the sum of knowledge and expertise that they have accumulated, they are leaders in research on both wild and cultivated plants and conservation. While there are more than 1800 Botanical Gardens in the world, only few of them have focused on scientific research and conservation, making them an essential component of global conservation goals e.g. Kew Gardens, Missouri Botanic Gardens, Singapore Botanic Garden, etc. The gardens which provide the training and necessary expertise for replication at regional or local levels, could be termed as 'Lead Botanic Gardens' or models that must be followed. Globally, these Lead Botanic Gardens together form important resource centers for biodiversity conservation.

Several Lead Botanic Gardens of the world like Royal Botanical Garden, Kew; Royal Botanical Garden, Edinburgh; Missouri Botanical Garden (USA); Beijing Botanical Garden and Nanching Botanical Garden in China based on their valuable plant collection and knowledge base have initiated various biotechnological and bioprospecting programmes. In India National Botanical Research Institute (NBRI), Lucknow; Jawahar Lal Nehru Tropical Botanical Garden & Research Institute (JNTBGRI) Trivandrum; Botanical Garden at Shivaji University, Kolhapur (Fig. 11a) and Desert Botanical Garden (CAZRI) (Fig.11b) are a few examples of those lead Botanical Gardens involved in active research in biotechnology and bio-prospecting through a visionary policy action, liberal financial support and academic back up from Conservation and survey Division of MoEF&CC, GOI, New Delhi.

**Thrust areas of Botanical Garden in India:**

1. Study of bottlenecks in propagation, multiplication, rehabilitation and recovery programmes for identified threatened and endemic species.
2. Development of techniques for propagation, multiplication, rehabilitation and recovery.
3. Development of knowledge products including factsheets, field manuals for each of the identified threatened and endemic species.
4. Capacity building in *ex-situ* conservation, rehabilitation and recovery programmes.


**Fig.11: Different Lead Botanical Gardens of India a) Shivaji University, Kolhapur; b) Desert Botanical Garden (CAZRI), Jodhpur; c) GBPHED, Almora**

5. Development of material for environmental awareness, lectures, workshops with respect to *ex-situ* conservation.

**Role of Botanical Gardens :**

1. Help to conserve natural vegetation specially Threatened Endemic species through multiplication and rehabilitating them in natural habitats under *ex-situ* conservation.
2. Undertake botanical research resulting in excellent referral system for plants as authentically identified, classified and labeled live collection in gardens and as dry collections.
3. Study of the phenology and response of the plants to climate change.
4. Carry out conservation biological studies with a view to find out ecological, biological and genetic bottlenecks in reproduction and survival of species.
5. Carry out rehabilitation programmes for Threatened and Endemic species.
6. Serve as center of training, with expertise is a focused area of subject specialization such as Taxonomy, Horticulture, etc.
7. Building up of information on *in-situ* as well as *ex-situ* conservation of the Threatened and Endemic species.
8. Compile information on the area of occurrence, area of occupancy, number and size of populations, spatial distribution of populations and identification of important associates such as pollinators and dispersers, reproductive and breeding systems and population trends in relation to habitat changes and pattern of disturbance.
9. Prepare Red Data Sheet for the selected species as per IUCN format.
10. Promote environmental awareness through well designed education programmes and educational material.
11. Develop relevant R&D expertise and capabilities in undertaking modern conservation and gene banking techniques including *in-vitro* tissue banks, DNA and Cryo Banks.

Botanical gardens play a great role in environmental education. Each year, more than 150 million people visit gardens all over the world and have the chance to get in touch with nature. Botanical gardens represent a unique environment to raise public awareness and to help people understand the importance of biodiversity (Fig.11c), educate people about the threats it currently faces and make them realize that nature conservation is everyone's duty. MoEF&CC, New Delhi considers one time financial support to Botanical Gardens across the country and encourages Universities and Institutions to send proposals for financial support.

**Madhumita Biswas**

Director, MoEF&CC, New Delhi

# Knowledge Corner

### Stabilization of Dune Sand with Ceramic Tile Waste as Admixture

The Dune-Sand has nil cohesion and thus has a very low compressive strength. The stabilization of Dune-Sand is of prime importance. The investigation reported herein presents a study of stabilization of Dune-Sand with Ceramic Tiles Wastage as admixture. All the California Bearing Ratio tests were conducted at maximum dry density and optimum moisture content as arrived from Standard Proctor Test. Direct shear tests were also performed. The main objective of this study was to obtain an economical stabilized mix of ceramic tiles wastage and dune sand so that largely and cheaply available dune-sand is used for various construction purposes

**Read more in** N.K. Ameta, Wayal A.S. and Puneet Hiranandani (2013). *American Journal of Engineering Research* (AJER), Vol. 2 (9) 133-139

### Quantification of Aeolian Bedform and Process Parameters in Thar Desert for Earth Surface Dynamics

This article reviews and summarizes the aeolian research on Thar Desert. It also attempts to draw regional perspectives from the data generated by field-based research, and suggests a way forward.

**Read more in** Amal Kar (2013). *Annals of Arid Zone*, Vol. 52 (3&4) 181-207

### Remote Sensing for Identification and Characterization of Zibar Sand Dunes in Sandy Alluvial Plains Thar Desert, India

Zibars, a kind of small dunes with coarser particles in the desert, are often difficult to identify in field. This study was carried out in the vicinity of Jodhpur to test the use of remote sensing techniques in identification of the zibars and their major characteristics. Following satellite data were used for different kinds of analysis: multi-spectral data in the form of FCCs of AWiFS and LISS-IV, hyper spectral data from Hyperion, and microwave data from RADARSAT-2. CartoDEM data was used to find out the elevation differences in the study area, while a field spectro-radiometer was used to find out the reflectance properties of different land surfaces. It was found that neither all kinds of images, nor all conventional or digital analysis techniques provide useful results. Spectral angle mapper classification of Hyperion data was found better. The study concluded that zibar pattern gets manifested on the satellite images due to grain size variation.

**Read more in** Suparn Pathak, Manoj Joseph and J.R. Sharma (2013). *Annals of Arid Zone*, Vol. 52(2) 1-6

# Conferences

| DATE | TOPIC | PLACE |
|---|---|---|
| June 5 - 6, 2015 | 3rd ICSD 2015 International Conference on Sustainable Development | Gregorian University, Piazza della Pilotta, 4, Rome, Italy |
| Jun 16 -17, 2015 | Conference on Decertification and Land Degradation | Ghent, Belgium |
| April 16 -17, 2015 | 3rd Oxford Interdisciplinary Desert Conference | School of Geography and the Environment, University of Oxford |

# Events By ENVIS CAZRI

### International Day for Biological Diversity on 22nd May, 2015

The day was celebrated on 22nd May 2015 under the aegis of ENVIS at CAZRI, Jodhpur. The function was chaired by Dr. R.K. Bhatt, Director (Acting), CAZRI, Jodhpur. Dr. Suresh Kumar, ENVIS Coordinator welcomed the guests and also read out the message from Hon'ble Sh. Prakash Javdekar, Minister of State (IC) Environment Forest and Climate Change, Government of India. Dr. D.C. Bhandari, Former Director (Acting), NBPGR, New Delhi delivered a key note address on "Agro Biodiversity Conservation and Sustainable. Agricultural Development" on this occasion (Fig.12).

**Fig.12: International Day for Biological Diversity being celebrated by ENVIS, CAZRI**


**Fig.13: World Environment Day on 5th June, 2015 at ENVIS, CAZRI**

### World Environment Day on 5th June, 2015 :

The function was chaired by Dr. R.K. Bhatt, Director (Acting), CAZRI, Jodhpur. Dr. Praveen Kumar, Head of Division -II welcomed the guests. Dr. Suresh Kumar, ENVIS Coordinator introduced the invited speakers to the house. Dr. Ritu Purohit, Programme Officer read out the message from Minister of Forest, Environment and Climate Change, Government of India. On this occasion, Dr. G.S Bhardwaj, Chief Conservator of Forest, Wild Life- Jodhpur and Sh. A.K Sharma, Scientist – (SG) CAZRI, Jodhpur delivered lectures on "Wild Life in Thar – Issues and Challenges" and " Breathing Environment with organic farming" respectively (Fig.13).

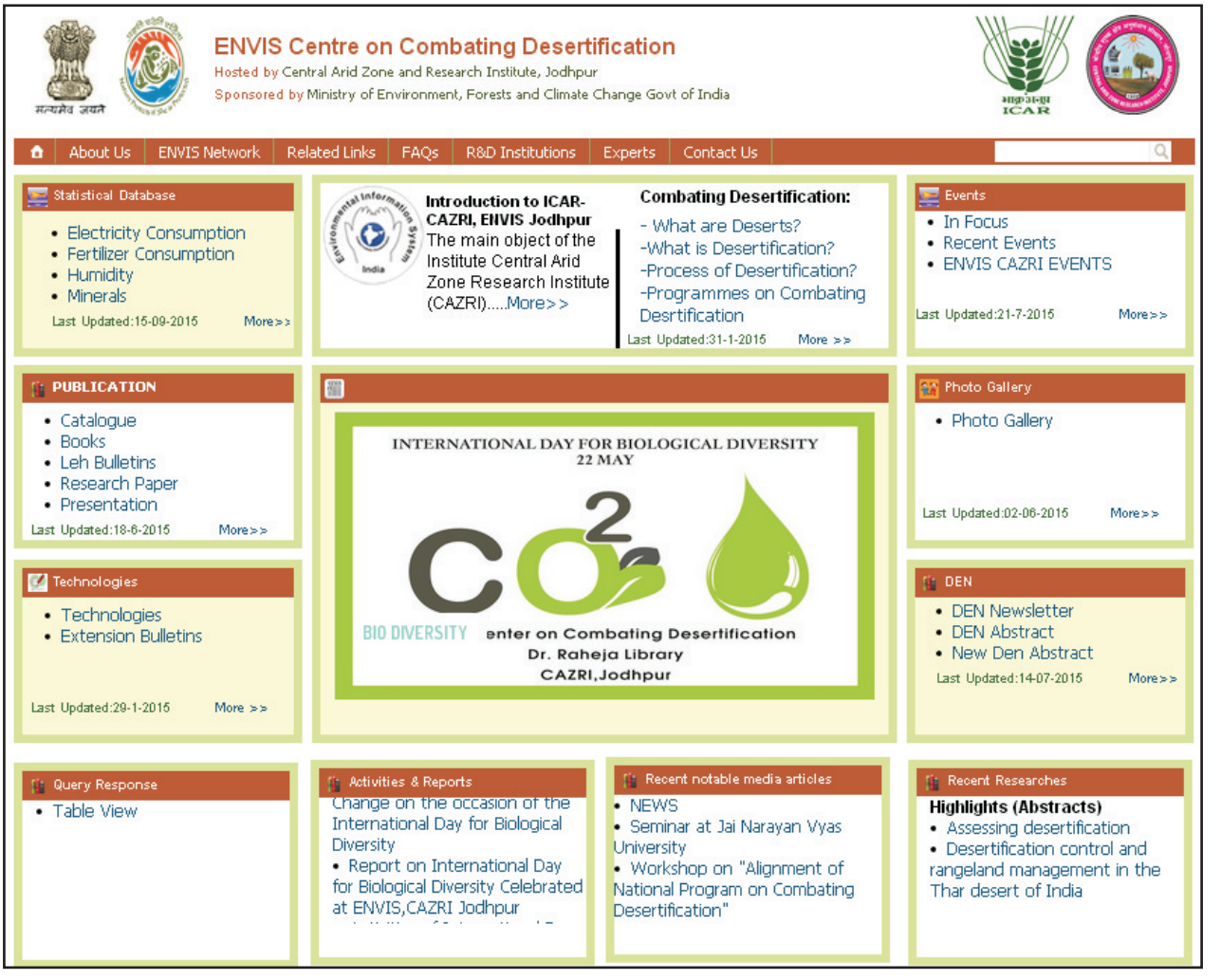
### World Day To Combat Desertification on 17th June, 2015

The function was chaired by Dr. R.K. Bhatt, Director (Acting), CAZRI, Jodhpur. Dr. Praveen Kumar, Head of Division -II welcomed the guests. Dr. Suresh Kumar, ENVIS Coordinator discussed about Desertification. Dr. J. C. Tarafdar, Professor Emeritus was the guest speaker who delivered his lecture on 'Role of microorganisms in maintaining soil health' (Fig.14).

**Fig.14: Eminent Scientists and the ENVIS Team at CAZRI on World Day to Combat Desertification**

**Compiled by ENVIS Team**
CAZRI, Jodhpur

# ENVIS CAZRI Website




## Following Statistical Databases of Rajasthan (Arid Zone) can be accessed in CAZRI-ENVIS Website

- Crops- Area, Production and Productivity
- Rainfall Distribution
- Human Population - Rural, Urban
- Livestock - Cattle, Buffalo, Sheep, Goat, Camel, Poultry
- Working Human Population
- Density of Human Population
- Sex Ratio
- Irrigation by Canal, Tank, Wells, Tubewells
- Agricultural Equipments - Animal Cart, Electrical Pump set, Oil Engine Pump Set, Plough, Tractor
- Fertilizer Consumption
- Landuse Pattern - Forest, Barren and Uncultivated land, Cultivated waste land, Current Fallow, Net Area Sown, Non Agriculture Use, Old Fallow, Pasture and Grazing, Trees and Groves
- Electricity Consumption - Industrial, Commercial, Domestic and Residential Uses
- Temperature
- Humidity
- Mineral Production

**Compiled by Shweta Mathur and Akshay Bhardwaj**
CAZRI, Jodhpur