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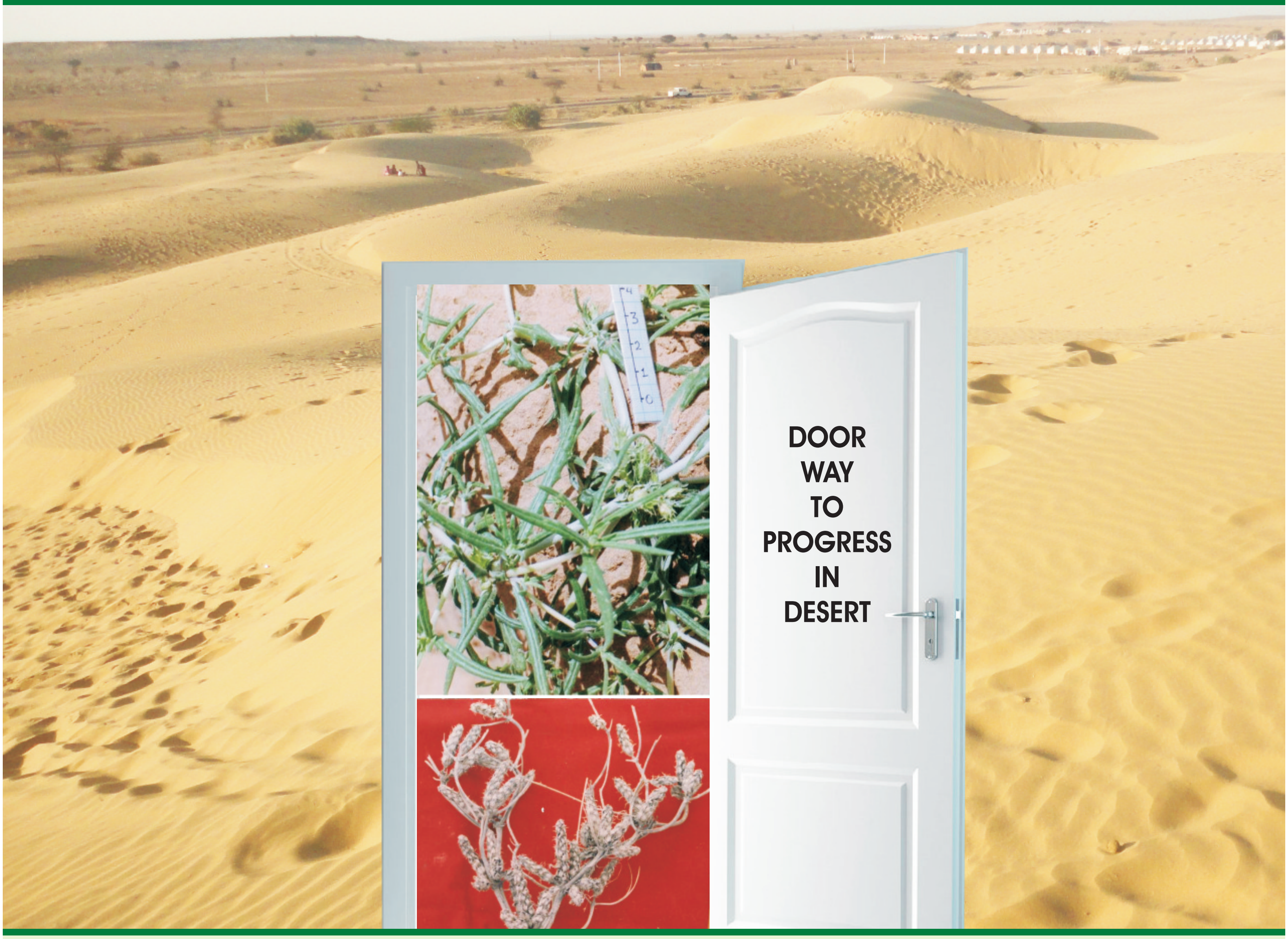
DESERT ENVIRONMENT NEWSLETTER

ENVIS Centre on Combating Desertification

ICAR-CAZRI

In this issue :



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From the desk of chairman

Dear Readers,

This issue is focused on the problem of desertification that affects one and all in various ways, especially the poor and marginalised farmers whose livelihood is adversely affected by it. The problem of desertification is not merely confined to the 'Deserts' but occurs 'Outside the Deserts' too. Highlighting this in the present issue, I would urge all ENVIS State Centres to take note of this information.

Did you know that a desert plant *Blepharis sindica* has its seed bank on the mother plant and not in soil? Read more about it inside. Desertification in deserts is causing dust storms and how this dust affects us, is given in 'Knowledge Corner'. Besides, regular feature on technological options and policy in controlling desertification, all together make this issue an immensely informative reading. Have Joyous Reading !

(O.P. Yadav)

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Know Your Desert

Desertification also occurs outside the Desert

Desertification term was first used by Aubreville in the year 1949. According to United Nations Convention to Combat Desertification (UNCCD) Desertification is defined as the land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities leading to loss of productive ecosystem and biodiversity.

Desertification is one of the major global environmental and socio economic problem that has attracted the attention of environmentalist, policy planners and NGO's and common people. This problem is becoming severe day by day in India, too. India is 7th largest country in world with 328.72 Mha area and second most populated country with 1.21 billion population, the nation-wide assessment carried out by Space Application Centre (SAC) shows that 96.4 Mha area of country is undergoing the process of land degradation that is 29.32% of the total geographical area of country and is 0.56% more than the year 2003- 2005.

To assess this major problem Space Application Centre (SAC), Indian Space Research Organization (ISRO) along with 19 concerned central/state departments including Central Arid Zone Research Institute (CAZRI) played a major role in determining the causes and actual desertification in each state and suggested preventive measures for controlling land degradation This study revealed that, desertification is caused by the following factors:

1. Soil erosion caused by wind/water
2. Deterioration of physical, chemical, biological or economic property of soil
3. Long term loss of natural vegetation

The study was based on three level systems which included the following:

Level (i): a. Agricultural irrigated land b. Agricultural un-irrigated land

Level (ii): Process of desertification: the factors those were responsible for land degradation, e.g. Water erosion, Wind erosion, Man-made factors, Salinity, Alkalinity etc.

Level (iii): Based on severity i.e. a. High b. Low

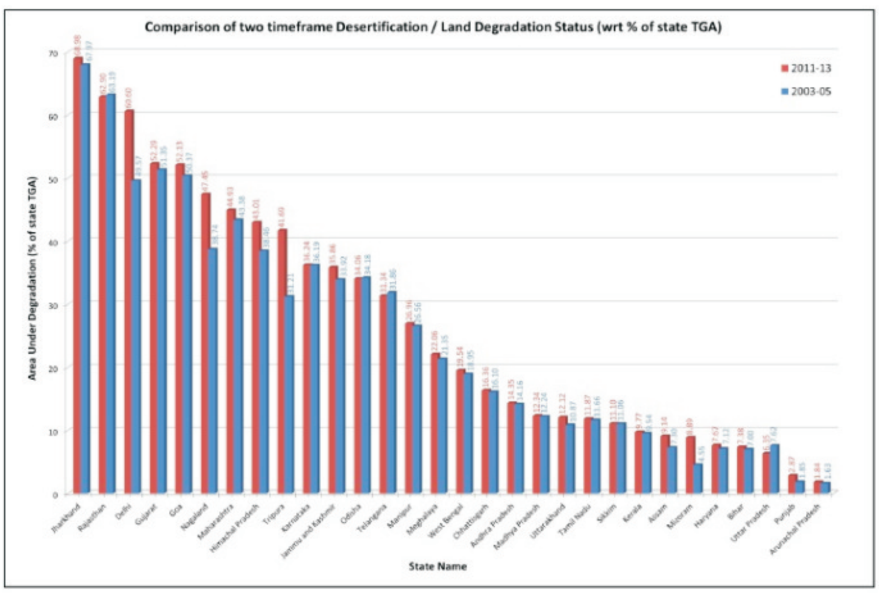

Fig. 1 Showing state-wise land degradation (Source: http://www.sac.gov.in)

The Analysis with respect to total geographical area of individual states in this report shows that Jharkhand, Rajasthan, Delhi, Gujarat and Goa are showing more than 50% area under desertification whereas states less than 50% area under land degradation are Kerala, Assam, Mizoram, Haryana, Bihar, Uttar Pradesh, Punjab and Arunachal Pradesh (Fig. 1).

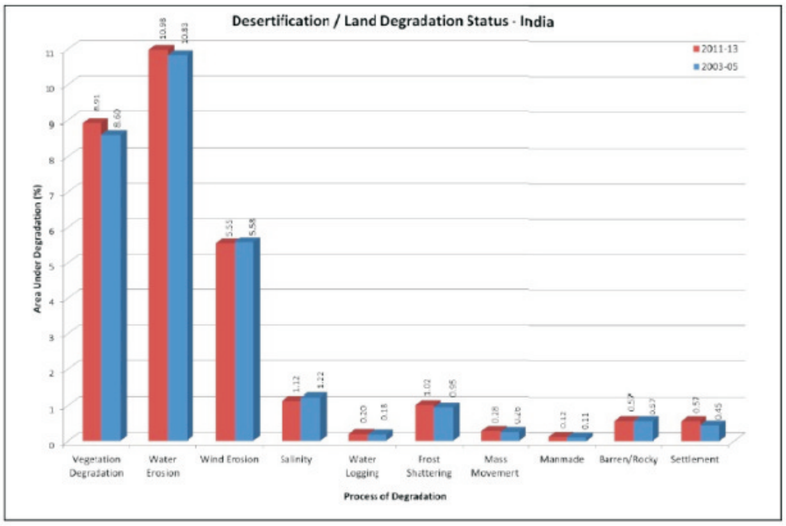

Fig. 2 Factors responsible for land degradation (Source: http://www.sac.gov.in)

The Analysis with respect to total geographical area of individual states in this report shows that Jharkhand, Rajasthan, Delhi, Gujarat and Goa are showing more than 50% area under desertification whereas states less than 50% area under land degradation are Kerala, Assam, Mizoram, Haryana, Bihar, Uttar Pradesh, Punjab and Arunachal Pradesh (Fig. 1).

Of the various processes responsible for desertification, the most significant is water erosion (10.98% in 2011-13 and 10.83% in 2003-05). The second most significant process is vegetation degradation (18.91% in 2011-13 and 8.60 in 2003-05) followed by wind erosion (15.55% in 2011-13 and 5.58% in 2003-05) (Fig. 2 & Table 1).

Table 1. Detailed study of desertification process as predominant in various states.

States	Highest % of Desertification due to	2011-13 (%)	2003-05 (%)
Andhra Pradesh	Vegetation Degradation	7.27	7.29
Arunachal Pradesh	Vegetation Degradation	1.44	1.29
Assam	Vegetation Degradation	6.02	4.11
Bihar	Water Erosion	3.41	3.23
Chattisgarh	Vegetation Degradation	9.97	9.97
Delhi	Settlement	53.64	42.61
Goa	Vegetation Degradation	37.32	35.74
Gujarat	Water Erosion	19.67	19.30
Haryana	Wind Erosion	3.43	3.35
Himachal Pradesh	Vegetation Degradation	32.17	28.43
Jammu & Kashmir	Forest Chattering	13.26	12.38
Jharkhand	Water Erosion	50.64	50.65
Karnataka	Water Erosion	26.29	26.38
Kerla	Vegetation Degradation	8.69	8.46
M.P.	Vegetation Degradation	8.19	8.16
Maharashtra	Water Erosion	26.90	24.77
Manipur	Vegetation Degradation	25.78	25.74
Meghalaya	Vegetation Degradation	19.42	18.49

Meghalaya	Vegetation Degradation	19.42	18.49
Mizoram	Vegetation Degradation	7.92	3.88
Nagaland	Vegetation Degradation	46.95	38.48
Odisha	Water Erosion	28.32	28.53
Punjab	Vegetation Degradation	0.65	0.37
Rajasthan	Wind Erosion	44.41	44.80
Sikkim	Vegetation Degradation	10.47	10.46
Tamilnadu	Vegetation Degradation	10.65	10.52
Telangana	Water Erosion	24.85	25.70
Tripura	Vegetation Degradation	22.54	11.93
Uttar Pradesh	Water Erosion	2.44	2.54
Uttrakhand	Vegetation Degradation	11.34	10.20
West Bengal	Water Erosion	14.98	14.64

Data shows that there is an urgent need to control desertification. Some of the ways to control it are as follows:-

I. Afforestation and planting of soil binding grasses that can check soil erosion, floods and water logging.

II. Protection of vegetative cover which can be a major instrument for soil conservation against wind and water erosion.

III. Integrating the use of land for grazing and farming where conditions are favourable allowing for more efficient cycling of nutrients within the agricultural system.

IV. Integrating land and water management to protect soils from erosion, salinization and other forms of degradation.

With the advent of urbanization, industrialization, modernization and technological updations our country is on way to advancement. But the advents of these technologies have led to land degradation. Suitable efforts need to be made with the contribution of demographic dividend of India path to make degraded lands into useful one's.

Compiled from: http://www.sac.gov.in/Vyom/index.jsp

By R.N. Kulloli and Taru Mathur

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Plant Shows its Metal- A Link to Reclamation

The presence or absence of particular species or varieties of plants in mineralized areas, and the effects of metals on plant growth have been observed and used in the search for concealed ore bodies since the 8th century. Botanists have observed the actual evolution under stress conditions of new subspecies in mineralized or metal-contaminated ground, and there is now a growing understanding of metal-tolerance mechanisms in various plants. The development of new, highly tolerant races of plants in metal-poisoned ground is much more rapid than envisaged previously. Plants may facilitate soil remediation by accumulating metal to toxic level or by concentrating metal in root cell walls and subsequently growing new adventitious roots. New nickel accumulators have been identified in many countries, and a study by R.R. Brooks of herbarium specimens of previously reported indicator plants has shown many to be true accumulators of specific metals. These and other advances indicate the continuing usefulness of geobotanical methods of prospecting and linking its application in reclamation.

Since presence of minerals are often carried miles from their original deposits, researchers/explorators need to be aware of geology and botany of the site. In Finland a huge deposit of copper and nickel was discovered after a mining engineer analysed the metal content of some birch leaves. In Missouri (US) a plant called leadwort (*Amorpha canescens*) thrives in soils near deposits of galena ore, from which lead is derived. In Nevada an unusual species of milk vetch (*Astragalus pattersoni*) has helped prospectors find uranium deposits while in Colorado a closely related

Astragalus species “indicates” selenium. In Arizona, modern-day prospectors still look for the desert trumpet plant (*Eriogonum inflatum*) when searching for likely sites to find gold.

Chinese are reported to have observed the association of certain plant species with mineral deposits at least as early as the 8th or 9th century. Agricola in 1556 published observations concerning physiological effects of metals on vegetation. It is reported that Thalius noted the association of *Minuartia verna* with metalliferous soils as early as 1588. The use of plants in prospecting was described in some detail by Barba in his book on "Methods of Prospecting, Mining and Metallurgy." In the 19th century, seven indicator plants were reported in the literature. Of these, three have been confirmed as indicators of mineralized ground: *Polycarpea spirostylis,* discovered by Bailey (1889) on copper soils in Australia; *Viola lutea*, reported by Raymond (1887) as an indicator of zinc deposits in Aachen, Germany; and *Eriogonum ovalifolium*, reported as a silver indicator in Montana by Lidgey (1897). Their distribution and accumulative powers were also studied in detail in these areas subsequently. From 1900 through 1965, more than 100 species indicative of one or more of 24 elements were reported, and in many cases, analyses showing them to be accumulators of the element were also identified. Since 1965 much research has been reported on the mechanisms of metal tolerance and the evolution of metal tolerant species.

Many plants are unable to grow in strongly mineralized soils; such soils commonly have a reduced flora or may, in extreme cases, be entirely bare. In these relatively open areas, there may be an abrupt change in the degree of sunlight, soil moisture, soil temperature, or drainage. Subsequently lack of competition may permit continued growth of relict stands of species that formerly had a wider range, or seeds of tolerant species or varieties from elsewhere may be able to germinate and grow in these areas that are otherwise unsuitable to plants in general.

Two types of plants have been shown to be tolerant of highly metalliferous soils. The first type, which includes many indicator plants, is capable of accumulating large amounts of metal in the foliage without excessive harm to the plant growth. These plants, as reported by Wild (1968) in Rhodesia, concentrate the metal in the leaves, but generally have heavy perennial rootstalks, and perish in dry or cold periods of the year, thus sloughing off a considerable portion of the absorbed metal. The second type, represented most commonly by grasses, tolerates mineralized soils by preventing the toxic element from concentrating in the aerial parts of the plant, either by retention of metals in the root or by a true exclusion of metals at the root surface, possibly owing to a low root cation exchange capacity that permits the entry of monovalent cations but rejects divalent cations.

In metalliferous soils there are several factors on which absorption depends. Quite often it is the available metal rather than the total metal in the soil and varying proportions of metal that will be water soluble, exchangeable, or organically bound. An increase in the availability of major plant nutrients such as phosphate or calcium in mineralized soils of low pH commonly affects the absorption of metals; ore-associated elements, such as iron, sulphur, arsenic, cadmium, or selenium, may be deterrents or stimulants to plant growth or may interact with the more abundant metals to decrease or increase their toxic effects; physiologic differences between plant species, ecotypes, and perhaps physiological state of individual plants that affect metal tolerance and uptake e.g, the chelated form in which a metal is transported is unique to each species. All these affect the absorption and uptake of metals. Finally, the characteristic pH and total ion concentration of cell sap may determine whether a plant can live in a given soil environment and how much metal it can absorb. Plants adapted to a soil with a high cation content generally have a higher total cytoplasmic ion concentration than do plants that are intolerant of mineralized soils. The location of metals in the cell is also closely associated with metal tolerance. The cell sap (vacuole system) of leaves has been shown to contain copper, zinc, iron, nickel, manganese, and a small amount of lead, but no cobalt or chromium. Researchers have demonstrated that the greater percentages of copper and zinc occur in the cell wall of tolerant and accumulator plants, and in the mitochondrial fraction in nontolerant plants. Others proposed that the cell walls of metal tolerant plants have a high exchange capacity for heavy metals, and that the older leaves senescence as the sites in the cell wall are used up, thus continuously depleting the plant of toxic metals. In the root, most metals are tightly bound in the cortex, but are water soluble in the xylem, where they are available for transport to the upper parts of the plant. Chromium, however, is tightly bound in both the cortex and xylem and remains in the root. Lead is mostly bound in the cortex, but a part is water soluble and available for transport. Early work by Bradshaw (1952) showed that metal tolerant populations of *Agrostis tenuis* could grow on mine soils, but those plants that were transplanted from normal pastures could not survive.

Recognition of sparsely populated or depauperate vegetated areas associated with highly mineralized soil has advanced in the last many years, and much progress has been made in determining the occurrence and controls of stands of obligate, relict, and evolved ecotypes that may be useful in prospecting. Many of the previously known indicator plants have been shown to be specialized races or ecotypes characterized by an unusual tolerance for a particular metal.

Globally, human activities threatened the flora of metalliferous soils and actions aimed in preserving metallophyte species are obvious. Designing and implementation of conservation and rehabilitation programmes, including restoration of habitats, is therefore necessary to limit the extinction risk of metallophyte plants and ecosystem loss. Such a strategy needs to have a sound understanding of the ecological niche of the target species and of factors determining plant community composition spatially. Apart from plant assemblages, species richness, single species belonging to similar plant communities are expected to react differently to the combination of environmental groupings. Consequently, understanding individual niche of metallophyte species as well as the niche distribution along environmental gradients is essential for conservation strategies in restored habitats of a target oriented species.

Establishment of plant populations known to have high tolerance for metals would appear to be a powerful tool in stabilizing and reclaiming mine wastes. The rapid natural evolution of populations of high tolerance can also be accomplished by selection, which is possible through a survival screening process.

Mining activities have been in existence for thousands of years and are known to ravage large areas leaving them uncultivable resulting in permanent, non-restorable land surface (Fig.3). The disturbances are most evident and protracted in arid areas due to moisture deficiency, salt accumulation and erosional hazards. As a result the satisfactory vegetation establishment is becoming difficult. Once mining is ceased, it is desirable to establish quickly a permanent vegetation cover that will reduce soil erosion, provide wildlife habitat and support other land uses. Rehabilitation of lands contaminated from mining activities are a very complicated process and requires a decision support system for rehabilitation of land in and around the mining areas or landscape. As the state of Rajasthan is richest in terms of availability and variety of minerals in the country contributing significantly in the production of 57 out of 79 minerals, post mining site reclamation are of huge importance for environmental sustainability and in doing so exploration, identification and detailed phytosociology, geobotany, mapping with the help of remote sensing and geographical information system of mineral indicating plants are of equal importance for the state of Rajasthan. This will ultimately help in reversing the process of land degradation and desertification due to mining activities.

Fig. 3 Degraded land due to mining

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Know Your Desert Plants

Missing links of a Endangered Species: *Blepharis sindica* T. Anders.

Blepharis sindica (Acanthaceae) is a lignified woody perennial species (locally known as Unt-kantalo or Bhangri) inhabiting the Indian Thar Desert and valuable for its provisional (medicinal uses) and regulatory ecosystem services (sand binder). Currently it's an endangered species whose natural population is decreasing due to habitat destruction and unscientific exploitation. It has been declared as threatened species in the report of UNDP-CCF II project and given A2cd vulnerable category as per IUCN red list.

Sandy dunes, crop fences with loose soil are its preferred habitats. It has woody tap root system, branched stem, sessile leaves in a whorl of four, flowers with strobilate, sessile, hairy spikes 2- 6 cm long, in the forks of the branches, solitary or few (5-7), fruit 8 x 4.5 mm capsule, ellipsoid, compressed, narrowed at both ends (Fig 4). Seeds are the officinal part of this species which are compressed, densely clothed with thick hygroscopic hairs. Flowering and fruiting appears from August to November. The survivorship pattern of this species showed high mortality during early phase of life cycle.

The species possesses a unique trait known as seratonious habit that is retention of viable seed on dead mother plants. The aerial seed holding on the dead plants (Fig 5) is a way to avoid seed predation. Although this species has sufficient reproductive potential for the production of adequate new progeny but in reality, its actual population size is continually declining and this contrasting condition results from (a) habitat destruction and (b) non-synchronization between the seed dispersal timing and actual ground conditions.

Evolutionary dispersal trait (delayed seed release) is also contributing in the endangerment status of *B. sindica.* Although serotonious habit of this species provide protection against the predators, however, due to this rainfall based sensory mechanism, plants disperse their seed when actual ground conditions (higher moisture) are not suitable for seed germination and survival. Higher sand proportion and moderate moisture conditions were most favorable for its growth. Thus, a species specific conservation priority is needed to protect this species.

Pure sand and higher proportions of sand -silt were more suitable compared to clay; further, gravelly surface was identified as most unsuitable habitat for this species. Collection of the seeds from mature fruits/capsule and their sowing with moderate moisture availability with sandy soil is recommended for both, *in-situ* and *ex-situ* conservation.

Fig. 4 *Blepharis sindica* plant in rocky habitat

Fig. 5 Dry plant with mature strobilus

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Technological options

Irrigating a Field when it is "Thirsty"

Farmers have always played a significant role in our society as they produce food to feed the world's population. However, one may forget that, not only do they provide food but they also provide energy, which nowadays, is of paramount importance, especially in the context of renewable energies. Indeed, farmers can produce energy from the wind, the sun or the biomass and they can use it on their own farm.

One of the areas in agriculture that benefits the most from solar energy is irrigation, especially in arid regions. The main reason is that using the sun for irrigation represents a virtuous circle that is when the sun shines, it feeds the irrigation system and a large quantity of energy is available when it is actually needed.

In arid farming, use of proper method of irrigation is also important in view of lack of rains and scarcity of water. Using water for irrigation of a field is often decided by way of guess work. Consequently lot of water that is not actually required by crop, is given to the crop leading to a shear wastage of this important natural resource. Thus irrigating a crop field, when it is actually "Thirsty" is the long felt need. Recognition of this thrust of crop and soil is done through a microprocessor based Integrated Circuit that is energized through solar power. This is called "Solar Irrigation System" as the system derives power from solar energy through photo-voltaic cells which is eco-friendly also. The system works by the following technique:-

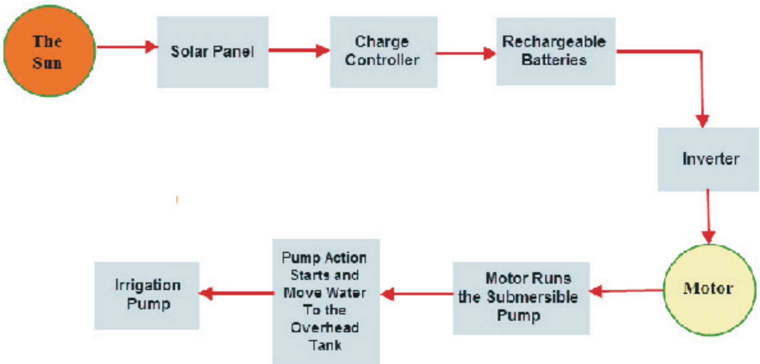

Fig. 6 Flow chart of Solar Irrigation System

Solar energy is used to operate the irrigation pump. The circuit (Fig.6) comprises of sensor parts built using operational amplifier integrated circuit (Op-amp). Op-amp's are configured here as a comparator (An electronic circuit for comparing two electrical signals). Two stiff copper wires are inserted in the soil to sense whether the soil is wet or dry. A microcontroller is used to control the whole system by monitoring the sensors and when sensors sense dry condition of soil, then the microcontroller will send command to relay driver Integrated circuits, the contacts of which are used to switch on the motor and it will switch off the motor when the soil is in desirable wet condition. The microcontroller does the process as soon as it receives the signal from the sensors through the output of the comparator, and these signals operate under the control of software which is stored in ROM of the microcontroller. The condition of the pump that is, ON/OFF is displayed on a 16X2 LCD which is interfaced to the microcontroller.

It is being used in the countries which suffer from high temperatures and scarce water resources such as India, America, Africa. The solar irrigation system could contribute to an efficient water management. The use of solar power in agriculture, which, in the future (and even now), could play a vital part in the management of the food and energy crisis, especially in developing and emerging countries where the access to the electricity is not always guaranteed. In this situation, farmers cannot depend on the traditional irrigation system. Thus, using an independent and alternative energy system can be a solution for the farmer to secure a safe power source and for the public to avoid the saturation of non-renewable resources

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Crusade against charcoal rot of arid crops: Success story of Maru sena 3

Under concurrent heat and moisture stress condition of arid and semi arid regions, *Macrophomina phaseolina* (Tassi) Goid., a soil borne plant pathogen, causes charcoal rot or dry root rot on many economically valuable plants like guar, cowpea, moth bean, mung bean, sesame etc (Fig 7). Losses up to 40% in legumes and oil seeds have been reported. Therefore, there is a need to evolve effective management strategies to ensure crop productivity and yield stability. Efforts have been made during past two decades to develop eco-friendly management strategies by utilizing native bio control agents. Several management strategies like moisture conservation practices, soil solarization, amending soil with Brassica residues and composts have been advocated for managing charcoal rot of legumes and oil seeds. In recent years, native strain of a specific bio-agent *Bacillus firmus* was isolated from *Brassica* residue amended soils of the region. *B. firmus* has been found specific antagonist to *M. phaseolina* when its antagonistic activity was tested against soil borne fungi including *Trichoderma harzianum.* However, *B firmus* could not inhibit the growth of any of these fungi.

In order to test its effectiveness in field against dry root rot, experiments were conducted at CR farm CAZRI, Jodhpur on guar and sesame in a field having history of cultivating *M. phaseolina* susceptible crops during last 10 years. The bio-agent significantly reduced incidence of charcoal rot on both the crops. On the basis of pooled average, B. firmus coated seeds appeared as superior treatment both in terms of reducing charcoal rot and enhancing seed yield. Considerable improvement in yield due to seed coating may also be due to plant growth promoting ability of this novel bacterium, which improved nodulation in legumes.

Effectiveness of seed coating with bio formulated product of *B. firmus* on incidence of dry root rot and seed yield of Guar and moth bean was demonstrated at 61 growers field adopted by the Institute in order to simultaneously imparting training. At each demonstration, 1600 m^2 area was sown with B. firmus coated and uncoated seeds within 24-48 hrs of coating. Plant mortality due to charcoal rot was recorded 60 days after growth in 5 randomly selected plots at each site and seed yield was also recorded at harvest. Least plant mortality (6.81%) due to dry root rot in guar was recorded on the basis of pooled average of 22 locations where seeds were coated with bio agent compared to 10.8% in plots sown with uncoated seeds. The effect of seed coating was more conspicuous on local cultivar and improved short duration genotypes. Increase in seed yield in the plots planted with *B. firmus* coated seeds ranged from 14.8-17.5% in guar and 14.5% in moth bean, respectively. In general, better germination and early flowering has been witnessed by growers in treated plots. This indicated that increase in seed yield was not only due to reduced disease incidence but was also due to cumulative effect of better germination, plant growth, nodulation.

Once a bio- agent has shown reproducible activity in a series of screening trials, methods for inoculums production, formulation and application needs to be considered in relation to the crop, disease and environment of use. Efforts were made to develop a bio-formulated product of this bio-pesticide where the bacterium can survive for at least 120 days without losing its virulence. Many locally and cheaply available on-farm wastes were evaluated in order to select those food substrates that can improve shelf life of *B. firmus* for a reasonable period. Our efforts culminated in identifying suitable food substrates, which was combined with a carrier to retain moisture in the bio-formulated product where bacterium could survive for a period of 120 days. The product named as Maru sena 3 (Fig. 8) was made available for distribution to the farmers through ATIC of the institute. In the last 8 years, hundreds of hectare land has been sown with bacterium coated seeds. Farmers have shown keen interest to use it for legumes and oil seed crops to the extent that an enthusiastic farmer (Choudhary Ramjivan) has kept the name of his house as Maru sena Bhawan.

Fig. 7 Dry root rot incidence in Cowpea

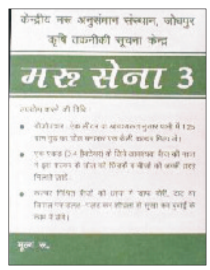

Fig 8. Bioformulated Maru sena 3

The process of developing bio-formulated product of this bio-pesticide has been filed for patenting so that the product can be put to commercialization for wider adaptability among growers. The patent was published in Indian patent site in November 2014 and final results are awaited.

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Knowledge Corner

Wind erosion, Dust Storms and its Health Hazards

The hot arid regions in Rajasthan constitutes 62% of country's total hot arid area and is mainly confined to western part of the state distributed over 21 m ha area covering 12 districts that are Jaisalmer, Barmer, Bikaner, Jodhpur, Sri Ganganagar, Hanumnagarh, Churu, Jhunjhunun, Sikar, Nagaur, Pali and 3 tehsils of Sirohi districts. As per aridity index this region is classified as arid region. Wind erosion is considered as the dominant form of desertification process in this region. Geomorphological assessment and related studies indicated that about 80% of landforms are of aeolian origin. A recent mapping by CAZRI also indicates more than 48% area is still covered under sand dunes of various morphology and dimensions.

Soil erodibility factor is an important factor affecting wind erosion process. The factor is comprehensively calculated in RWEQ as the erodible fraction (EF) and soil crust factor (SCF) using data on sand, silt, clay, organic matter and CaCO3 content as follows:

$$EF = \frac{29.09 + 0.31Sa + 0.17Si + 0.33Sa/Cl - 2.59OM - 0.95CaCO_3}{100}$$

$$SCF = \frac{1}{1 + 0.0066(Cl)^2 + 0.021(OM)^2}$$

Where, Sa is sand content (%), Si is silt content (%), Cl is clay content (%), OM is organic matter (%), CaCO3 is calcium carbonate content (%). Thematic maps on both these factors (Fig. 9) shows that the area covering Jaisalmer, Bikaner, Churu, Jhunjunu, Sikar, Jodhpur and Nagaur district of western Rajasthan lies under high EF factor (0.57-0.60). Jaisalmer, Bikaner and western most part of Jodhpur lies under high SCF factor (0.69–0.84). This indicates that these areas are highly prone to wind erosion thus contributing dust that makes "Dust Storms".

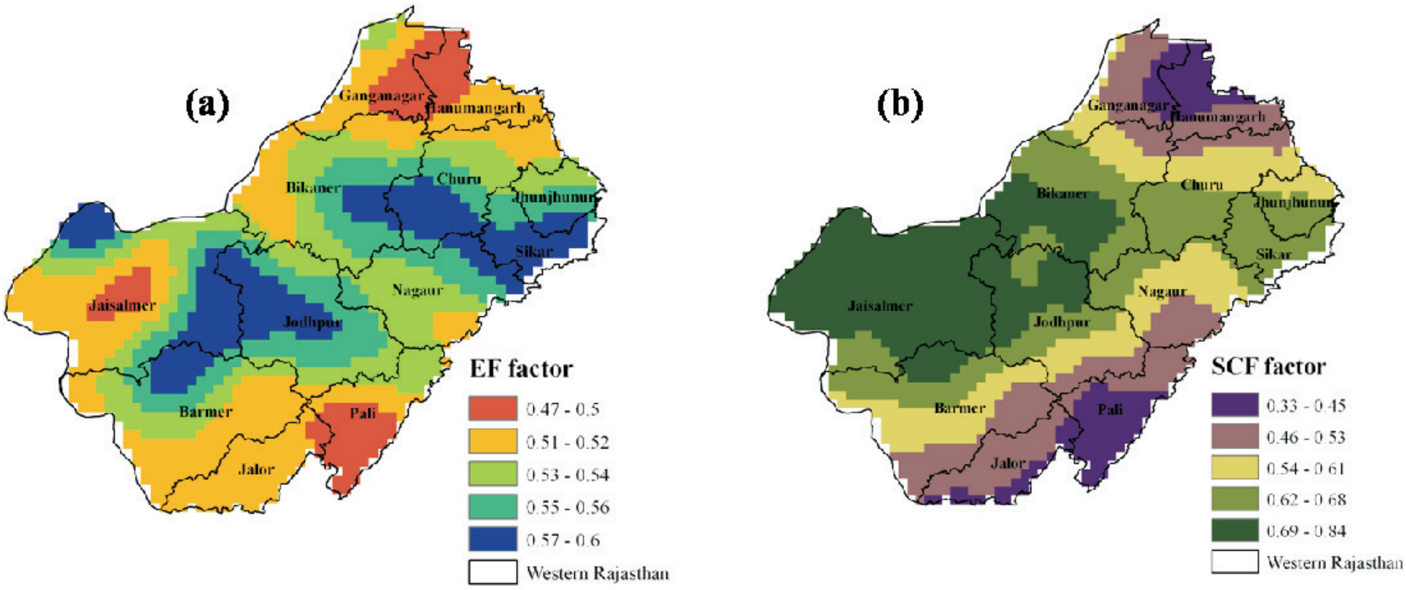

Fig. 9 RWEQ factors in western Rajasthan;
(a) Soil erodible fraction (EF) factor and (b) soil crust factor (SCF)

Occurrence of dust storm is a frequent phenomenon in the region during summer months. Computed soil loss in suspension mode during dust storm events revealed a maximum soil loss of 1166 kg ha-1 during dust storm event on 15-06-2009, which was of only 30 minutes duration. On an average, soil loss rate during dust storm events of the year 2009 was 17 kg ha^{-1} min^{-1}. Deposition of eroded suspended soil particles either at local natural surfaces or surfaces far away from the source area is the final step of wind erosion process. Natural surfaces where deposition takes place frequently are plant leaves, grasslands, water bodies etc.

Eroded soil mass commonly known as dust, emitted during wind erosion events over desert area throughout the world, remains in atmosphere for a long time as suspended particles. These suspended particulate matters in atmosphere have an adverse effect on respiratory and cardiovascular activity of people and thus are considered as health hazard. Furthermore, eroded soils carries lot of carbon and nutrients along with it and thus reduces the soil fertility in source areas and enrich the nutrient contents in unwanted places through dust deposition like in water bodies etc. Moreover, these suspended particulate matters mix with other minute particles of the atmosphere e.g. carbon soots, smoke, salts etc. and produce a blanket of haze, and aerosols and known environmental hazard. Particle size analysis of collected aeolian samples during a dust storm event of 15th June, 2009 showed that particulate matter having size less than 10 μm (PM10) was 30% in eroded aeolian mass, whereas the same for desert surface was only 7.5%.

Dust emitted during wind erosion events over desert area throughout the world is contributing significantly towards atmospheric aerosol. Such type of aerosol, in association with other aerosol products like sulphate aerosol, carbonaceous aerosol, sea salts etc. produce a vast blanket of haze in upper atmosphere, specifically in troposphere. These tropospheric aerosols have both direct and indirect effect on net radiative forcing, which can be defined as change in net downward flux of shortwave radiation due to presence of any substances in atmosphere. Several reports from different parts of the world have shown that atmospheric aerosols have a negative net radiative forcing and hence a cooling effect unlike of greenhouse gases. Dust aerosols generated during wind erosion events in the Thar Desert create dust haze over a large area and even carried over towards Indo-Gangetic plains in severe dust storm events. Regional transport of dust aerosol is clearly viewed in MODIS image obtained during 10th June, 2005 as depicted in Fig. 10. This figure also shows the intercontinental dust transport from Sahara desert of Africa to Thar Desert of Asia.

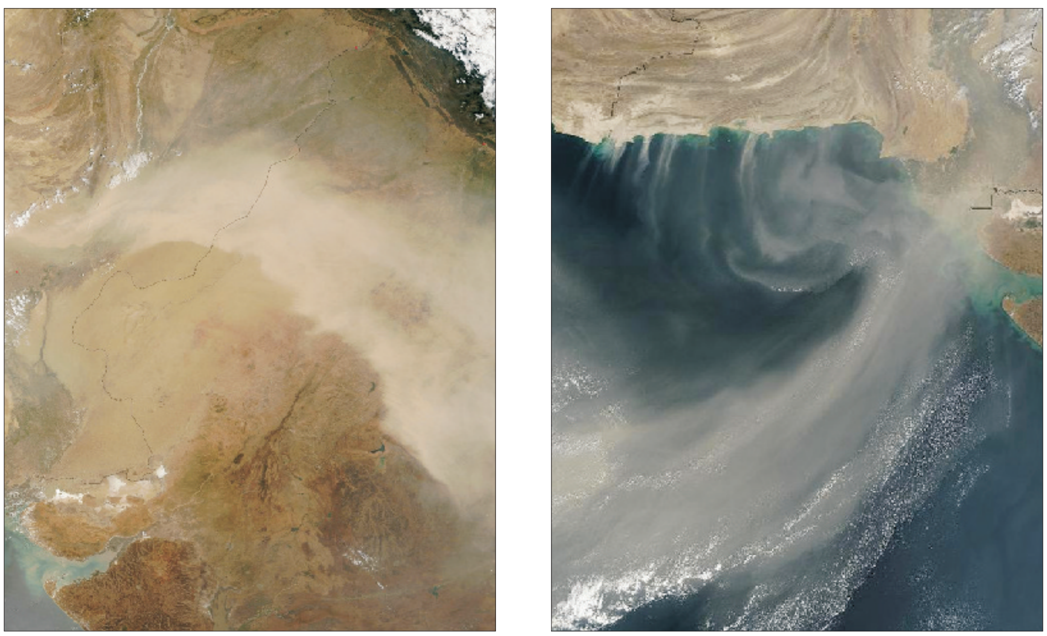

Fig. 10 MODIS image of dust transport from source region of Thar Desert to Indo-Gangetic Plains and intercontinental dust transport (a) 10th June, 2005, (b) 14th December, 2003

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Know Your Institutions

Space Application Centre

Space Applications Centre (SAC) Ahmedabad, is a major research and development centre of the Indian Space Research Organization (ISRO). It plays a key role in realizing vision and mission of ISRO.The core function of the centre lies in development of space borne and air borne instruments/payloads and their applications for national development and societal benefits. These applications are in diverse areas and primarily meet the communication, navigation and remote sensing needs of the country. Besides these, the centre also contributes significantly in scientific and planetary missions of ISRO like Chandrayan-1, Mars Orbiter Mission etc. The communication transponders developed at this centre for Indian National Satellite (INSAT) and Geo Synchronous Satellite (GSAT) series of satellites are used by government and private sector for VSAT (Very Small Aperture Terminal), DTH, internet, broadcasting, telephony etc. This centre also designs and develops the optical and microware sensors for the satellites, signal and image processing software. GIS software and many applications for Earth Observation (EO) programme of ISRO. These applications are in diverse areas of Geosciences, Agriculture, Environment and Climate Change, Physical Oceanography, Biological Oceanography, Atmosphere, Cryosphere, Hydrosphere etc.

Genesis and History

The genesis of the centre dates back to 1966, with establishment of the Experimental Satellite Communication Earth Station (ESCES), by late Dr. Vikram Sarabhai in Ahmedabad. It was an experimental Earth Station and training centre where scientists and engineers of India and other developing countries could receive training and first-hand experience in the design, development and operations of an earth station for communications and broadcasting, and later on in 1972, the different units of ISRO in Ahmedabad pursuing research in applications of space technology were merged to form SAC. The payload for first experimental communication satellite of India, 'APPLE' was designed, fabricated and qualified at SAC. And also the foundation of two satellite for earth observation (SEO) were also launched that were called Bhaskara satellites, Bhaskara I and II were the first Indian Meteorological satellites which carried microwave radiometer called SAMIR to provide information on sea state and atmospheric water vapour content for use in meteorological studies. SAC has state of the art General Circulation Models for experimentation with satellite data. Prediction of weather in the extended range and prediction of Ocean state in the short range are the fields of active research.

Compiled from www.sac.gov.in

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Know Your Policies

UNCCD and India's Policy

The United Nations Convention to Combat Desertification (UNCCD) is one of the outcomes of Rio Conventions that focuses on desertification, land degradation and drought (DLDD). UNCCD defines Desertification as "land degradation in the drylands (arid, semi- arid and dry sub- humid regions) resulting from various factors".

India became a signatory to the UNCCD on 14th October, 1994 and ratified it on 17 December, 1996.India is the 7th largest country in the world having total geographical area of 328.73 Mha, which occupies only 24% of the world's geographical area but supports over 16.7% of the world population. The area under lands in India is 228.3 Mha, which is 69.6% of the total geographical area, and comprises of arid lands (50.8 Mha). About 32% of the land is undergoing various forms of desertification and 25% of the geographical area is affected by desertification.

State	Area of Rajasthan affected by various kinds of land Degradation (Lakh ha)							
	Water & wind erosion	Water logged	Alkali/ sodic soil	Acid soil	Saline soil	Mining/ industrial	Total degrade	Geographical area (lakh ha)
Rajasthan	201.91	0.00	1.52	0.00	0.82	0.00	204.25	342.24

Though India does not have a specific policy or legislative framework for combating desertification as such, the concern for arresting and reversing land degradation and desertification gets reflected in many of our national policies that are: National Water Policy 1987, National Forest Policy 1988, National Agricultural Policy 2000, Forest Conservation Act 1980, Environmental Protection Act 1986, National Environment Policy 2006, National Policy for Farmers 2007, National Rain Fed Area Authority (NRAA- 2007) which have enabling provisions for addressing these problems.

Besides the above policies and programmes, several schemes have also been implemented by India and UNCCD:-

1. **The Sustainable Land and Ecosystem Management (SLEM) programme-** the objective of this programme is to promote sustainable land management and use of biodiversity as well as maintain the capacity of ecosystems to deliver goods and services while taking into account climate change.

2. **Land for Life Award –** the land for life award was launched at the 10th session of the Conference of the parties to the United Nations Convention to Combat Desertification (UNCCD) seeking to promote efforts for sustainable land management. The land for life award provides global recognition to individuals, teams, institutions, businesses, research institutes, decision makers, non-governmental organizations and civil society organizations whose work and initiatives have made a significant and innovative contribution to sustainable land management.

In order to provide research support to various programmes for combating desertification, land degradation and drought, Government of India has established a network of research & development institutions across the country. Some of the major institutes are – Indian Council of Agricultural Research-Central Arid Zone Research Institute, Central Institute for Dryland Agriculture, Indian Council of Forestry Research and Education-Arid Forest Research Institute, Forest Research Institute, Himalayan Forest Research Institute etc.

Hence, India has always taken desertification as a high priority in its Five Year Plans and has consistently endeavored for the development of the drylands.

(Compiled from 5th National Report of UNCCD-2012, MoEF&CC, GOI, New Delhi)

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News

कल्याणी विवि पश्चिमी बंगाल के छात्रों ने काजरी का भ्रमण किया

नवज्योति/जोधपुर।

कल्याणी विश्वविद्यालय पश्चिमी बंगाल पर्यावरण विज्ञान विभाग के एमएससी के छात्र-छात्राओं ने काजरी में बुधवार को शैक्षणिक भ्रमण किया। एनविस केन्द्र प्रभारी डॉ. सुरेशकुमार ने मरू वानस्पतिक उद्यान में विद्यार्थियों को बताया कि पश्चिमी राजस्थान में अनेक बहुउपयोगी औषधियां वनस्पतियां है, जो पहाड़ों, वनों, बंजर भूमि में सर्वाधिक है। इन पौधों से जीवनदायनी दवाएं बनती है। उन्होंने अश्वगंधा, शंख पुष्पी, चामकस, वज्रदन्ती, अस्थमाबेल, शतावर, अड़ूसा, सर्पगंधा, हरसिंगार, ग्वारपाठा आदि पौधों के बारे में बताया। उन्होंने कहा कि यह सभी वनस्पतियों की दवाओं में मुख्य भूमिका रहती है। तरूणा माथुर, रवीकुमार, ने मरू उद्यान में पेड़ पौधों व उद्यान में चल रहे शोध कार्यों के बारे में बताया।

डॉ. आरकेकौल ने काजरी में चल रहे शोध कार्यों के बारे में जानकारी दी। तकनीकी सहायक रमेशचंद्र ने संस्थान के पॉली हाउस व फलों उद्यानिकी में लगे बेर, आंवला, अनार, बेल आदि के शोध क्षेत्रों का भ्रमण कराया व बहुउपयोगी पेड़ों, झाड़ियों, छायादार वृक्षों के बारे में विस्तार से जानकारी दी।

डॉ. दिलीप जैन ने सौर ऊर्जा के प्रयोग के बारे में विस्तारपूर्वक बताया कि हम सौर ऊर्जा के क्षेत्र में किस प्रकार अधिक से अधिक लाभ ले सकते हैं। कृषिका क्षेत्र हो या अन्य कोई भी क्षेत्र हो सौर ऊर्जा द्वारा हम बिजली पैदा कर हर क्षेत्र में उपयोग में ला सकते हैं।

तकनीकी सुचना केंद्र के तकनीकी अधिकारी गजेसिंह जोधा ने, शुष्क क्षेत्र में बाजरा, ग्वार, मूग, मोठ, तिल आदि की फसल व उन्नतबीजों के बारे में बताया कि किस प्रकार कम पानी में अधिक पैदावार ले सकते हैं।

कल्याणी विश्वविद्यालय के साथ में आये प्रो. एससी सांतरा, डॉ. डी. दास ने बताया कि विद्यार्थियों में काजरी के शोध कार्यों, पर्यावरण व सौर ऊर्जा के प्रति जानकारी तथा कृषि शिक्षा के क्षेत्र में रोजगार के अवसरों के बारे में जानकारी प्राप्त करने हेतु काजरी में शैक्षणिक भ्रमण कार्यक्रम रखा गया। भ्रमण दल में 3 प्रोफेसर व 20 छात्र-छात्राओं ने संस्थान के शोध क्षेत्रों का भ्रमण किया।

आफरी में पुनश्चर्या प्रशिक्षण

मरुस्थल में वानिकी कार्य चुनौती

आफरी में भारतीय वन सेवा अधिकारियों के पुनश्चर्या प्रशिक्षण को संबोधित करते आफरी निदेशक

पत्रिका न्यूज़ नेटवर्क
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बासनी/जोधपुर मरुस्थलीकरण किसी क्षेत्र विशेष की नहीं, वरन सम्पूर्ण विश्व की ससमस्या है। संसार का लगभग 24 प्रतिशत तथा राजस्थान का लगभग 23 प्रतिशत भू-भाग मरुस्थलीकरण से प्रभावित है। यहां की विषम परिस्थितियों में वानिकी कार्य एक चुनौती है। यह बात राजस्थान वन विभाग के सेवानिवृत्त प्रधान मुख्य वन संरक्षक अभिजीत घोष ने कही। वे शुष्क वन अनुसंधान संस्थान (आफरी) में भारतीय वन सेवा अधिकारियों के पुनश्चर्या प्रशिक्षण कार्यक्रम में मुख्य अतिथि घोष ने कहा कि मरुस्थलीकरण रोकने के लिए सभी विभागों को एकीकृत कार्य परियोजना विकसित करनी चाहिए। कार्यक्रम के विशिष्ट अतिथि सिक्किम के सेवानिवृत्त प्रधान मुख्य वन संरक्षक एमएल ऐरावलिया ने बताया कि गत कुछ वर्षों में वानिकी कार्यों से राजस्थान के मरु क्षेत्र में अपूर्व बदलाव आया है। मध्यप्रदेश के प्रधान मुख्य वन संरक्षक राकेश कुमार गुप्ता ने मरु क्षेत्र में परम्परागत एवं आधुनिकी तकनीकों के समन्वित उपयोग द्वारा वानिकी शोध करने की वकालत की। कार्यक्रम के प्रारम्भ में आफरी निदेशक एनके वासु ने मरुक्षेत्र की पारिस्थितिकी से रू-ब-रू करवाया और वासु ने आफरी द्वारा लवणीय भूमि सुधार, सेम की समस्या से निवारण तथा टिब्बा स्थिरीकरण आदि में किए गए शोध कार्यों तथा उनके परिणामों के बारे में बताया। समूह समन्वयक (शोध) डॉ. टीएस राठौड़ ने धन्यवाद ज्ञापित किया। कार्यक्रम संचालन डॉ. तरुणकांत ने किया।

संरक्षण पर जोर

तकनीकी सत्र में आफरी के डॉ. जी सिंह ने मरु क्षेत्र की पारिस्थितिकी तंत्र और पुष्पीय पादपों की विविधता पर, संवेदन सुदूर केन्द्र के डॉ. एमके गौड़ ने प्राकृतिक संसाधनों, वन मानचित्रण आदि के सुदूर संवेदन तकनीकी द्वारा वानिकी क्षेत्रों के लिए जा सकने वाले विभिन्न कार्यक्रमों के बारे में बताया।

सेतरावा में अधिकारी देखेंगे टिब्बा स्थिरीकरण

भारतीय वन अधिकारी बुधवार को जैसलमेर स्थित आकल जीवाश्म पार्क, डेजर्ट नेशनल पार्क और सेतरावा में टिब्बा स्थिरीकरण और अन्य वानिकी क्षेत्रों का अवलोकन कर मरु क्षेत्र की पारिस्थकी को प्रायोगिक रूप में समझने का प्रयास करेंगे।

पत्रिका Tue, 20 December 2016 epaper.patrika.com//c/15485091

अनार बदल देगा मारवाड़ का भाग्य

कृषि विवि [illegible] में आयोजित अनार उत्पादन व उपयोग विषयक कार्यशाला में [illegible] कृषि वैज्ञानिक।

कृषि विवि में अनार उत्पादन एवं उपयोग पर एक दिवसीय कार्यशाला, विद्यार्थियों के साथ देशभर के वरिष्ठ कृषि वैज्ञानिकों ने लिया भाग

[illegible]

पत्रिका Sun, 11 December 2016 epaper.patrika.com//c/15314

शुष्क क्षेत्र में तकनीक का उपयोग करें तो चारा व आजीविका के अवसर बढ़ेंगे : हर्ष

शुष्क वन अनुसंधान संस्थान की ओर से पांच दिवसीय प्रशिक्षण कार्यशाला का समापन

जोधपुर| शुष्क वन अनुसंधान संस्थान (आफरी) की ओर से आयोजित पांच दिवसीय प्रशिक्षण कार्यशाला का शुक्रवार को समापन हुआ। इस मौके पर कृषि विश्वविद्यालय मंडोर के वैज्ञानिक एलएन हर्ष ने कहा कि कृषि क्षेत्र में तकनीक का उपयोग करना जरूरी है। ऐसा करने से जहां पशुओं के लिए चारे का उत्पादन बढ़ेगा वहीं आजीविका के अवसर भी बढ़ेंगे। उन्होंने कहा कि जलवायु परिवर्तन को भी इससे रोका जा सकता है और अपने पक्ष में बनाया जा सकता है।

अजमेर से आए प्रो. केके शर्मा ने कहा कि वन क्षेत्रों के महत्व को देखते हुए वन्य जीवों के प्रबंधन व मैनेजमेंट पर जोर देने की जरूरत है। इससे वन्य जीवों के बारे में जानकारी प्राप्त होंगी वहीं उन्हें सुरक्षा देना भी आसान हो सकता है। इस मौके पर विशेषज्ञों ने मरुस्थल पर स्टडी की आवश्यकता बताई। उनके अनुसार लोगों की वन क्षेत्र पर आजीविका निर्भर रहती है। विशेषज्ञों ने कहा कि इस प्रकार का प्रशिक्षण साल में दो बार होना चाहिए। कार्यशाला के अंतिम दिन तकनीकी सत्र हुए। मध्यप्रदेश से आए प्रधान वन संरक्षक आरके गुप्ता ने कार्यक्रम की अध्यक्षता की। आफरी के निदेशक एनके वासु ने आभार जताया।

New Databases of Rajasthan at CAZRI-ENVIS Website

- Trends of rural and urban population in various districts of Rajasthan.
- Trends of livestock population in various districts of Rajasthan.

Compiled & Uploaded by : **Taru Mathur,** ENVIS, ICAR-CAZRI, Jodhpur

Conferences

Date	Topic	Place
National		
December 17-19, 2016	International Conference on Environment and Agriculture in the UN-Sustainable Development Goals	Bhopal, India
International		
December 25-27, 2016	4th International Conference on Environment Pollution and Prevention (ICEPP 2016)	Kyoto, Japan
November 28 - 30, 2016	2nd International Conference on Green Energy	Atlanta, USA.
November 28-30, 2016	3rd World Congress and Expo on Recycling	Atlanta, USA
December 21-22, 2016	6th International Conference on Agriculture, Environment and Biological Sciences (ICAEBS'16)	Kuala Lumpur, Malaysia