DEN NEWS

DESERT ENVIRONMENT NEWSLETTER

Volume 7 No. 1-4 January-December 2003

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ENVIS CENTRE ON DESERTIFICATION
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EDITORIAL

Desert ecosystem confronted with extremities of climate, fragilities of natural resources and weak socio-economic milieu poses issues of survival of human and animals particularly in drought years. Severe drought also leads to animal and plant epidemics, which are required to be attended on priority. Under these conditions desert dwellers tend to migrate in search of better facilities and work for additional income. In such a scenario, income generation through medicinal and aromatic plants, endowed in arid region, and many value added products may help ease situation.

I hope that this issue of DEN News, dealing with some of the burning issues of arid zone, will be useful for people at large and better their quality of life.

PRATAP NARAIN
Director

OYSTER MUSHROOM FOR NUTRITIONAL SECURITY AND INCOME GENERATION

Nand Lall Vyas, Manjit Singh and Som Prakash Joshi

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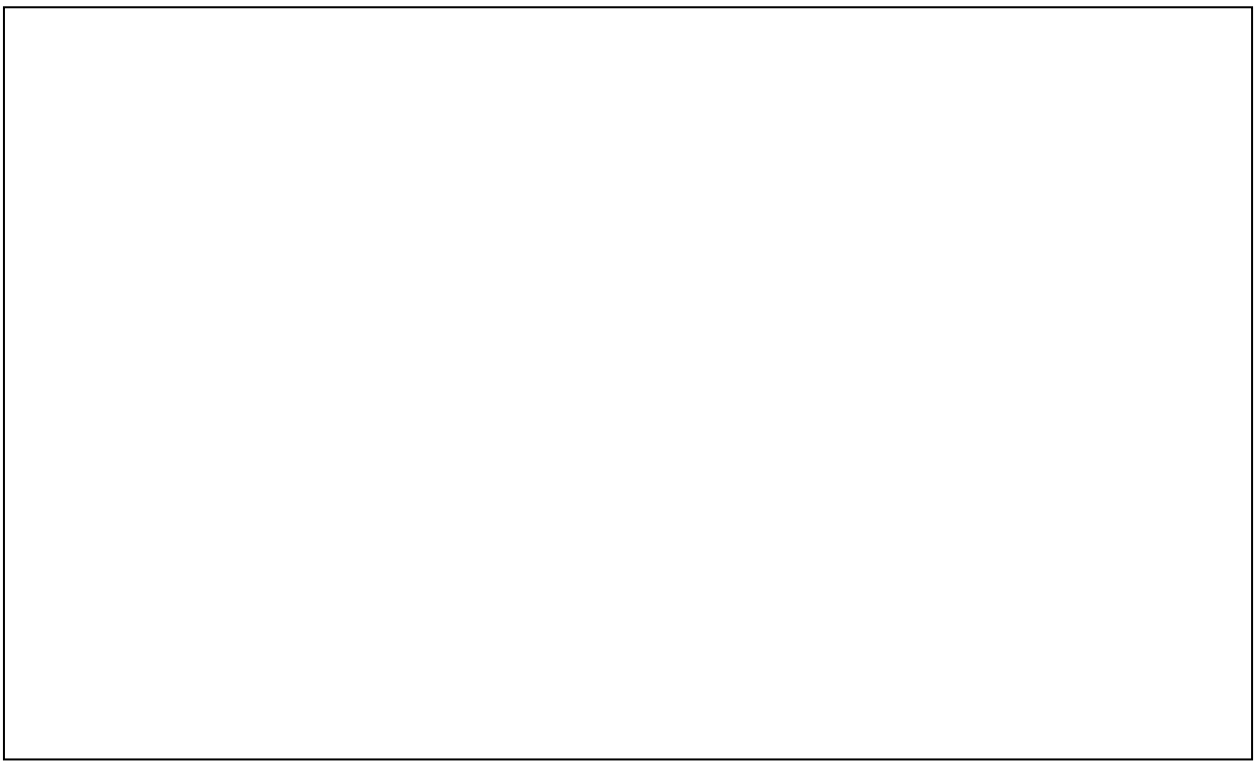
Mushrooms are undoubtedly one of the man's earliest food, In Rajasthan edible mushrooms like *Phellorinia* spp., and *Podaxis* spp. (Fig.1) grow during rainy season and are collected from natural habitat and consumed by the natives. Mushrooms are 100% vegetarian and the nutritive value is better then vegetable. Mushrooms are large reproductive structures of edible fungi, about 300 species belonging to 70 genra experimentally, 20 cultivated commercially and 4-5 species produced on industrial scale throughout the world. Of these the two commercially important species being cultivated in India are white button mushroom (*Agaricus sp*) and oyster mushroom (*Pleurotus spp*) "Meat for the poor", as mushrooms are known, are rich in essential minerals, vitamins of the B-complex group such as Riboflavin, Niacin and Panthothenic acid and various amino acids. In addition to protein (3.7%) they also contain carbohydrates (2.4%), fat (0.4%), minerals (0.6%) and water (91%) on fresh weight basis. They contain minerals like calcium, phosphorous, potassium, iron and copper. Mushrooms have no cholestrol. Easily deigestible, it is an excellent food for children, pregnant women, the old and people suffering from heart disease, diabetes, acidity, constipation, hypertension and anaemia. Mushroom cultivation creates employment opportunities for school drop-outs, youths and women and for those requiring additional income. Mushrooms are eco-friendly as they utilize the agro-waste and recycle biomass , and also mature fast. In Rajasthan, and various other parts of india, kharif is the major crop and many farmers are free during winter months. Oyster mushroom (*Pleurotus spp*.) cultivation during this period will help in supplementing the income and generating work opportunities for the farming families. The mushroom finds a ready market for use in cuisine in hotels and homes.

How to Grow Oyster mushroom ?

Different locally available substrates like wheat straw, pearlmillet straw, moongbean stalk, cow-pea straw, mothbean straw and sewan & dhaman grasses are used for oyster mushroom cultivation. The temperature required for it is 20- 30˚C with a humidity of 70-85%. The best season for growing oyster mushroom in Rajasthan is from October to March. One crop cycle takes 45-60 days, hence a number of crops can be taken during the above season. Its cultivation does not require much skill and investment. Fresh hand thrashed straw is used. Cut into pieces (3-6 cm), this straw is then steeped in clean water in a drum for about 18 hours. Straw can be disinfected by adding 7g bavistin and 125 ml. formaline in this drum (for 10 kg dry straw). In another method, this chopped straw is soaked in hot water (65 + 5˚C) for one-two hours. After squeezing the excess water the substrate is filled in polythene bags (size 30x40 cm) after mixing the spawn at the rate of 2% by wet weight of substrate (i.e. 200 gm in 10 kg). Fresh grain spawn should be used. The bags should be perforated at 6-8 places. These bags are then incubated at 20-30˚C at 70-80% relative humidity for spawn run. Unlike green plants mushrooms do not require light for the synthesis of food. In no case bags should be opened before complete spawn run i.e. till substrate is fully covered with the white mycelium. The polythene bags are then removed and these blocks are arranged on a platform. Spraying of water is done twice-thrice a day or as and when required for maintaining 70-80% relative humidity. Diffused light and aeration has to be provided for 1-2 hours in the room. Fruiting bodies of mushroom will appear with in 7-8 days which can be harvested after two days (Fig. 2). Three to four flushes can be taken with in a period of 4-6 weeks. Fruiting bodies should be harvested carefully to aviod any disturbance to other pin heads as far as possible. These are then cleaned and packed in perforated polythene bags for sale in fresh form. Extra produce can be sun dried or dehydrated at 50-55˚C and stored in sealed polythene bags for later use.



(Fig.1 Phellorinia and Podoxis- naturally occurring edible mushroom in desert)

(Fig.2 Oyster mushroom)

SOME ECOLOGICALLY AND ECONOMICALLY IMPORTANT SHRUBS OF INDIAN ARID ZONE

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Integrating concerns of productivity and conservation is important for balanced functioning of the fragile ecosystem of arid zone. Shrubs, an important constituent of arid ecosystem, are a long-neglected life form. Shrubs have a resilient role in resisting erosion and desertification. In areas with low tree cover these are the primary source of fuel for rural masses and fodder for their livestock. Many shrubs have high growth rate, ability to withstand biotic pressure, conserve soil and moisture, improve soil productivity and have the potential to provide products useful to the local people as well as industry. Despite the importance of shrubs in arid and extreme arid zones, these are the first casuality of any afforestation programme. Introduction of tractors and mechanisation has further contributed to eradication of shrubs from cultivated fields. Rehabilitation of wastelands can be more effective if shrubs are also introduced along with trees. Some of the important ones are:

- *Commiphora wightii* (Guggul)
- *Calligonum polygonoides* (Phog)
- *Capparis decidua* (Kair)
- *Haloxylon salicomicum* (Lana)
- *Zizipus nummularia* (Bordi)
- *Lawsonia inermis* (Mehndi)
- *Grewia tenax* (Gangani)
- *Acacia jacquemontii* (Bawli)
- *Leptadenia pyrotechnica* (Kheemp)
- *Cassia angustifolia* (Senna)
- *Withania somnifera* (Ashwgandha)
- *Aloe vera* (Gwarpatha)

Capparis decidua, commonly known as 'kair' in Rajasthan and Gujarat is widely distributed in arid tracts of India. This leafless shrub having deep root system provides fruits that are used for pickles and are known to have medicinal value (useful in cardiac troubles and biliousness) as well. The moderately hard and heavy wood is resistant to termite attack and used by rural people for making handles, cart wheels and axils. Information is available on phytochemical constituents like alkaloids, isocodonocarpine etc. and its micropropagation.

Lawsonia inermis, commonly known as Mehndi or Henna yields dye, oil and having many other uses like natural pesticide against nematodes, prophylactic agent against skin diseases, skin inflammation, sore throat etc. This species is also a common hedge plant in arid regins. The dye/leaves are exported to various European and Arabian countries.

Commiphora wightii, commonly known as Guggul, yields oleo gum-resin from incision in its bark. This resin, normally referred guggul, has lipid activity and is anti-inflammatory diuretic, expectorant, and diaphoretic. In the last few decades there has been sharp decline in natural population of this species. Hence, the genetic diversity in this species must be conserved.

Withania somnifera (Ashwgandha) is a medium sized under shrub. Its roots are known to have medicinal value and are used in cases of nervous debility and rheumatism. Withanolides isolated from this species have been used for curing Alzheimer's disease.

Cassia angustifolia (Senna), a small shrub indigenous to Arabia and yielding leaves having medicinal value (laxative), is cultivated in dry lands of south India. It has been introduced in arid tracts of Rajasthan where it has given promising performance primarily due to non-edibility of its leaves. The leaves have sennosides and the quantity of this phytochemical has been reported to be higher in sandy lands. Major part of the senna leaves are exported.

Calligonum polygonoides (Phog) is a shrub that has wide distribution on sand dunes. Besides its ecological significance in stabilisation of sand dunes, its roots are excavated for use as quality fuelwood. The overexploitation of this species for this purpose has drastically reduced its population and there is urgent need to collect its germplasm and rehabilitate various sites using superior genotypes. Its flowers are rich in proteins and are used as food by rural masses. The root extract has medicinal value and when mixed with catechu is used as gargle for sore gums.

Aloe vera (Gwarpatha) an important medicinal plant, is also used as vegetable. Its cultivation is gaining popularity in arid and semi-arid areas because of its commercial significance. Many of the shrubs mentioned above can be integrated into farming systems for enhancing productivity and imparting sustainability to the fragile system. Some of these and other shrubs and creepers like *Citrullus colocynthis* can be promoted on wastelands, sand dunes, etc. to meet both economic and ecological goals.

MEDICINAL PLANTS BASED ECO-BALANCED PRODUCTION SYSTEM FOR DRYLANDS

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Drylands include arid, semiarid arid sub-humid part of the geographical regions. These cover about 56% of agricultural areas and contribute 46% of primary production in the world. Main characteristics of dry land are (1) high variability in rainfall from year to year and distribution within a year and (2) rainfall dependent farming. It has been estimated that even after development of all irrigation potential 70-75% part (80 million ha) of drylands will remain rainfed.

In the drylands, mostly the single or mono-cropping of cereals like pear millet, sorghum, course millet, legumes like pigeon pea, groundnut etc. are taken as intercrop of cereals. This mono-cropping many a times fails or production remains below economic level due to rainfall variation. The dwindling conventional production system of dryland is likely to face more severity of climatic changes in future due to global warming/green house effect etc. Thus there is need to search and include some other drought resistant, efficient water utiliser plants, in the production system,to make it economical & ecologically viable. It has been observed that the native plants in a production system increase the sustainability of system.

There are some other prevailing conditions in dryland which support this direction of thinking.

1. A large part of drylands is lying as wasteland because of edaphic reasons (rocky-stony, saline land), biotic pressure of wild herbivorous animals, excess human activities for mining of minerals, etc. About 187 million ha land of our country is classified as wasteland and every year 2.5 m ha land is adding to this. Proper rehabilitation and development of productive system needs appropriate plants. Making wasteland productive of just like creating additional land.
2. Many a times farmer keeps one part of his land as fallow in rotation with the assumption of fertility restoration. During fallow period several natural plants come up on fallow land. Utilization of these plants or some other plants as substitute which can grow with least care on fallow land can help in increasing the value of fallow land. Improved use of fallow land is again making available additional land for production.

Thus if both the above types of land are put under cultivation with special management and suitable crops, it will on one side not affect the food production and on the other side it will greatly help in controlling desertification in such lands and help to eco-balanced the fragile systems.

The Eco-balanced system

The eco-balanced system means production system which is managed in such a way so that long term balance can be made between ecological and economical returns. Without ecological returns it will not be sustainable for long term and without economical returns it won't be acceptable to farmers, thus balance is needed.

Medicinal Plants: A viable option

For converting all the limitation into opportunities of edapho-climatic conditions in dryland and for making production system ecologically and economically sustainable, gradual and partial inclusion of medicinal plants in the existing mono-cropping can be a viable option having several desirable qualifications.

1. Medicinal plants are available in all possible forms of plants e.g. tree, climbers, shrubs, herbs, annuals, perennials, etc. Thus there may not be any problem for their spatial and temporal accommodation in existing cropping system. Besides, these will provide additional benefit of conservation.
2. To spread the risk of drought, agroforestry with multiple and multi-tier components is a traditional technology. Thus accommodating medicinal plants of different nature i.e. trees, shrubs, herbs etc. in the production system may not be entirely new concept for adoption in drylands. Out of total MP's in use, 24% are trees, 20% shrubs & woody climber and 66% are herbs.
3. During drought the most affected part of the crop is fruit while in medicinal plants, the other parts like leaf, root, etc are also economic product and less affected by drought and thus give some yield, unlike the crops which fail during drought.
4. In several medicinal plants the quality is better in adverse conditions as it is reported that the active ingredient of medicinal plants, mostly the alkaloids, is produced by plant as safety mechanisim during adverse edaphi-climatic condition like low soil fertility, water scarcity, very high or very low temperature, etc. and thus the quality in enhanced.
5. A major part of the region is currently wasteland (12 million ha) due to various land forms e.g. deep sand/sand dunes, gravely, rocky areas. There are suitable species like *Cassia angustifolia* (senna) in deep sand/sand dunes; *Commiphora wightii* on rocky/ gravely land; *Plantago ovata* and *Vinca rosea* in saline soils. Using wastelands for cultivation will not only increase the production of these plants but will also help halt desertification due to increased vegetative cover.
6. Ferilizer, pesticides and irrigation (FPI) are the prime requirement of high input agriculture (HIA) and after 4-5 decades of experience the HIA is not being observed a viable option for dryland as so many ill effects like secondary salinization, nitrate and pesticide residues, etc. are increasing. On the other side this limitation for HIA is the opportunity for medicinal plants which grow best in natural conditions.
7. As mentioned in previous point, due to edopho-climatic limitation, till now most part of dryland is comparatively free from the residue of FPI, and this is again a opportunity for organic farming of MPs where the conversion period for organic farming can be minimized.
8. In drylands farmers remain idle after rainy season for about 6-7 months and lands become orphan (no vegetation for 5-8 months). Inclusion of medicinal plants in production system can provide round the year work (field operations and processing of medicinal plants as cottage industry) and a vegetation cover to soil for protecting it from erosion.

All the above conditions favor and fulfill the principal aims of the organic farming i.e. conservation of biodiversity, no use of synthetic chemicals, maintaining nutrient cycling and socially and ecologically just system.

Natural or organic farming

Essentially be having conversion of natural resources e.g. land, water, flora and fauna etc., cyclic return of the nutrients in organic form taken from the system and no use of the synthetic fertilizer, pesticide, etc. Unlike the food grain, which are almost cultivated with FPI for quantity and the word organic farming cannot fit for them, in case of medicinal plants, whose quality is more important than quality, are primarily dependent on the nearness of their growing conditions to their natural habitats. Many a times they are being grown in the forest as natural farming. It is just like basmati rice from Dehradun or Coffee form Colambia where

flavor is more important than yield which is mainly due to edapho-climatic conditions. Thus the word natural or eco-farming is more appropriate for the medicinal plants.

Natural/Organic production of medicinal plants in the drylands

The plants which are used for medicinal purposes should not have any residue of fertilizer or pesticides - otherwise they become more of poison than a medicine. Moreover, the medicinal plants have several active ingredients (biochemical) and growing them with fertilizer, pesticides and irrigation may alter or deteriorate their quality. Thus, as far as possible, they have to be grown in near-to-nature condition so that both the quality of medicinal plants and the eco-balance can be maintained. For that there are two possible ways of production as described below with the success story of the arid land, climatically the most hostile part of the drylands.

In-Situ Production

Nature has immense potential for restoration of an ecosystem provided the conditions are favorable. Besides overexploitation, habitat destruction and deforestation are major human activities which are reducing the medicinal plant population drastically. The drylands ecosystem have been sustained since time immemorial and it is only the over exploitation of natural resources which makes the system unsustainable. In general, man-made restoration analogous to the nature is difficult and expensive as one would need to study the habitat and micro environmental requirements of each and every species for their cultivation. Given these problems *in situ* conservation projects have been started, in a watershed project near Jodhpur. The major emphasis was given to create environment so that the effect of severe biotic and abiotic stresses can be minimized and allow nature for restoration work. The area has been protected by stone wall fencing, soil and water conservation measures are in place and the participation of local people has been gained. The naturally regenerated plant population of *Commiphora wightii* has increased by 813.3 percent in 7 years. *C. wightii* is an endangered medicinal plant in the region, however, despite much research into macro/micro propogation, experiments in cultivation have not been comparable with the *in situ* conservation project. This has been proved cost effective also.

Ex-Situ Production

There are some medicinal plant which are required in large quantity e.g. psyllium, senna etc. and thus cultivation is necessary for meeting the demand. It will be better to grow medicinal plants with conservation of resources and organic based nutrient cycling management for soil fertility.

Senna in arid zone: an example of eco-balanced production

Senna (*Cassia angustifolia*) is a perennial herb (laxative properties) used in bulk in almost all the systems of medicine and also having export of Rs. 200 million/yr from India. The farming of senna in an eco-balanced way stated in the 1993 on the wastelands of arid zone (north-west Rajasthan). Presently senna is being growing in about 5500 ha area in natural farming in this region. The beautiful eco-balance of this crop with edopho-climatic and socio-economic environment is given in table 1. This is an example of exploring the opportunity. There may not be perfect eco-balance in a system but the approach should remain towards eco-balance, it will take time to reach at perfection.

Table 1: Complimentary relation of senna with sandy arid land

Sandy arid land	Senna
Low rainfall and bright sunshine in most part of the year	Best for good quality of Senna.
Application of fertilizer, pesticide and irrigation is highly risky and deleterious to soil health and disturbs this fragile ecosystem.	Grow well in rainfed conditions without fertilizer and pesticide, i.e. purely by organic farming.
Makes Risk in annual crops due to Frequency droughts	Perennial in nature, deep root system, thus least affected by drought.
Menace of wild animals like blue bull, rabbit etc and due to lack of protection it is difficult to make vast wasteland productive.	This crop is not liked by any wild animal, thus can be grown on wastelands.
Increasing area of cropping on marginal lands is causing desertification which is further accelerating by increasing use of tractor in such lands. Use of tractor is also reducing the natural regeneration of the highly useful plants like *prosopis cineraria, Zizyphus numularia, etc.*	Being Perennial it is sown once in 4-5 years, also least intercultural required after establishment. Thus both of these environmentally unsafe practices can be avoided.
High wind regime causes drifting of sand from sand dunes, which many a time, spoils the productive lands, obstructs rail and road traffic.	It's deep root system, quick establishment and perennial nature provide permanent green cover on sand and thus reduces the sand drift. In other world it could be one of the best plants for sand dune stabilization.
Farming community remains idle (unemployed) for about 7-8 months, after the rainy season	This crop can be harvested thrice in a year, value addition can also generate employment.
Economic stability due to drought is a major constraint for development of this region.	It is drought resistant, provides income round the year, heaving export value, thus helpful for economic stability.

A person who is engaged in killing creatures, polluting wells, gardens, tanks and ponds certainly goes to hell.

ROLE OF DECISION SUPPORT SYSTEM IN UNDERSTANDING DESERTIFICATION AND ENVIRONMENTAL ISSUES IN WESTERN RAJASTHAN.

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Studies on the basis of stratigraphic records, aerial photography and satellite remote sensing suggest that both fluvial and aeolian geomorphic processes are responsible in sculpturing the present day (Quaternary) desert landforms. The arid western Rajasthan, which also includes Thar Desert in India, has majority of area covered by sand dunes. Fluvial process is second to aeolian as deserts receive low, erratic and ill-distributed rainfall. The variation in rainfall distribution has significantly influenced formation of relatively a wetter region in the eastern part of Aravalli ranges and a drier extreme arid region in the west along the Indo-Pak border. Few aspects of desertification and emerging environmental problems in this region, mainly related to water erosion, water-use and its development. and discussed here. The discussion would highlight cause-effect relationship existing in human interferences-developmental activities and desertification problem. The focus is on the importance of Decision Support System in understanding and minimizing the effects of desertification in this region.

Water erosion

Water or run-off induced soil erosion is the most serious process of land degradation and desertification affecting 187.1 mha of the country's geographical area. In the Indian context, it results in loss of topsoil and terrain deformation (ravines, gullies, MOA-1985). The broad types of water erosion in this zone are given below.

Sheet erosion : The manifestation of sheet erosion is not prominent compared to rills and gullies, but has significant impact on the soil forming processes. The magnitude of sheet erosion and its impact on the alluvial plains are best understood in region having a relatively flat plain topography. Such a situation is occurring in a belt in Jodhpur-Soila-Khimsar-Nagaur region. The eastern part of such region is armed with rocky/gravelly pediment surfaces. During rains, run-offs generated on these plains cause major sheet wash and soil loss. Such processes have turned many fertile croplands to shallow unproductive lands in this region.

Table -1

Types of water erosion	Predominant area
Sheet and rill erosion	Jodhpur-Soila-Khimsar-Nagaur, Nimod-Dariba-Sewali (Sikar), Ramsin-Gajepura-Bhinmal (Jalor)
Gully erosion	Eastern and western slopes of aravalli hills in Udaipur-Desuri-Kumbhalgarh, Ras-Rabriyawas-Katmore (Pali), Badgaon-Bhadrajan-Parvi (Jalor)
Stream channel/bank cut erosion	Along the major streams (Jawai, Sukri, Sagi near Deta, Akoli in Jalor and Bandi in Pali and Guhiya in Jodhpur district.

Rill and gully erosion in the foothills of Aravallis: Soil erosion through accelerated rills/gullies development occurs along the eastern margin of Thar in Rajasthan where the average rainfall varies from 350-500mm. Our studies in the eastern margin of Aravallis shows that fluvial processes, acting on stable aeolian forms, have formed few drainage networks in the form of rills to wide gullies in the south of Ras, Nimbeti (Pali) and Jaswantpura-Raniwara in Jalor district. The depth of incision is generally more where the exposed rock forms are sloppy and obstructed or having a sand cover. At several places (Katmor-Rabriyawas-Balipura and Khariyaniv-Mev region in Pali district, Badgaon-Bhadrajan in Jalor, flat alluvial plains have been deformed due to gully developement. In the Aravalli hill ranges, along the eastern margin of the Thar, the hill slopes are being regularly denuded of natural vegetation cover for fuel, fodder. Consequently, the soils are being washed out by rill and gully erosion that in many areas there is hardly any soil left to start a re-plantation programme.

Fluvial processes and Floods: Flood in deserts are dangerous and sometimes cause more damage in comparison to more rainfall regions. The manifestations are in the form of stream bank cut erosions, sediment erosion and depositions in the channel bed and on fertile alluvial plains. The coarse sandy and gravelly sediments under the process of mass movement have turned many lands unproductive with rock fragments (Flash floods in 1979, and also in 1990 in Jodhpur and Nagaur region). The degradation caused in the process, despite government efforts and policy, may have been repaired to some extent but it would take thousands of years to bring back its productivity.

Water use, development and desertification

Despite climatic limitations, Indian arid zone remains one of the most densely populated regions of the world but like other arid regions, it is water scarce. In order to make a living under harsh environmental conditions, development of irrigation has been considered the most potent means. Of late, the water scenario of the region has prospered through diversion of water through canals from the rivers of the adjoining humid zone (the Gang-1927, the Bhakra-1954, and the Indira Gandhi Nahar-1961), construction of the embankments for surface water storage (Jaswant sagar, Sardar samand, Jawai, Hemawas, Kailana) and water conservation in nadis, tanka and khadins.

Nearly 1 % area of NW of arid zone of Rajasthan is occupied by canal network helping in the irrigation activities. In the remaining part of the arid region, saline /brackish water is the only source of irrigation.

Water logging: Vast areas in the northern most part of the state (South & SE of Suratgarh between Tilonian, Kishanpura, Bhojuwala (Ganganagar) and Manakhteri-Baropal- Jakhranwali (Hanumangarh) have the problems of water logging because of sub-surface hydrological barrier. Similarly, such problems due to seepage of canal water and profuse irrigation in the valley of Saraswati with gypsum sub-surface have been noticed at Dabli, Ranjitpura, Masitawali and Bashir in Hanumangarh district.

Initially (1968) the problem of water logging was noticed in 907 ha area between Baropal and Mankhetri. By 1993-94, nearly 10680 ha area was affected in both stage-I & II under IGNP and by 2001, the total affected area has reached 13041 ha.

Salinity: The situation of waterlogged and salt affected soils is perhaps, the serious problem of western Rajasthan, arising due to large-scale introduction of irrigation to un-irrigated area without provision of adequate drainage. Once the groundwater is within 2m of the soil surface, the soluble salt move upward due to capillary rise and aided by high evaporation cause salt accumulation and soil salinity. Major problems of such kind are now frequent in canal irrigated area or major irrigation project command area like IGNP where a rise of water table @ 0.7-1.1m was reported in Stage-I and the condition is said to be more alarming in Stage-II.

Similarly canal irrigation through small reservoirs constructed in the southeastern part of the western Rajasthan across the ephemeral streams (Sardar samand reservoir at the confluence of Guhiya and Sukri), Jaswantsagar on Luni River, has developed problems of salinity. Vast areas near Chaupra and Sardar samand reservoir have turned saline causing degradation of croplands and grazing lands.

Brackish water irrigation: Use of brackish ground water in the cropfieds has created problems of sodicity and severe degradation of croplands in Pali (Raniwal-Ramawas in Jaitaran tehsil) and Churu (Hamirawas in Rajgarh tehsil) district. The surface is manifested with surface crusts, hardness, patchy distribution of grasses and scrubs and difficult to plough on drying and puddle on wetting. Soil characteristics of the profile indicate low

concentration of salts but high pH values (8.7-10) indicating severe sodicity. The problem is due to irrigation by saline-sodic ground water.

Textile effluents and land degradation: Dyeing and printing of textile being a traditional industry of Rajasthan and due to the heavy demand in the country, a good number of textile industries have come up along the riverbanks of Jojri (Jodhpur), Luni (Barmer) and the Bandi (Pali). As per CPCB, 1993, there were 383 industrial units in Jodhpur city with water demand of 7.975 million liters per day has now increased to 15 million due to increase (35 percent) of industries within 1984-85 to 1995. Problem is more acute in Pali and Balotra area where more than 23 % and 31% area have been very severely affected because of wastewater discharge from 767 and 399 textile units respectively.

As per CAZRI-1997 report, the ground water along these rivers up to a distance of 1 to 1.5km is highly polluted due to seepage from irrigated fields and stagnated polluted water. Few farmers are using the effluent water directly for irrigation as noticed in Sangariya village in Jodhpur. Such practices have yielded mixed response, a good yield in the beginning and subsequent lower yield as well as complete land degradation in the years to come.

Use of Decision Support System

The need for framing a DSS (Decision Support System) for Desertification related studies (processes, factors and consequences) lies in the fact that understanding of desertification problem is related to involvement of both human and physical dimensions. As per Nairobi seminar on Desertification, 1977, "desertification" arises from the fragility of dry land ecosystems, which under excessive pressure of human use lose productivity and the ability to recover. It accepts the fact that desertification can develop from natural causes alone but it is likely to have interaction with human use systems, in arid, semi-arid and sub-humid lands. The United Nations Committee on Combating Desertification has also emphasized the role of human factor in its definition which states desertification is land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variation and human activities (UNCED, 1992).

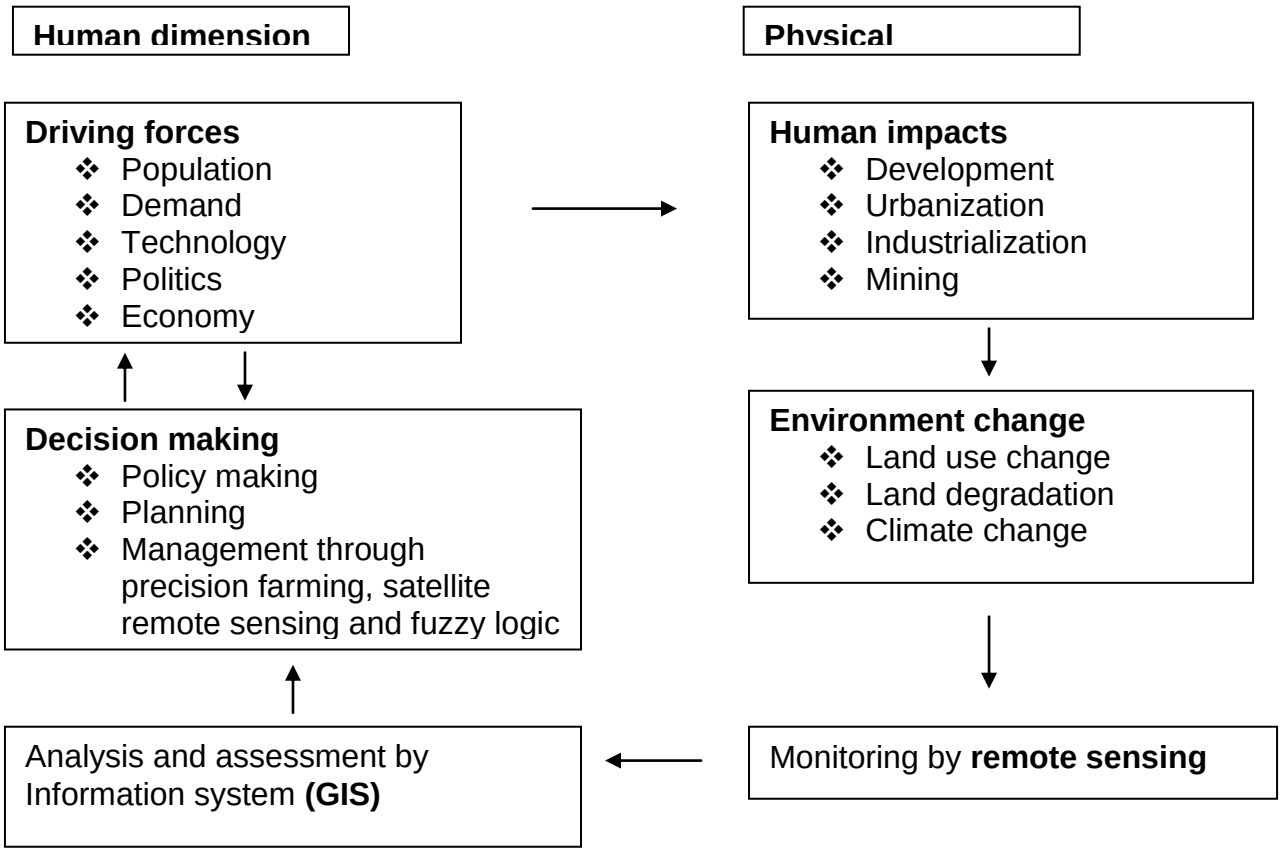
Components of decision-making

Majority of Decision Support Systems (DSS) deal with two components: physical and human in solving complex environmental problems. In the following table (Table 2), a model of such relationship has been depicted to show how driving forces give rise to human targets, which in turn exert pressure and cause impacts. For example to sustain a growing population, a region needs development, which can be defined in terms of improved level of living (urbanization), through industrialization, activities like mining apart from agricultural development. All these cater to both basic needs of the people as well as developmental activities based on demand, economic target and technological interventions. Such endeavors are likely to exert pressure on the environment because of change in landuse, land degradation and in general the climate change. Since all these become part of our living, the management of each element of the system needs formulation of criteria for decision-making. Remote sensing helps in the monitoring of both spatial and temporal changes occurring due to developmental activities as mentioned above. Use of information system (GIS) would contribute to analyze and assess a good number of criteria in a single environment as well as development of a database for future updating. Such information/database would help and support the policy managers and decision makers in developmental planning.

Use of information technology is increasingly being used to help managers make better decisions. Some of the recent uses involved with DSS concept are 1) precision farming, 2) satellite/remote sensing, 3) fuzzy logic and farming system models-artificial intelligence.

While precision farming is an activity model others help in the quick and precise decisions.

Table-2 Decision Support System



Precision farming

Precision agriculture is an activity particularly true in North America, Europe and Australia in Site Specific Crop Management (SSCM), which has advantage of lost cost but accurate global positioning systems (GPS). The promise of this technology is exciting as it can enhance profitability by boosting yields and/or reducing the amount of inputs. Thus it minimizes the negative environmental effects. But for India, it is yet to be effectively launched due to cost of site-specific data relative to returns from using the data.

Satellite /remote sensing

With the advent of satellite technology and remote sensing, the decision makers have the advantage of access to both spatial and temporal data. Some agricultural producers are starting to make use of such data to identify problems related to growing crops, land degradation and able to corelate the problems of low yield to causes. In the field level, where the landowners are decision makers, are able to take corrective measures to minimize the damage. India being one of the leading pioneers in this technology, large-scale satellite data is being generated to provide solution on field as well as on regional level.

Fuzzy logic

Till now, it was assumed that real world phenomena can be modeled either by exactly defined or delineated entities like polygons or by smooth continuous fields. But there lies uncertainty in certain fields. For example, while mapping desertification status mapping, we have come across situations where single land has been affected by water erosion, salinity and vegetation degradation. In this case there are overlapping boundaries, which defines uncertainty for decision makers. With the

concepts like fuzzy logic, the interpreter is permitted to partially using models and logic to create fuzzy set surfaces. This will help in the identification of location of “confusion”.

Farming system models and Artificial Intelligence

Though database and modelbase remain separate entitities in farming system, they should be bridged by some database management system. For arid ecosystem, decision is required very often on the issues of crop combinations, crop rotation for maximization of yields as well as sustainability. The farmer has to take decision not only for crops but also for trees, plants, grasses etc and using models like silvia-pasture, horti-pasture and agro-forestry. Also, there has to be system, which would provide a kind of balance between crops, seeds and livestock. Concept of artificial intelligence is now in practice to help the decision makers in recommending fertilizer types, amounts, varieties, identifying pests and suggesting control measures on the basis of specific problem.

Conclusion

The study highlights various desertification processes in western Rajasthan. The role of a Decision Support System is now crucial looking at the gamut of problems arising out of natural and human impacts. Though ITK (traditional knowledge) has advantages, for a growing population, few more recent approaches (as discussed) are available to support quick discussion. We have discussed water erosion and water related problems of the region to emphasize on the human interference and desertification issues. Infrastructures are key to regional development, but the present day activities, as described above, can disrupt the social –cultural systems that support a particular human use system. Besides science, there are rules to overcome and have some control on the mis-use of precious natural resources. In the 21st century, we have the technology and system to exhibit considerable coping ability; like we did during drought-2002, but continuous accelerating pressure may cause a suffocating environment for our next generation. Droughts do not always lead to desertification but its frequency activates land degradation processes. Since, things are happening far and wide therefore, quick and site specific information is required in the form of Decision Support System for sustenance of both physical and biological world.

MOBILIZING MINDS

UNESCO's Envionment and Sustainable Development Activities

The 1992 Earth summit (UNCED) in Rio de Janeiro advocated the integration of enhanced socio-economic development with conserving a healthy environment.Development must become sustainable to ensure that it meets the needs of the present generation without jeopardizing the ability of future generations to meet their own. Agenda 21 provides the international programme of action for taking this new course of sustainable development. It requires a change in national policies and a redefination of priorities in international cooperation, including the implementation of recent international conventions.

The first prerequisite of sustainable development is education for all, followed by the advancement, sharing and application of scientific knowledge. Only an informed public and a trained workforce can introduce the new sustainable production and consumption patterns required.

Environment and development issues are by definition complex and multidisciplinary and require responses built on similar lines. UNESCO's unique broad mandate and expertise in the sciences, education, culture and communication, enable the organization to respond to the requirements of sustainable development, to enhance interdisciplinary scientific work and to increase cooperation between all areas of its competence.

UNESCO has been focusing on environment and development issues for the past 50 years. Since the earth Summit, UNESCO has reoriented its programmes and priorities further to address and promote sustainable development . This publication summarizes those programmes and priorities in the sciences and education which make the most significant contribution by UNESCO to sustainable development.

(Source: **UNESCO 2003 p.1**)

BIRDS OF CENTRAL ARID ZONE RESEARCH INSTITUTE, (CAZRI) CAMPUS JODHPUR, INDIA

Mohd. Idris

Central arid Zone Research Institute, Jodhpur-342003

Central Arid Zone Research Institute, (CAZRI) when established about four decades ago was couple of kilometers away from the heart of the town, Jodhpur ($26^0$18'N, $73^0$08'E) (Fig. 1). However, now it is in the midst of the city, Jodhpur. Jodhpur is situated at the fringe of the Great Indian Desert (Thar), was established by Rao Jodha in the 1459 as state of Marwar. Central Research Farm (CR Farm) of CAZRI is having 283.48 ha. of land. This area has been distributed in scrub grassland, forest type, agriculture land and some of its area covered with residential and official buildings. Most common trees in the campus are Neem (*Azadirachta indica)* Khejri *(Prosopis cineraria) P. juliflora*; Babul, (*Acacia nilotica)* Israel babul, (*A. tortilis)* Ber, (*Zizyphus nummularia), (Z. mauritiana)* Siris, (*Albizia lebbek)* Sisoo*, (Dalbergia sissoo)* Amla *(Emblica officinalis)* Hingota (*Balanites aegaptiaca)* Rohira *(Tecomella undulata)* Peepal (*Ficus religiosa)* Arjun *(Hardwickia binanta)* Jungle jalebi (*Pithecellobium dulce)* Goondi (*Cordia rathi)*; Kassod tree (*Cassia siamea)* and *Eucalyptus* spp. etc. Shrub species namely, *Bougainvillia* sps. *Punica granatum*, *Nerium indicum*, *Delonix regia* and *Clophospermum mopane* are commonly present in the CR Farm. Under "Water Harvesting Technology Project", water reservoirs were constructed in the area for collecting rainwater. These reservoirs are being used for watering nurseries and horticultural crops. Fishes (mirror carps) were also released to see the growth of the fishes in confined area of the pond. It was just to explore the possibilities of other resources of income generation for farmers in the lean period of 6-9 month when there were no crops in the fields. An open drainage of filthy water containing cow dung and other waste material is also flowing in the western side of the CR farm along with boundary wall.

The climate of this region is “hot desert” type. It is characterized by great extremes of minimum and maximum temperatures ranging from 3.4 to 10^0C in winter and 40 to 45 ^{o} C in summers. The highest maximum temperature has been recorded up to 50^0C. The average annual relative humidity of air varies from 26 to 66 %. Most of the rainfall occurs during Monsoon season i.e. July to September. The average annual rainfall is ranging from 80-425mm.

METHODOLOGY

An avifaunal survey was conducted in the fenced area of the CAZRI, campus, Jodhpur on monthly basis. During the study period from January 2000 to December 2002, Gaston’s (1973) methods were followed to record the observations. All observations were made using a pair of 8x40 binocular. Birds were identified by using standard guide books (Ali, 1981; Ali and Futehally, 1967; Ali and Ripley, 1983, 1987 and Wood Cock 1980). Classification was carried out according to Ali and Ripley (1983).

RESULTS AND DISCUSSION

A total of 57 species of birds belonging to 32 families were recorded during study period. Of the total recorded, 71.9 % were common 22.8% rare and 5.3% were occasional visitor in occurrence. The highest species representation was observed in the order Passeriformes with 22 species belonging to 13 families followed by Falconiformes with 6 species belonging to single family i.e. Accipitridae. Out of 57 species 29 species (50.8%) were resident breeder while 24 species (42.1%) local migrants, 2 species (3.5%) resident and two species were winter migrants.

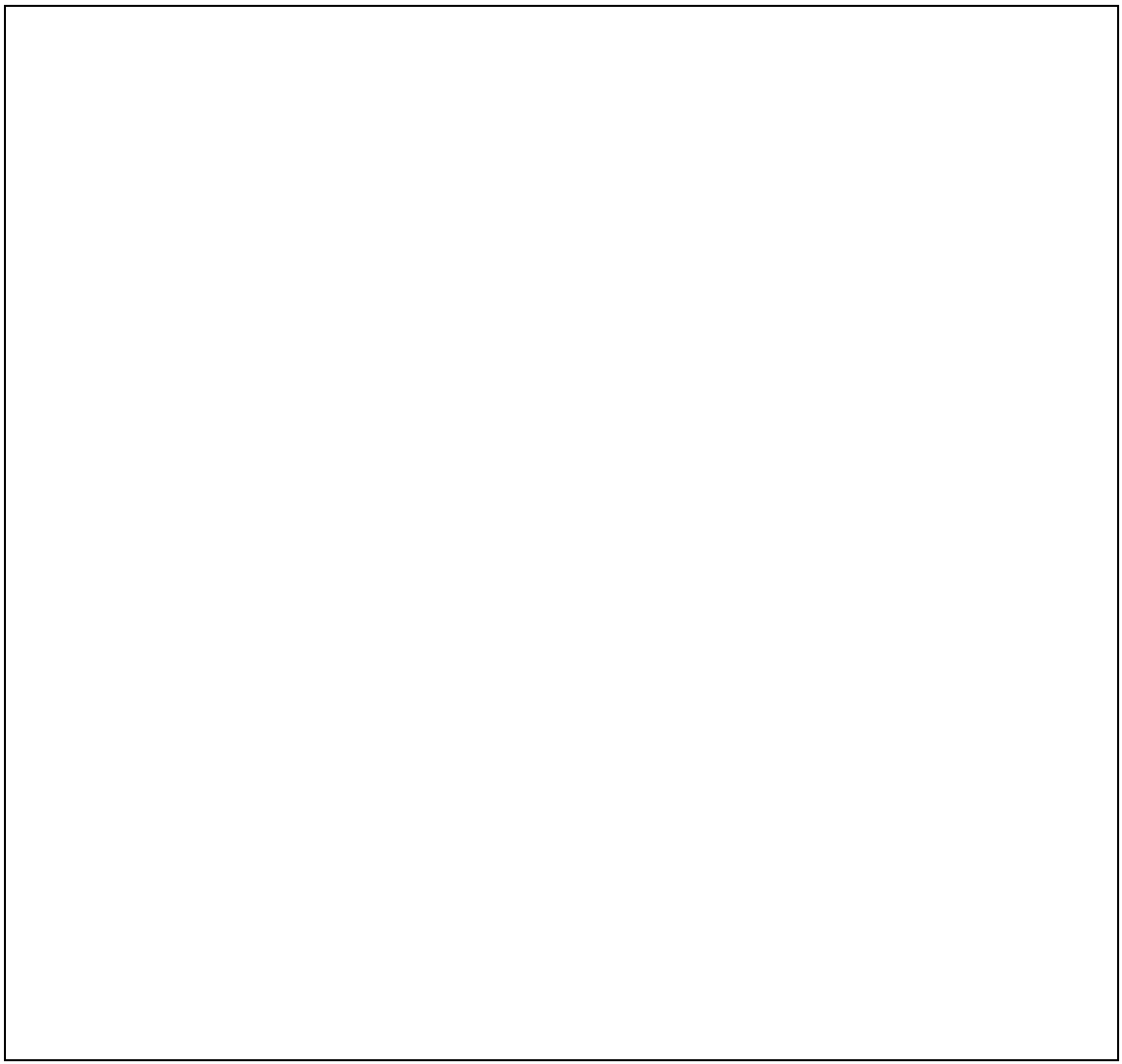


Fig.1

Brood parasitism was also observed in house crow (*Corvus splendens*) and common babbler (*Turdoides caudatus*) by koel (*Eudynamys scolopacea*) and common hawk cuckoo or Brain fever bird (*Cuculus variaus*) respectively. The breeding of these birds was observed in the month of July to November.

Indian great horned owl (*Bubo bubo*) was observed early in the morning (8.10.2001) only once on the semi-dried tree of *Prosopis cineraria*. A group of 4-5 Indian long billed vultures (*Gyps indicus*) was residing on the near by hill. Now, their number as reduced drastically. Likewise, white or scavenger

vulture, (*Neophron percnopterus*) is also having same status as *G. indicus*. It is "Need" to protect these scavengers.

As CAZRI is an agriculture based institution, arid crops like millets and pulses, are being commonly grown here. Fruit orchards of Ber, pome granate and date-palm are also present in the area. Because of their feeding habits either as predators of insects or as crop pests, birds play a very important role in agriculture. Out of 57 species only 10-12 species are regarded as crop pests. On an average daily food intake of the seedivorous birds is 10% of their body weight. Among vegetarian birds, parakeets are considered as true pest of agriculture all over country however, sparrows, bulbuls, pigeons, doves, pea fowls, crows, mynas etc. can also be grouped as agricultural pests.

Previous studies on bird fauna of around Jodhpur by Agoramoorthy and Mohnot (1989) revealed occurrence of 102 species representing 39 families. Bohra and Rana (1994) recorded 81 species of birds belonging to 37 families from Machia Safari Desert Park (MSDP), Jodhpur. Another bird watching survey was conducted near the Chopasni lake, 8 km away from North West side of Jodhpur by Singh and Idris (1996), recorded 50 species of birds belonging 29 families. The present study area, CAZRI campus, Jodhpur, despite of its relatively small size, appears to support an extremely rich and diverse bird community. If one considers the total number of resident species of birds (102) around Jodhpur, the observed number of species in CAZRI campus (57) represents 56.6%. The bird diversity in this confined area is largely due to availability of varied habitats viz., forest, fruit orhards, shrubs, grasslands and crop fields. The birds associated with large water bodies have not been observed except one belongs to family phalacrocoracidae i.e. *Anhinga rufa* and two birds of family ardeidae namely *Ardeola grayii* and *Bubulcus ibis*.

ACKNOWLEDGEMENTS

Author is grateful to Dr. Pratap Naraian, Director, Central Arid Zone Research Institute, Jodhpur for valuable suggestions and providing necessary facilities. I am also thankful to Dr. B.D. Rana Ex-Project Coordinator for his kind cooperation and Dr. H.C. Bohra, Principal Scientist for encouragement and guidance during the study period.

Table 1. Checklist of birds of CAZRI, Campus, Jodhpur (India) Year 2000-2002.

Order/Family/Species	Abundance	Status
ORDER- PELECANIFORMES		
Family-Phalacrocoracidae		
Darter or Snake bird (29)*, *Anhinga rufa*	R	LM
ORDER-CICONIFORMES		
Family-Ardeidae		`
Paddy bird or pond heron (42), *Ardeola grayii*	C	LM
Cattle erget (44), *Bubulcus ibis*	C	LM
ORDER- FALCONIFORMES		
F***amily***-Accipitridae		
Common Pariah kite (133), *Milvus migrans govinda*	C	Res/B
Brahminy kite (135) *Haliastur indus*	R	LM
The shikra (139), *Accipiter badius*	C	Res/B
Indian long billed vulture (182), *Gypus indicus*	R	LM

White or scavanger vulture (186), *Neophron percnopterus*	R	LM
Pale Harrier (190), *Circus macrourus*	R	LM
ORDER-GALLIFORMES		
Family- Phasianidae		
Grey patridge (246), *Francolinus pondicerianus*	C	Res/B
Common grey quail (250), *Coturnix coturnix*	C	Res/B
Common Pea fowl (311), *Pavo cristatus*	C	Res/B
ORDER- GRUIFORMES		
Family-Charadriidae		
Redwattled lapwing (366), *Vanellus indicus*	C	Res/B
Family-Burhinidae		
Stone curlew (436), *Burhinus* oedicnemus	C	Res/B
Family- Recuvirostridae		
Black winged stilt (430), *Himantopus himantopus*	R	LM
Family- Laridae		
River turn (462), *Sterna aurantia*	R	LM
ORDER- COLUMBIFORMES		
Family-Columbidae		
Blue rock pigeon (516), *Columba livia*	C	Res/B
Indian ring dove (534), *Streptopelia decaocto*	C	Res/B
Red turtle dove (535), *Streptopelia tranquebarica*	C	Res/B
Little brown Senegal dove (541) , S.*senegalensis*	C	Res/B
ORDER-PSITTACIFORMES		
Family-Psittacidae		
Rose ringed parakeet (550),*Psittacula krameri*	C	Res/B
ORDER-CUCULIFORMES		
Family-Cuculidae		
Pied crested cuckoo (571), *Clamator jacobinus*	R	LM
Common hawk cuckoo or Brain fever bird (573),*Cuculus varius*	C	Res/B
Koel (590), *Eudynamys scolopacea*	C	Res/B
Crow pheasant (600),*Centropus sinensis*	C	Res /B
ORDER-STRIGIFORMES		
Family-Strigidae		
Indian great horned owl (627), *Bubo bubo*	O	LM
Spotted owlet (652), *Athene brama*	C	Res/B
ORDER- APODIFORMES		
Family-Apodidae		
House swift (703), *Apus affinis*	C	Res/B
ORDER- CORACIFORMES		
Family- Alcedinidae		
Pied king fisher (719), *Ceryle rudis*	R	LM
Common king fisher (722),*Alcedo atthis*	R	LM
Family- Meropidae		

Small green bee eater (750),*Merops orientalis*	C	res/B
Family-Coraciidae		
Indian roller (755), *Coracias benghalensis*	R	WM
Family- Upupidae		
Hoopoe (763), *Upupa epops*	C	LM
ORDER-PICIFORMES		
Family-Capitonidae		
Crimson- breasted barbet (792), *Megalaima haemacephala*	C	LM
Family-Picidae		
Yellow fronted pied wood pecker (847), *Dendrocopos mahrattensis*	C	Res/B
ORDER-PASSERIFORMES		
Family-Alaudidae		
Ashy crowned finch lark (878), *Eremopterix grisea*	C	Res/B
Family-Laniidae		
Grey shrike (933), *Lanius excubitor*	O	LM
Rufous backed shrike (946), *L. schach*	O	LM
Family-Dicruridae		
Black drongo (963), *Dicrurus adsimilis*	C	Res/B
Family-Sturnidae		
Common myna (1006), *Acridotheres tristis*	C	LM
Bank myna (1009), *A. ginginianus*	C	LM
Brahminy myna (994), *Sturnus pagodarum*	C	Res/B
Family- Oriolidae		
Golden oriole (952), *Oriolus oriolus*	R	LM
Family- Corvidae		
House crow (1049), *Corvus splendens*	C	LM
Jungle crow (1054), *C. macrorhynchos*	C	LM
Family-Campephagidae		
Common wood shrike (1070), *Tephrodornis pondicerianus*	C	Res
Family – Pycnonotidae		
White checked bulbul (1125), *Pycnonotus leucogenys*	C	Res/B
Red vented bulbul (1128), *P. cafer*	C	Res/B
Family- Muscicapidae		
Common babbler (1254), *Turdoides caudatus*	C	Res/B
Tailor bird (1538), *Orthotomus sutorius*	C	Res/B
Indian robin (1720),*Saxicoloides fulicata*	C	Res/B
Family-Sylviinae		
Desert warbler (1571), *Sylvia nana*	C	Res
Family-Motacillidae		
Pied or white wagtail (1885) , *Motacilla alba*	R	WM
Family- Nectariniidae		
Purple sunbird (1917), *Nectarinia asiatca*	C	Res/B
Family-Ploceidae		
House sparrow (1938), *Passer domesticus*	C	Res/B
Weaver bird (1957), *Ploceus philippinus*	C	LM
White throated munia (1966),*Lonchura malabarica*	C	LM

C-Common; LM-Local migration; Res/B-Resident breeder; R-Resident,
WM-Winter migration; O- Occasional.
* Number within the brackets after the common names are the numbers given by Ali and Ripley (1987)

INFORMATION NETWORKING FOR GHANA'S AGRICULTURE RESEARCH AND DEVELOPMENT

Joel Sam
Ghana Agricultural Information Network System, Ghana

The Ghana Agricultural Information Network System(GAINS) was established in 1992 as part of the National Agriculture Research Project(NARP). Its aim is to facilitate the dissemination of agricultural information to policy and decision makers, research scientists, planners, lecturers, students, extension workers, and farmers. GAINS links the libraries of all the main stakeholders in agricultural information provision in Ghana

Importance of Information networking

Library and Information systems in the agricultural sector in Ghana used to operate independently of each other resulting in an uneven development and duplication. There was therefore the need to establish a networking system with the view to:

- Reduce duplication of research activities-know what each other is doing
- Share information on research activities and findings
- Reduce costs
- Learn information management skills
- Bring together scattered agricultural research information
- Make a greater impact on research efforts
- Ensure even development of agricultural information infrastructure
- Make available and easily accessible current information
- Improve the planning, design and execution of research, including the diffusion of research results.

Approaches to networking

A number of approaches to networking were adopted.It was agreed that there should be a phased approach in which activities to be undertaken in each phase would be clearly defined and discussed with the partners.

One basic principle agreed on was collaboration to facilitate resource sharing, minimize unnecessary duplication of resources, and to increase comprehensiveness in literature resources. A central focus for agricultural information was therefore adopted with a coordinating Centre seen by all the partners as playing a leading role in the implementation of the network. In addition, agricultural information services should be perceived and provided in a holistic manner to ensure even development. A Technical Management Committee was set up from participating institutions to draw up detailed plans for staffing, equipping, stocking and services.

Futhermore, agricultural librarians needed to collaborate in identification of key literature resources,developing physical structures, and in user surveys. It must be stressed that the process of consultation and consensus building was used a lot during the formative stages of the network. It was undertaken at various levels(top management and middle management as well as the information personnel level) where roles, responsibilities, and benefits-both individual and collective-were discussed and common strategies adopted. This approach was preferred to imposing guidelines from a central point.

Results of networking

Though people generally appreciate the positive impact of networking, they sometimes also think that by coming together they are being asked to do more work than before. Thus the issue of what benefits they will derive(individually and institutionally) was taken seriously.

The results of agricultural information networking in Ghana over the past ten years have been tremendous.From the institutional point of view, the main benefit was the development of a functional

network that coordinated all the fragmented agricultural information resources and made them easily available and accessible to the partners. This reduced considerably the time required to search for information and to know which institute has what information.Futhermore, the resources of the various information centres,which previously were not available to outside users, could be accessed through the network.

In addition, the GAINS coordinating Center was built and other libraries were rehabilitated or extended. Basic items of equipment such as computers, copiers, air conditioners, and phones were supplied at the inception of the network. Each participating institute was allocated 4-5 specialist journals yearly and thirty-five books. CD-ROM facilities were installed at five sites.

A computerized database was also developed. This indexes Ghana's agricultural research from the colonial period to the present and contains largely unpublished literature such as research reports, annual reports, consultancy reports and dissertations. It was the first database to bring together the fragmented and scattered agricultural research literature in Ghana.

Information personnel benefited immensely from local and overseas training programmes. Nine local training programmes were also organized for information personnel to update their knowledge in areas like information marketing,CDS/ISIS, and information retrieval. Training was also provided to personnel in participating research institutions to help them keep abreast of new trends in information management. Frequent face-to-face interactions fostered unity and cooperation among the partners.

Lessons and Challenges

In implementing the GAINS project over the past ten years, lessons learned include:

- Commitment of partners is vital. Without this,the modest successes would not have been possible.
- Ownership of the process has been very important since no partner has felt alienated.
- Roles and responsibilities of partners needed to be clearly defined from the onset.
- Differences in opinion have been resolved in a transparent and timely manner.
- Benefits of networking needed to be made apparent to all partners.
- Respect for and appreciation of each other's contributions is very crucial.
- Involvement and commitment of top management contributed to the achievements.
- A champion to drive the process is essential.It was emphasized that the library was not for the librarians and there was the need for the users to drive the process.
- Resources to be shared should be clear to all partners.
- All should adhere to deadlines,In spite of the progress made, current challenges include:
- Lack of qualified personnel and high staff turnover in some partner institutes. This means there is a recurring problem of lack of in-depth knowledge and skills in information technology in some institutes. Even in situations where there was no staff turnover, the frequent changes of staff representing an institute on GAINS matters did not bring about consistency and continuity of work.
- Lack of incentives for the staff of partner institutes hampers project activities, as they are not motivated enough to carry out project activities, which some of them view as an additional assignment.
- Inadequate logistical support continues to be a drawback in some partner institutions.The main problems are access to the literature and lack of computers.
- There is an uneven development of basic infrastructure in the partner institutes.Those with good management support have a relatively better-developed basic infrastrusture than in the others.
- Late reporting, different formats or no reporting of project activities delays the

quarterly reports.Reports submitted in most cases do not follow the reporting format agreed on.

- Lack of Library budget for some partner institutes has contributed in no small measure to the uneven development of the network. The tendency has been to depend on the Coordinating Centre for continous supply of basic equipment.

Conclusion

Networking of the agricultural information system has enhanced the landscape of agriculture infrastructure and research activities in Ghana.It has led to a steady growth and improvement in agriculture information delivery and skilled personnel. For the system to have a long-term sustainability, the partner need to show more committment and to be better resourced by their parent organizations. The partners should also come to realize that the network is their own creation and it is in their own interest to be part of it.

More Information from:

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GAINS:<www.gains.org.gh>
(**Source: INASP Newsletter No. 24 Nov. 2003**)

CGIAR CONSORTIUM TAKES SHAPE

Monica Allmand

Librarians and information managers working in the Consultative Group for International Agricultural Research recently established the CGAIR Libraries and Information Services Consortium (CGIARLISC).Driven by constantly changing information needs of end users,advances in information and communication technologies, and limited financial and human resources, consortium members committed themselves to:

- Share resources and knowledge, such as joint journal subscriptions,document delivery services, content,expertise, technologies, and processes.
- Facilitate access to information held at all the CGIAR Centres.
- Contribute to the dissemination of CGIAR research output.
- Jointly develop and execute projects within the CGIAR and in collaboration with other institutions and partners.
- Exchange best practices in knowledge and information management.

So far, the group has:

- Developed and maintained a CGIAR library portal providing access to all CGIAR library resources.
- Set up and maintained a union catalogue of serial holdings of the various CGIAR centre libraries.
- Negotiated discounted joint subscriptions to journals and databases such as science Online and eCAB.
- Agreed to work with a common journal aggregator for all centres(Swets Blackwell).
- Collaborated with other organization like FAO and INASP in promoting free access to electronic documents.
- Purchased a document delivery software-Ariel-which legalizes inter-library loans and hastens electronic document delivery across the centres.

Overall, the benefits realized through the consortium include stronger buying power, access to collective technical expertise, greater resource sharing (digital and traditional media), enhanced staff development, risk sharing, and oint grant-seeking and lobbying.
More information from:
Monica Allmand
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(**Source: INASP Newsletter No. 24 Nov. 2003**)

PEARL MILLET DISEASES DURING SEVERE DROUGHT

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Severe water stress weakens the immune system, opening the door for a variety of ailments that an otherwise healthy plant could overcome. During the drought in 2002, rainfall from June-August in western parts of Rajasthan drastically deviated (–74.61%) from the normal. At most of places July remained either free from rains or rained in traces. Besides scanty rainfall, the region also faced intolerably high temperatures. Maximum daily temperatures varied between 40-45^{o}C whereas minimum ranged from 20-33^{o}C. Recent report of the crop weather watch group has pointed out that July rainfall of southwest monsoon was the worst in hundred years (Anonymous, 2002). This has created problem of raising crop and generated fear for the availability of food and fodder. The situation of the farmers became so miserable that they could not even sow the seed at many a places. Even the sown seeds betrayed the growers in the absence of rainfall and high temperatures. Nevertheless, some farmers having irrigation facilities had, somehow, saved the crop by providing 5-7 irrigations at some of the places.

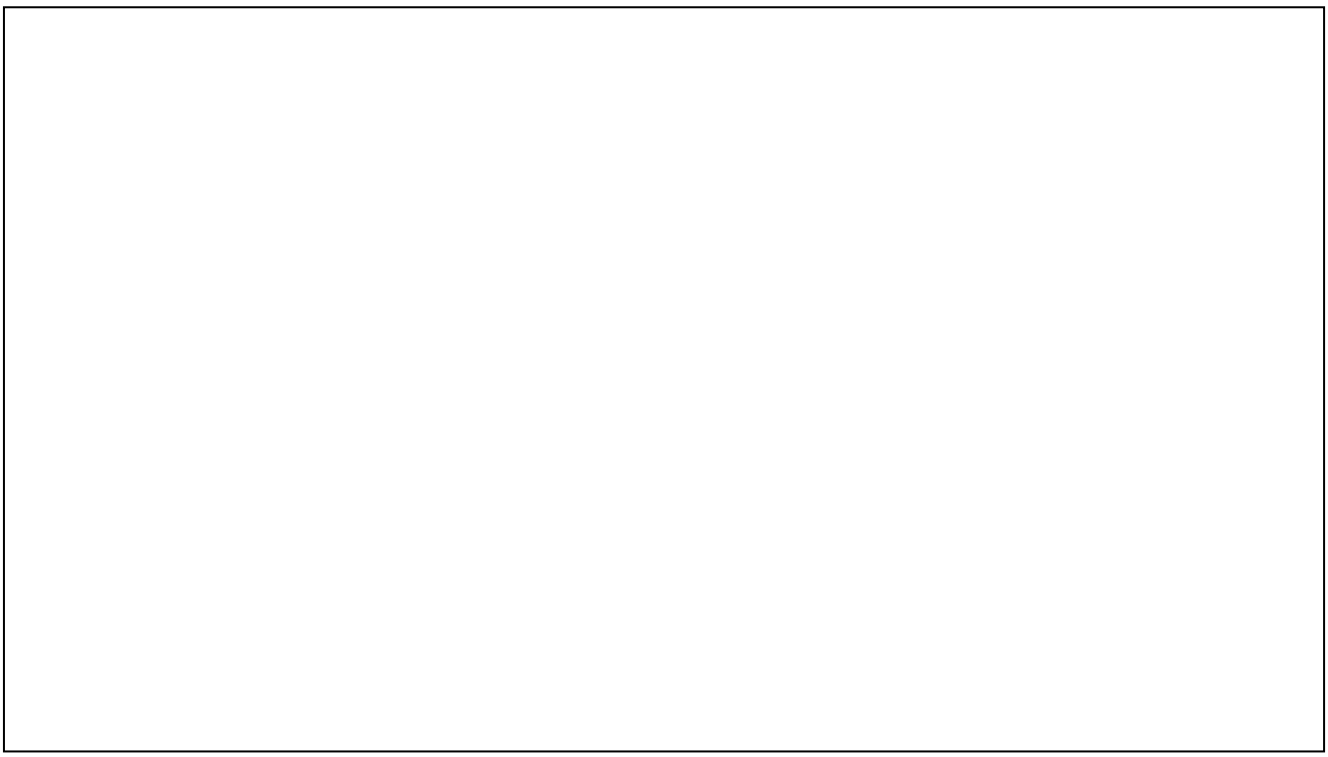
Food economy of Rajasthan depends on rainfed crops, and pearl millet is a staple food of the rural people and fodder for livestock. Major diseases occurring in the rain-fed areas are downy mildew (DM: *Sclerospora graminicola*), smut (*Tolyposporium penicillariae*), ergot (*Claviceps fusiformis*), rust (*Puccinia penniseti*) and leaf blast (*Pyricularia penniseti*) (Arya and Kumar, 1976). Constantly changing environmental conditions, the genetic constituent of cultivars and development of variability among pathogens are factors responsible for disease epidemics during good monsoon period. Broad genetic base helps the crop in better survival even under stress conditions but also facilitates in developing new pathotypes causing serious diseases. However, extreme drought situations do not allow even the virulent pathogens to cause diseases.

Recently, survey was conducted in western parts of Rajasthan to assess the impact of severe drought on pearl millet diseases. At most of the places overall situation of the crop was very poor. In rainfed areas the crop remained stunted, dehydrated with yellowing of leaves and small sized ear heads devoid of seeds. Even the crop was not normal where limited irrigation facilities were available. Disease scenario in rainfed as well as in irrigated areas was slightly different (Table) 1. Overall disease incidence during severe drought conditions was very poor in comparison to normal rainfall period. Downy mildew, smut and leaf spot diseases were either absent or occurred in traces under rainfed areas. In irrigated areas 0-4% downy mildew and smut was recorded. Lesions of DM produced during severe drought condition were much smaller and sporadic in comparison to normal rainfall year (Fig.1A & 1B). Various cultivars such as ICTP 8203, HHB-67, ICMH-451, Eknath and other local cultivars were observed in farmer's fields. Among these cultivars, only Eknath was found infected with DM. Eknath was found highly susceptible to DM even during 2001. Nevertheless, diseases were greatly reduced under severe drought situation than normal rainfall year. This suggests that fungal pathogens are inhibited during periods of drought, as they require moisture to infect and to develop the diseases. The lack of soil moisture and dew in droughts may have affected the growth and multiplication of pathogens.

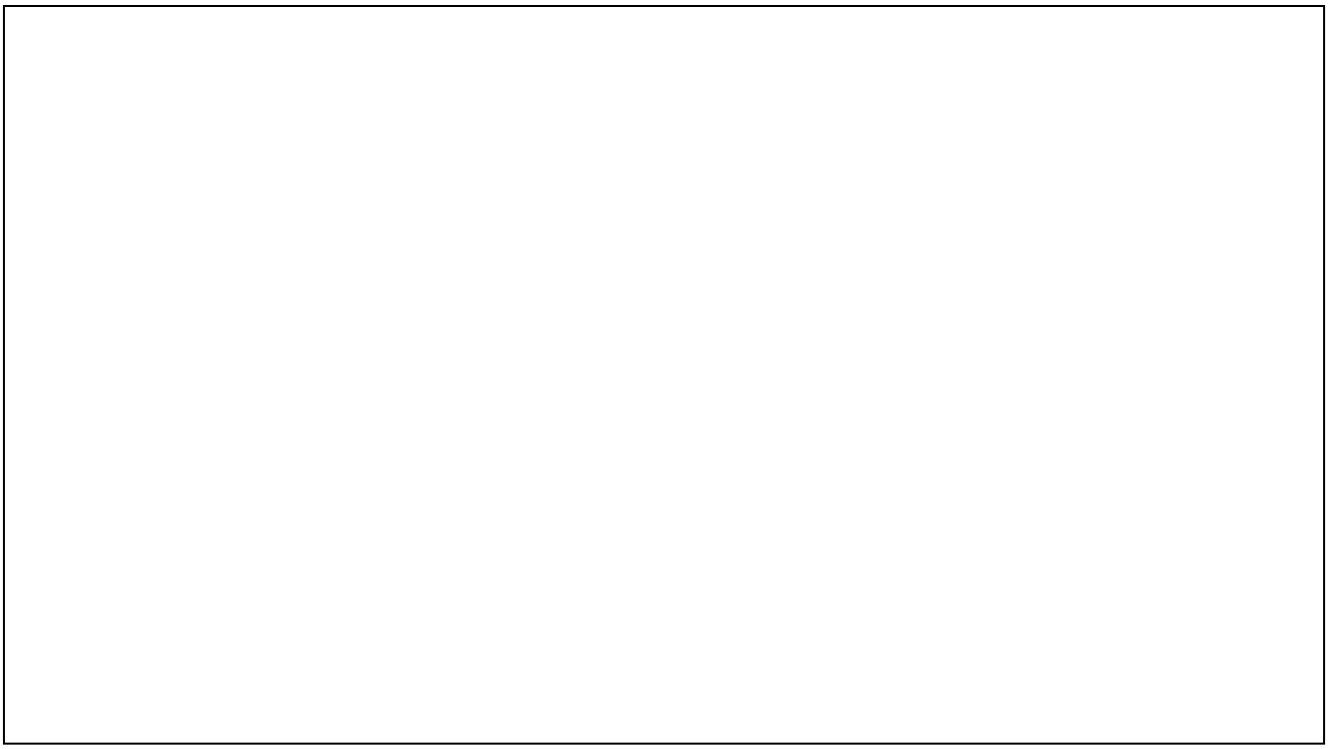
Table 1. Disease incidence in pearl millet during different rainfall periods of year 2001 and 2002

Disease	Incidence (%)			
	Average Total Rain fall^{+}			
	Normal Year (252mm)*		Severe Drought Year (65 mm)**	
	Rainfed	Irrigated	Rainfed#	Irrigated
Downy mildew	22-50	35-100	Traces	0-4
Smut	0-5	3-12	Nil	Traces
Ergot	Nil	Traces	Nil	Nil
Leaf spot	3-25	35-48	Nil	0-3

\+ Rain fall of Bikaner and Jodhpur divisions
* July-September period of year 2001
** July-September period of year 2002
\# Plants remained at 4-7-leaf stage



(Fig. 1A. Leaves showing sporadic DM lesions in severe drought year)



(Fig. 1B. DM lesions covering whole leaf in normal rainfall year)

Although drought factors reduced fungal disease incidence but some new organisms get an opportunity to appear. During the survey (2002), bacterial leaf spot (*Pseudomonas* sp.) was observed on leaves in irrigated fields. This disease has not been recorded so far from this area. Claflin et al., (1992) has reported this disease from northern Nigeria. The survey revealed that under severe drought conditions diseases of pearl millet were reduced drastically. Western Rajasthan is among the drought stricken areas of the country; therefore, farmers need to be aware of the negative effects of drought on crop growth and health, which may otherwise continue to be a problem for years to come.

NATURAL DISASTERS

Natural disasters of geological origin have claimed tens of thousands of lives in recent decades. While tomorrow's extreme natural phenomena cannot be prevented from occurring, their consequences can be less severe when more effective measures of disaster preparedness and warning are implemented as an integral part of sustainable development.

To develop guidelines and strategies for helping populations faced with natural disasters to be better prepared, UNESCO works alongside a number of governmental and non-governmental agencies in the framework of the international decade for Natural disasters Reduction. UNESCO provides assistance in investigating the causes and consequences of natural disasters and recommends ways of mitigating future threats, of rehabilitating the disaster-stricken area and reducing its long-term vulnerability, based on scientific and technical measures, as well as through education and information programmes focusing on communities at risk.

A study programme is currently supported by UNESCO, the goal of which is to integrate disaster prevention into development programmes in vulnerable countries. Training modules on earthquake risk reduction are also being tested in a series of seminars. Support is being provided for risk assessment and early warning systems in relation to earthquakes, volcanic eruptions, landslides , tsunamis and sea-level changes. UNESCO is also involved in an international effort, in cooperation with WMO and LOC, to forecast floods and drought in Africa and Asia.

A number of high- risk volcanoes are being monitored. In cooperation with the countries concerned, a joint UNESCO-US Geological Survey Programme is seeking, through seismological and engineering techniques, to reduce potential losses due to earthquake activity in the Eastern Mediterranean.

Finally, practical advice is given through brochures and guidelines on how to build schools that will be relatively safe if a natural disasters occurs in order to minimize human losses and discontinuity in educational programmes. Campaigns and information materials are also developed to safeguard cultural hertitage, monuments, sites and property against hazards of various origins.

(Source: **UNESCO 2003 p.9)**

ANNOUNCEMENT:

Next issue of DEN News will be in Hindi. Please send your contribution in Hindi to:
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BOOK POST