CAZRI

At A Glance

Central Arid Zone Research Institute

(Indian Council of Agricultural Research)
Jodhpur-342 003 (Rajasthan) INDIA

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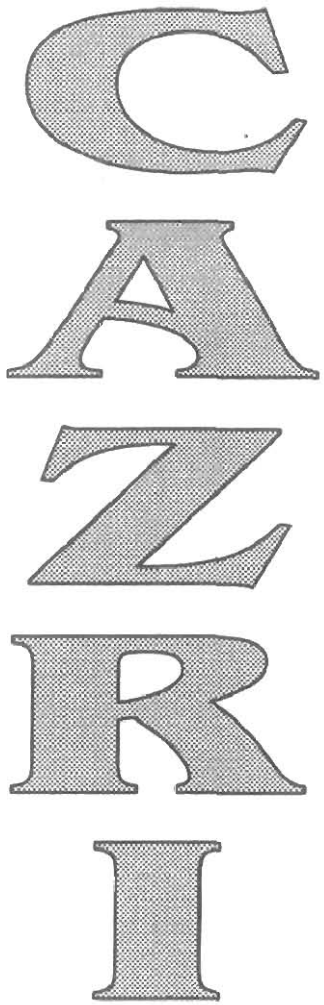


The Government of India in 1952 established "Desert Afforestation Research Station" at Jodhpur for undertaking researches to identify suitable trees and silviculture practices for large scale tree plantation in the Thar desert. In 1957 it was renamed as "Desert Afforestation and Soil Conservation Station" and subsequently based on the report submitted by Dr. C. S. Christian of the CSIRO, Australia, the station was upgraded to Central Arid Zone Research Institute on Oct. 1, 1959.

CAZRI is a unique Institute of its kind, at both national and international levels. The Headquarters is located at Jodhpur on 284 ha land. The Institute has 8 Divisions devoted to scientific research. There are four regional research stations and five experimental areas to undertake researches on location specific problems.

FACILITIES

The Institute has five major units of laboratories and office buildings, a farm complex and several small units of field laboratories, auditorium, a conference hall and a museum. Krishi Vigyan Kendras (KVK's), to impart vocational and other trainings to farmers, farm women, rural youth and grass root level extension workers and to conduct on-farm research and front line demonstra-tions are located at Jodhpur and Pali. Hostel facilities are also available at both the KVKs. There is a hostel for research students and trainees and a guesthouse within the campus.

The Institute has an excellent Library facility with over 20,000 books and 50,000 back volumes of journals and periodicals. It also possesses Agris data base from 1975 to date on all aspects of agriculture. ENVIS project on desertification is also in operation. A cell on Agricultural Research Information System (ARIS), having latest technologies like e-mail, and Internet services, has been established. Details about CAZRI are available on its web site: **http://cazri.raj.nic.in**.

At present Institute has a sanctioned strength of 150 scientists, 323 technical, 125 administrative and 286 supporting staff. The Institute is primarily funded by ICAR and a few externally funded programs supported by national and international agencies. The Institute scientists are in demand for consultancy in different fields of specialization.

MANDATE

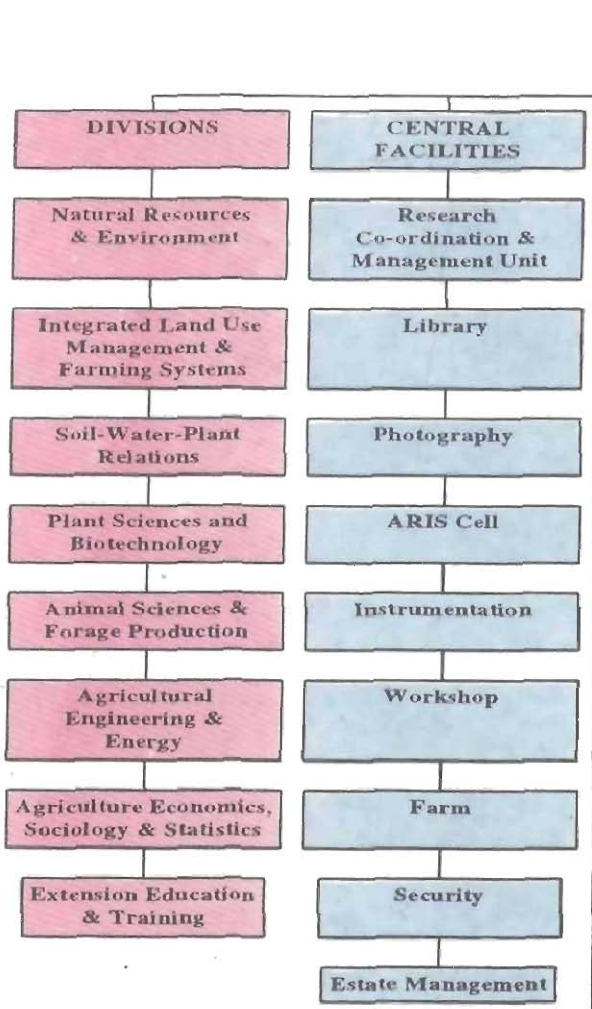
- ☆ To undertake basic and applied researches that will contribute to the development of sustainable farming systems in the arid ecosystems
- ☆ To act as repository of information on the state of natural resources and desertification processes and their control
- ☆ To provide scientific leadership and collaboration with State Agricultural Universities for generating location specific technologies for achieving the objectives
- ☆ To act as a center for training in relevant scientific areas
- ☆ To collaborate with relevant national and international institutions in achieving the above objectives
- ☆ To provide consultancy.

SIGNIFICANT ACHIEVEMENTS

Natural resource surveys

Integrated survey of natural resources including landforms, soils, flora, fauna, surface and ground water, present landuse and land degradation status have been undertaken using the concept of Major Land Resource Units (MLRUs). Buried courses of rivers in the desert, such as Saraswati, were mapped using satellite imagery, confirmed through geophysical depth soundings and successfully used for ground water exploration.

DIRECTOR



Regional Research Station	Soil Type and Topography	Rainfall (mm)	Activities
Pali *Estd: 1953** *Area: 380 ha*	Shallow sandy loam, Transitional plain of Luni Basin	400	Management of saline/sodic water R & D for location specific farming systems Seed production of grasses and trees
Bikaner *Estd: 1958** *Area: 263 ha*	Loamy sand, duny sand and interdunal arid western plains	250	Integrated farming system research with focus on silvipasture and livestock management Water management (canal) - drip and sprinkler irrigation Environment Impact Analysis (EIA) Seed production of trees and grasses
Jaisalmer *Estd: 1959** *Area: 133 ha*	Loamy sand, dunes, sand interdunes and rocky-semi-rocky areas	150	*Lasiurus sindicus* (Sewan grass) based silvopastoral system Research on khadin water harvesting system Water management (Ground water and canal) EIA and biodiversity conservation Seed production of trees and grasses
Bhuj *Estd: 1987* *Area: 58 ha*	Saline/sodic, sandy loam and silty clay loam (Banni area)	275	Assessment, fine tuning and demonstrations of technology Evaluation of suitable farming systems for saline/sodic soils Seed production of trees and grasses

*Established as experimental areas, subsequently upgraded as RRSs in 1986.

Satellite imagery

Divisions	Major Programmes
Natural Resources and Environment	☆ Integrated basic and human resource appraisal, monitoring, and desertification
Integrated Land Use Management and Farming Systems	☆ Integrated arid land farming system research ☆ Plant product processing and value addition
Soil-Water-Plant Relations	☆ Management of land and water resources
Plant Science and Biotechnology	☆ Biodiversity, conservation and Improvement of annual and perennials ☆ Integrated pest management
Animal Sciences and Forage Production	☆ Improvement in livestock, forage production and conservation
Agricultural Engineering and Energy	☆ Non conventional energy systems and farm machinery power
Agricultural Economics, Sociology and Statistics	☆ Socio-economic investigation and evaluation
Extension Education and Training	☆ Technology assessment, refinement and training

Desertification

Based on satellite imagery, maps of processes leading to desertification and common property resources (CPRs) have been prepared. Soil movement due to barren surface and high wind velocity is a major problem. The extent of soil movement under different land use systems has been quantified. Technologies to minimize sand movement through establishment of shelter belt and technologies for dune stabilization have been developed.

Shelterbelts

Shelterbelts consisting of three rows having a central row of tall tree like *Albizzia lebbek* with one row of branched trees like *Acacia tortolis*, *Cassia siamea*, and *Prosopis juliflora* on either sides, are established across the wind direction. Such shelterbelts reduce the wind velocity by 20-46% and soil loss by 76%. Shelterbelts planted along highways effectively controlled piling up of sand.

Sand dune stabilization

About 58% of the area of arid Rajasthan is occupied by dunes. These dunes are highly mobile and are serious threat to agricultural fields, canals, highways, buildings, etc. Therefore, technologies have been developed to stabilize these dunes through plantations of grasses and trees. Adopting these techniques sand dunes spread over 16,000 ha area have been stabilized.

Water management

For efficient rainwater harvest through roof surfaces, constructed catchments and saucer-shaped microcatchments, and for large storage technologies like *khadins, nadis.*

Barren sand dune

tankas, anicuts, have been refined and developed. Since soils are sandy and water retention is poor, water is rapidly lost either as evaporation or deep drainage. Technologies to minimize these losses have also been developed through adoption of subsurface barriers, mulching, and soil amendments. In undulating grasslands contour vegetative barriers effectively conserved the soil and moisture. A low cost micro-irrigation device using double walled earthen pot (Jaltripti) has been developed to establish tree saplings with limited water, ensuring saving of about 80% water.

Watershed management

For holistic management of water the concepts of integrated watershed management for areas having single drainage system and index catchment for areas lacking single drainage system have been developed.

Water pond

Stabilized sand dune

Crop production

Technologies for sustainable crop production under rainfed conditions have been developed. These include (a) application of FYM on sowing line to prevent crust formation, (b) optimum tillage to capture sufficient rain water, (c) paired row planting for efficient utilization of soil moisture, (d) intercropping to reduce risk of crop failure in aberrant weather, (e) rainwater harvesting, (f) incorporation of amendments to im-

Water harvesting

Tanka

Jaltripti

prove soil moisture retention, and (g) application of life saving irrigation where resources permit. Large numbers of improved varieties of grasses, pearl millet, clusterbean, moth bean and horsegram, developed at the Institute, have been released. Benefits of high soil fertility in ameliorating the adverse effects of moisture and salinity stress have been established and contributions of legumes in improving the soil fertility and contribution of BNF in improvement of yields of legumes have been quantified. In the desert most of the urea applied is lost due to volatilization. A simple cost effective technology involving sulphur-mixed urea that increases the efficiency of urea from 20-45%, has been successfully developed.

Pearl millet

Maru guar

Vegetative barrier

Wastelands and their management

The arid region is endowed with minerals that are being increasingly exploited and a trial of wasteland is left. Technologies integrating suitable species, soil amendments and water harvesting, for rehabilitation of gypsum and limestone-mined lands have been developed. The soils irrigated with saline-sodic ground waters having high residual sodium carbonate are being degraded due to sodification. Such lands have been successfully managed through incorporation of gypsum. Printing, tying and dyeing of clothes are important activities in the desert region. The land spoiled and the groundwaters contaminated due to industrial

Acacia senegal

Cenchurs ciliaris

effluents have been quantified. Treatment of such toxic effluents has been suggested. Trees have been identified that can be planted using these effluents or on affected lands.

Alternate land use systems

In the arid and semi-arid regions raising annual crops along with perennial trees and grasses give stability to the system. In view of this, technologies for various agroforestry systems like, agrihorticulture, hortipastoral and silvopastoral systems have been developed. Adoption of ley farming involving cultivation of crops in rotation with grasses has improved the soil physico-chemical properties and crop yields. Management practices and productivity of range lands in different agroclimatic zones have been developed and their carrying capacity quantified.

Lasiurus sindicus

Limestone mined wasteland

Researches are underway to improve genetic potential of grasses and trees through biotechnology.

Arid horticulture

In the arid region there is plenty of scope for plantation of fruit trees. Technique for propagation of ber through budding of improved varieties like Gola, Seb and Mundia on local root stock has made major impact in the arid and semi-arid regions. A large number of varieties have been identified that can be successfully raised even on marginal lands with certain conservation measures.

Rehabilitated mined wasteland

Soil degraded due to industrial effluents

Soil degraded due to sodic water

These include Jalore seedless of pomegranate, Dhara Road and Faizabadi local of bael, Kanchan and Krishna of aonla. Due to technologies developed to raise improved varieties and better management practices the area under orchard is continuously on the rise. Techniques for extraction and processing of juice/pulp of fruits like ber, bael, pomegranate, aonla, etc., have been standardized.

Integrated pest management

The major diseases are downy mildew in pearl millet crop and bacterial blight and dry root rot in clusterbean. Downy mildew has been effectively minimized by SE-NW row orientation and taking millet as an intercrop with clusterbean. Seed treatment and foliar spray of streptocycline reduced the blight intensity, while low crop density and incorporation of 10 t ha^{-1} FYM or cruciferous crop residues in the soil minimized dry root rot infestation. Soil solarization using polythene mulching minimized the population of soil borne pathogens.

Agroforestry

Soil reclaimed with gypsum

Silvopasture

Invertebrate pests causing economic losses to crops, forest and fruit trees have been surveyed. Fruit fly in ber has been effectively controlled by foliar sprays of endosulfon, quinalphose and carbaryl. Among vertebrate pests two gerbils, viz., *Tatera indica* and *Meriones hurrienas* and ametad (*Millardis metteda*) are the key ro-

Agrihorticulture

Hortipasture

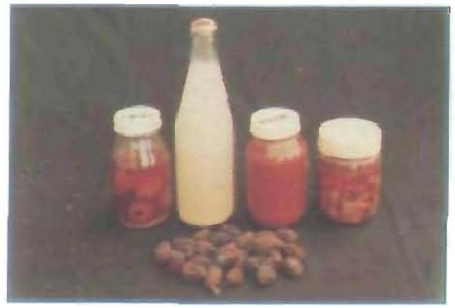
dent pests in arid areas. A model involving use of zinc phosphide baiting, followed by bromadiolone coupled with trapping, has been developed.

Livestock management

Livestock are an important source of sustenance for farmers, particularly during low rainfall year, when crop yields are too low to be of any economic significance. The time of first calving and the inter-calving period has been reduced significantly through proper management in native cattle. Marwari and Magra breeds of sheep are suitable for the desert tracts as these breeds can sustain on twice a week watering without any adverse effect on body weight. Parbatsar, a new breed of goat, has been identified. This breed has higher growth rate, milk yield and duration of lactation. A technique of ensiling surplus fodder, using over-fermented milk, urea and molasses, has been developed. Digestibility of high tannin containing top feed has been improved by soaking the feed in 1% aqueous solution of sodium carbonate. A balanced concentrate mixture has been developed that hastens the body weight gain, and milk yield in cattle. Tumba seed cake is economical and increasingly becoming popular amongst farmers.

Aonla

Ber



Fruit products

Solar energy

In the arid regions there is plenty of solar energy available to meet the human en-

Tharparker

Migration of sheep and goats

ergy needs, both in urban and rural areas. Various types of solar cookers to cook food and feed, water heaters and distillation plants have been designed and developed. Dryers to dehydrate agricultural produce are getting popular as the produce retains its color, flavor and the texture. Similarly wax melter and candle-making machine are also getting popular. To make these devices versatile, multipurpose devices are being fabricated. Solar PV panel have been successfully used to supply power to run TV, light, fan, and to operate drip irrigation system.

Farm implements

A number of farm implements have been designed and developed. These include a

Solar yard

Tumba seed cake

tworow planter and an animal drawn two-row seed drill having fluted roller type metering device for uniform seed distribution. Manually operated ber grader to grade *bers* in different sizes was developed.

Silage making

A technique of silage making from poor quality dry forages has been standardized.

Solar dryer

Socio-economic aspects

The socio-economic viability of the technologies developed was evaluated and surveys on the socio-economic aspects of the desert dwellers undertaken. The cost benefit analyses of various land use systems revealed that pasture-based livestock system has

Solar PV panel

DG distributing nutrient block

positive net present value and annuity as compared to arable farming. Thus farmers need to be encouraged to adopt the livestock-based farming system.

Transfer of technology

The Institute has been able, through its extension and training activities, to reach a large number of farmer's, and government officials with information on new desert development technologies developed at CAZRI. Field days, farmers fairs and exhibitions have helped in rapid dissemination of CAZRI improved technologies developed in the Institute. Through Institute-village-linkage program, launched in 1996, the technological interventions have been evaluated through on-farm research (OFR), on-farm trial (OFT) and verification trials (VT). Field days and on-farm and off-farm trainings are also arranged/organized to create social awareness amongst the technology users.

DG visiting IVLP Program

International training course

CONSULTANCIES

The institute scientists have developed a number of technologies for management of arid and semi-arid lands and have been providing short term and long-term consultancies to various countries/agencies.

Trainees visiting field

TRAININGS

The Institute has excellent faculty and infrastructure to impart trainings to grass-root workers, researchers, planners and managers on various aspects of management of arid and semi-arid lands. In recent times a number of trainings sponsored by national and international agencies have successfully been conducted.

BILATERAL PROGRAMS

The Institute has successfully undertaken bilateral programs of mutual interest with the national and international agencies. These

include international collaboration on dryland agriculture with USDA, climate variability and water resources with CEC, rehabilitation of mine spoils with USGS, and pearl millet improvement with ICRISAT.

The Arid Agro-ecosystem Directorate established under the National Agricultural Technology Project (NATP) cares for entire production spectrum of arid regions. About 30 interdisciplinary and inter-institutional research programs on Agri-silvi-horti-pastoral production system and Livestock and Fish production system, involving ICAR institutes and state agricultural universities located in hot and cold desert areas, are in operation.

As a result of these vigorous efforts of over 40 years, the CAZRI today is an inter-

His excellency Sam Nujama, President of the Republic of Namibia

Iraqi delegation visiting meseum

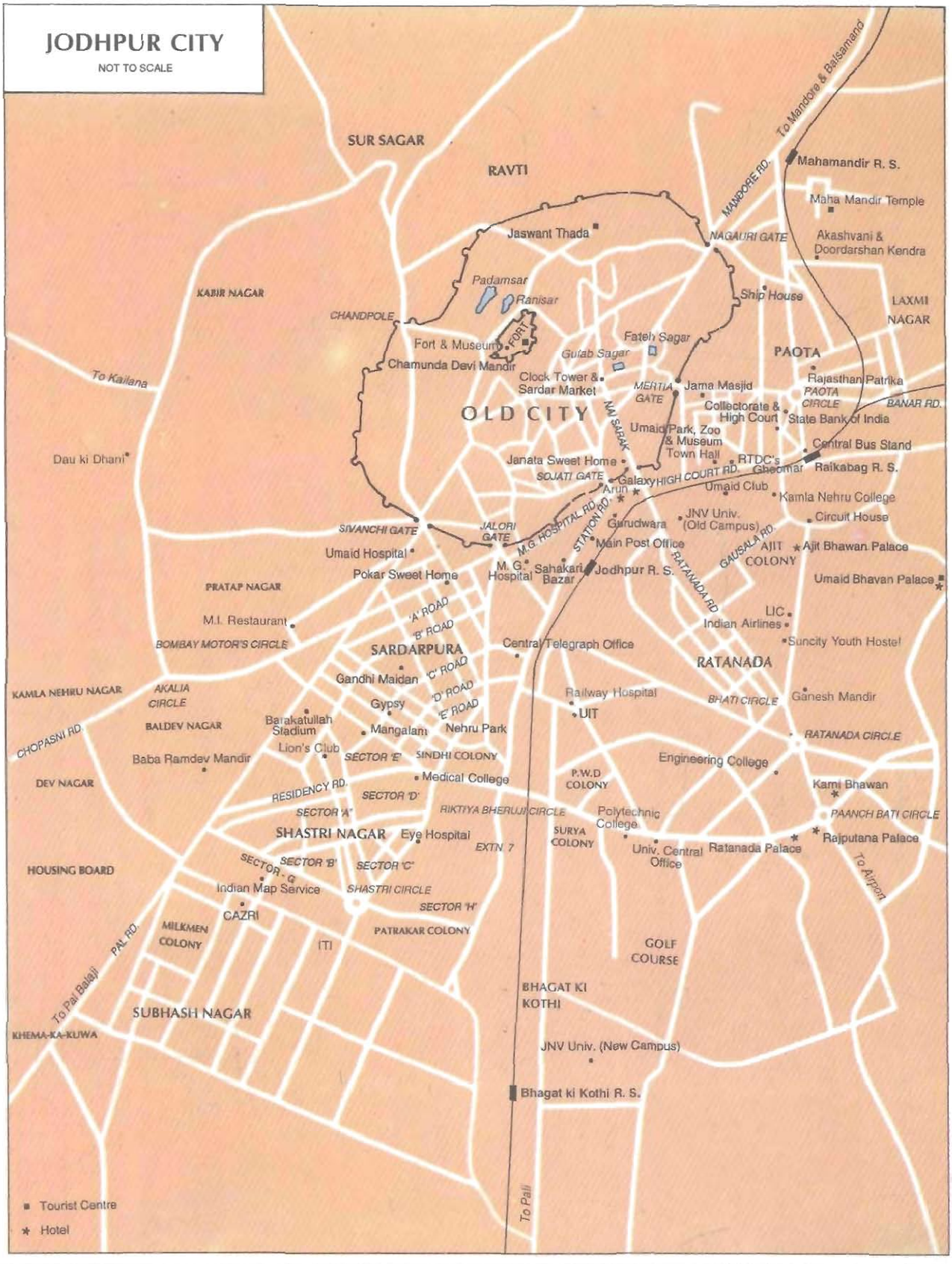
nationally recognized center for research pertaining to problems of arid and semi-arid zones. In fact, CAZRI is a unique multidisciplinary research organization in the South and South-East Asia, having research facilities for over 30 different disciplines. Since its inception the vision of this organization has been to bring prosperity to the fragile ecosystem of desert. With the dedicated efforts of CAZRI scientists, Thar, at present, is scientifically better understood and extremely well documented among the deserts of the world.

FUTURE THRUSTS

In future, emphasis will be laid on adopting multidisciplinary and holistic approaches including strengthening linkages with farmers and Government and non-government organization. Major thrusts will be on

- ☆ Desertification monitoring/mapping
- ☆ Bio-technological improvement of indigenous trees/shrubs/grasses/crops
- ☆ Integrated watershed management, there planning and development through modern tools
- ☆ *On-station and on-farm research on* development of farming systems research
- ☆ Post-harvest technology and value addition
- ☆ Management of renewable energy resources
- ☆ HRD and technology transfer.

Institute web site being inaugurated by Dr. R.S. Paroda


JODHPUR CITY
NOT TO SCALE
SUR SAGAR
RAVTI
To Mandore & Balsamand
MANDORE RD.
Mahamandir R. S.
Maha Mandir Temple
Akashvani & Doordarshan Kendra
Jaswant Thada
NAGAURI GATE
KABIR NAGAR
Padamsar
Ranisar
Ship House
LAXMI NAGAR
CHANDPOLE
FORT
Fort & Museum
Chamunda Devi Mandir
Gulab Sagar
Fateh Sagar
PAOTA
To Kailana
Clock Tower & Sardar Market
MERTIA GATE
Jama Masjid
Rajasthan Patrika
PAOTA CIRCLE
BANAR RD.
OLD CITY
Collectorate & High Court
State Bank of India
NAI SARAK
Umaid Park, Zoo & Museum
Town Hall
Central Bus Stand
Dau ki Dhani
Janata Sweet Home
RTDC's Ghoomar
Raikabag R. S.
SOJATI GATE
HIGH COURT RD.
Galaxy
Arun
Umaid Club
Kamla Nehru College
SIVANCHI GATE
JALORI GATE
M.G. HOSPITAL RD.
STATION RD.
Gurudwara
JNV Univ. (Old Campus)
Circuit House
Umaid Hospital
Main Post Office
GAUSALA RD.
AJIT COLONY
Ajit Bhawan Palace
PRATAP NAGAR
Pokar Sweet Home
M. G. Hospital
Sahakari Bazar
Jodhpur R. S.
RATANADA RD.
Umaid Bhavan Palace
M.I. Restaurant
'A' ROAD
'B' ROAD
LIC
Indian Airlines
BOMBAY MOTOR'S CIRCLE
SARDARPURA
Central Telegraph Office
Suncity Youth Hostel
RATANADA
'C' ROAD
'D' ROAD
'E' ROAD
Gandhi Maidan
KAMLA NEHRU NAGAR
AKALIA CIRCLE
Gypsy
Railway Hospital
BHATI CIRCLE
Ganesh Mandir
UIT
BALDEV NAGAR
Barakatullah Stadium
Mangalam
Nehru Park
CHOPASNI RD.
RATANADA CIRCLE
Lion's Club
Baba Ramdev Mandir
SECTOR 'E'
SINDHI COLONY
Engineering College
DEV NAGAR
Medical College
P.W.D COLONY
Kami Bhawan
RESIDENCY RD.
SECTOR 'D'
SECTOR 'A'
RIKTIYA BHERUJI CIRCLE
Polytechnic College
PAANCH BATI CIRCLE
SHASTRI NAGAR
Eye Hospital
EXTN. 7
SURYA COLONY
Univ. Central Office
Ratanada Palace
Rajputana Palace
HOUSING BOARD
SECTOR 'G'
SECTOR 'B'
SECTOR 'C'
To Airport
Indian Map Service
SHASTRI CIRCLE
SECTOR 'H'
CAZRI
PAL RD.
MILKMEN COLONY
PATRAKAR COLONY
ITI
GOLF COURSE
To Pal Balaji
BHAGAT KI KOTHI
SUBHASH NAGAR
KHEMA-KA-KUWA
JNV Univ. (New Campus)
Bhagat ki Kothi R. S.
To Pali
Tourist Centre
Hotel