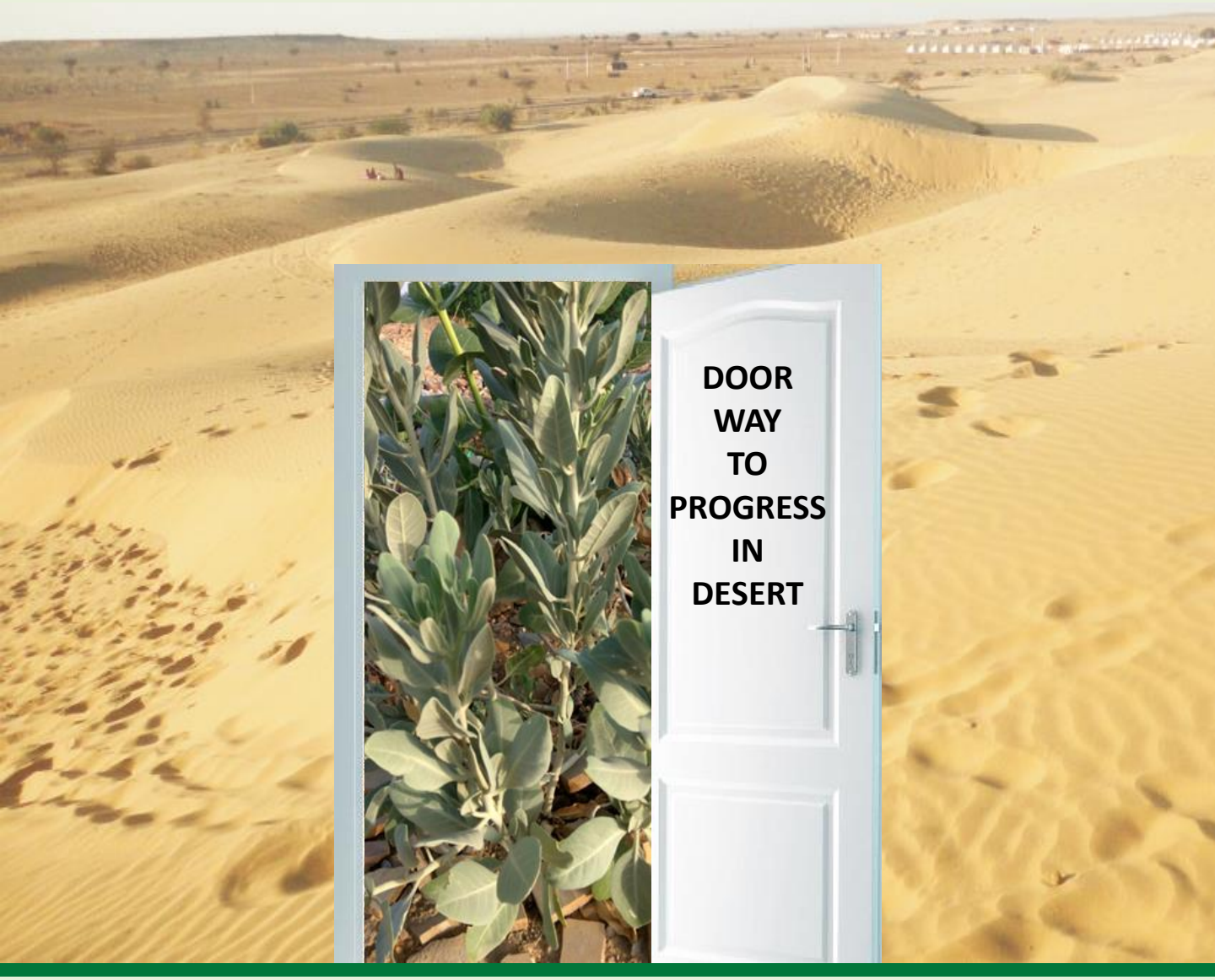
January - June 2022 Volume 24(1-2)

DESERT ENVIRONMENT NEWSLETTER

ENVIS Centre on Combating Desertification

ICAR-CAZRI

In this issue :



Hosted by
ICAR - Central Arid Zone Research Institute
Jodhpur

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

Published by
ENVIS CENTRE
on Combating Desertification

From the desk of chairman

Dear Readers,

Plant secondary metabolites provide protective and adaptive functions to the plants in extreme climatic conditions. They play important role in the survival of the plants in the arid region. Plant species such as Aerva javanica, Capparis decidua, Calligonum polygonoides, Haloxylon salicornicum, Leptadenia pyrotechnica, Withania coagulens etc. have diverse groups of secondary metabolites including flavonoids, phenols, alkaloids, tannins and saponins which impart tolerance to plants to the different abiotic pressures. The secondary metabolites also act as antioxidants and help plants combat oxidative stresses. Some of the plant species derived biochemicals also possess industrial applications. Guar or clusterbean (Cyamopsis tetragonoloba) a native kharif pulse crop of the arid region of India produces galactomannan gum in its seed which finds multifarious industrial applications and fetches more than Rs 3000 crores annually through exports. Plant species like Cordia myxa, Opuntia ficus indica, Aloe vera etc. contain mucilaginous polysaccharides having functional properties such as storage of water, protection of the embryo, seed dispersal and also possess medicinal value. These mucilages should be explored for their application in food and pharmaceuticals as binding agents, emulsifiers, gelling agents and packaging materials.

I am happy that this issue has briefly discussed these aspects.

O.P. Yadav
Director, ICAR-CAZRI

Address for Correspondence
Dr. P.C. Moharana
ENVIS Coordinator
ICAR - Central Arid Zone Research Institute
Jodhpur 342003, INDIA

Phone
+91 291 2786931

Visit us at
http://www.cazrienvis.nic.in

Email at
cazri-env@nic.in

Editors: Dr. O.P. Yadav, Dr. P.C. Moharana
Dr. J.P. Singh and Dr. Vipin Choudhary

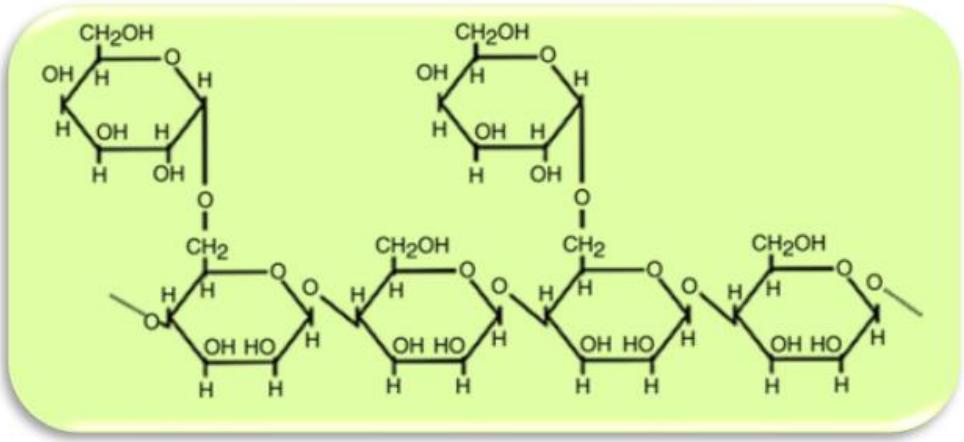
Know Your Desert

Industrial Applications of Guar Gum in Hot Arid Region

Guar also commonly known as clusterbean (*Cyamopsis tetragonoloba*) is a drought resilient legume native to the desert region, and its name is derived from a Sanskrit term for cow fodder. This crop has its roots in the western and northwestern regions of India and Pakistan and grown for millennia as a vegetable, green manure, green fodder, seeds, and for the extraction of guar gum. But during the past few decades, it has started to gain popularity for its industrial uses. India, particularly, the state of Rajasthan accounts for 80% of global guar production, producing nearly 1 to 1.25 million tons annually. Guar gum is mostly produced in India and Pakistan, although it is also produced by other nations, including the United State of America, China, Australia, and few countries of African continent.

Guar seed consists of 14–17% seed coat and 43–47% germ, while the galactomannanrich endosperm content is in the range of 35–42%. Majority of guar seed is exported after processing into guar gum powder or endosperm splits. The quantum of guar gum consumption is largely dependent on the oil drilling sector in the overseas market. Last year, India exported guar gum of worth Rs. 3334 crores.

More than 80-85% of guar gum is galactomannose; the remaining parts are made up of protein, pectin, pentosan, phytin, ash, and dilute acid insoluble residues. A single α-D-galactopyranosyl unit is connected by (1-6) linkages to the chains of (1-4)-linked β-mannopyranosyl units. On an average, galactose moiety is attached to every second mannose moiety in the main chain of galactomannan molecule. Presence of galactose prevents the formation of other molecular structures due to the steric hindrance; thus provide added solubility and stability to guar gum.



Chemical structure of Galactomannanc

Industrial Applications

The galactomannan molecule is suitable for a wide range of chemical reactions due to its long chain molecular structure and abundance of hydroxyl groups. It is used in many industries for a wide range of applications due to its unique qualities, which include solubility in cold and hot water as well as thickening, emulsifying, gelling, stabilising, binding and wide pH stability. Guar gum has been the subject of much study about the possibility of altering its physical and chemical

properties through grafting, blending, and composition with synthetic and natural polymers. As a result, it is extensively employed as a raw material in a variety of sectors. In the past few decades, an attempt has been made to detail the experiments and advancements in the use of guar gum and its derivatives for a variety of uses. Its affordability and naturalness, when compared to other polymers, make it the hydrocolloid of choice for both industries and consumers

Guar and guar gum based industries

Food and Beverage Industry: Since early 1950s, guar gum has been used in making processed foods, in which it acts as a thickener, binder, anti-freeze, etc. and thus acts as an indispensable ingredient for food industry. It prevents the formation of ice crystals, to give creamy texture to the ice creams. In baking industry, guar gum is added to contribute to both dough yield and the extension of shelf life with added texture and crumb structure. It efficiently thickens batter and works as a great binding agent for items used in gluten-free baked recipes. Its utility can be envisaged by range of food preparations that make use of it like, soups, baked goods, gravies, yoghurt, milk and cheese products, processed cheese, etc. It has the moisture retention capacity for making pasta and the flow properties for making sauces and dressings. Therefore, guar gum is one of the most popular hydrocolloids added to sauces, noodles and ketchups. Beverage industry utilizes gum powder as a thickener to increase viscosity of beverages. It provides stability at low pH and solubility in cold water which makes it an ideal option for the beverage industry.

Dairy Industry: Guar gum can be utilized as a prebiotic source that stimulates the growth of potentially probiotic bacteria or native gut microflora. Partially hydrolysable guar gum (PHGG) is a water soluble dietary fiber that is non-digestible in the upper gastro-intestinal tract. PHGG benefits the health of hosts by altering the colonic microbiota and by stimulating short chain fatty acids production. The husk of guar gum splits and the germ are both high in protein; hence guar meal is frequently fed to livestock like cattle, sheep and poultry an alternative to costlier protein supplements.

Oil and Mining Industry: Guar gum is a cost-effective and eco-friendly alternative for mining industry with added advantages of biodegradability, high resistance to mechanical and thermal degradation. It acts as a green corrosion inhibiter and enhances oil recovery. It also serves as a flotation agent and a flocculants, which promote extraction of many minerals from their ores and water purification.

Textile Industry and Printing: When used for textile printing, gum powder absorbs water to form a sticky paste, which makes the direct painting process on wool, nylon, and silk easier. Guar thickeners are dye dispersants that give colour during the printing on polyester and related fabrics, giving liveliness to the print. Due to its binding, thickening, gelling and blending properties, guar gum powder has vast demand in paper industry as well.

India has got comparative advantage in production and export of guar and guar products. Hence, there is a need to encourage cultivation of guar (clusterbean) to reap its industrial value. The demand for guar gum is increasing due to its physio-chemical properties that serve so diverse industries. It is frequently used in the food industry as a thickener, binder, viscosifier, and stabilizer since it is soluble in cold water and forms solutions with high viscosities even at low concentrations. Guar dietary fibre exhibits good qualities as a soluble partially hydrolyzed colloid. It can reduce cholesterol and postprandial blood glucose levels. Guar gum has recently been used to create biodegradable packaging films with mechanical and barrier qualities that are comparable to those of commercial synthetic polymers. Guar gum's applicability and utility may further be increased with chemical modifications. Association and interaction among guar industry partners, research institutes and farmer groups will generate a better information flow and in turn will strengthen its market value both nationally as well as internationally.

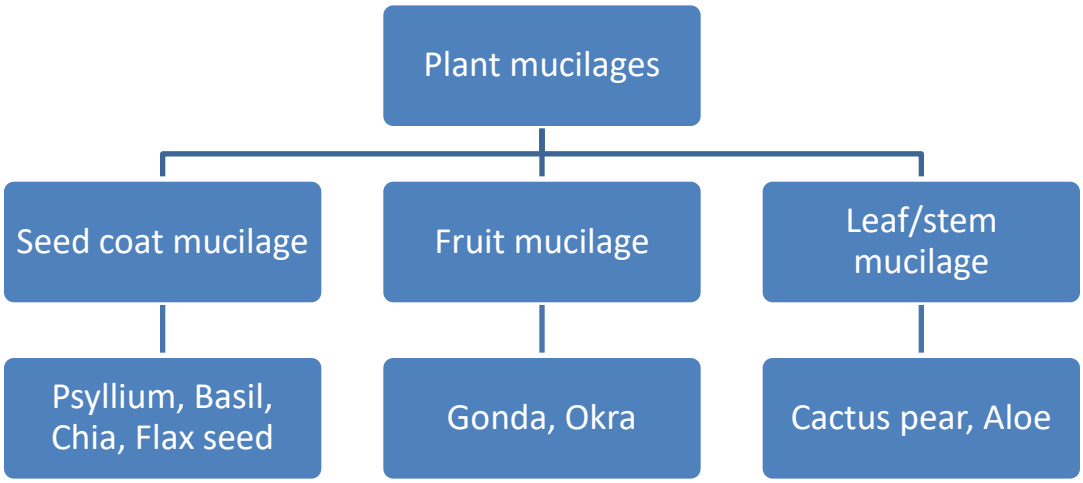
Aman Verma, Saurabh Swami, Devendra Singh.
ICAR-Central Arid Zone Research Institute, Jodhpur

Importance of Mucilaginous plants of Hot Arid Region

Mucilages, also known as slime, are polysaccharides or proteoglycans secreted by the plant species during development. They are different from gums which are similar exudates but are released after wounding and pathogenic cell wall degradation. Mucilages are found in plant families such as Acanthaceae, Asteraceae, Boraginaceae, Brassicaceae, Cucurbitaceae, Euphorbiaceae, Fabaceae, Lamiaceae, Malvaceae, Rosaceae, Rutaceae, Sapindaceae, Solanaceae, Zygophyllaceae etc. Common mucilaginous plant species that are found in hot arid region include *Cordia myxa* (Gonda), *Opuntia ficus indica* (Hatha Thor/Cactus pear), *Plantago ovata* (Isabgol/ Psyllium), *Aloe vera* (Guarpatha) etc. Mucilages are synthesized in the Golgi apparatus of the cells and secreted to the apoplastic space. The biological role of mucilages in plants depends on the species and their habitat. Mucilages have role in protection of the embryo as well as to facilitate dispersal and eventual germination of seed, membrane thickening, and to attract and capture prey in carnivorous plants like *Drosera* species. In the dry regions, mucilages also play role of storage of water in succulent plants as in case of several species of cactus.

Type of plant mucilages

Plant mucilages can be classified as seed coat mucilage, fruit mucilage and leaf/stem mucilage based on the plant part. The hydrophilic mucilage deposition occurs in epidermal cells of seed coat or pericarp of the fruits. Seed coat mucilage is released when seeds are hydrated and a gel-like capsule is formed around the seed. Mucilages are also known to be secreted from the root cap, where they act as lubricating agents for roots and promote ionic and microbial interactions in the soil. They are also found in the transmitting tract where they act as a medium for the growth of pollen tube.



Structure and properties of mucilage

Mucilages are composed primarily of pectins and hemicelluloses and exhibit high swelling upon hydration. They are extremely hydrophilic due to the acidic nature of the polysaccharide and may also contain cellulose micro fibrils or cellulosic fibres. Pectin rhamnogalacturonan I is generally present in the basil (*Ocimum* species), chia (*Salvia hispanica*) and flax (*Linum usitatissimum*) mucilages. It has an alternating backbone of 1→2- linked rhamnose and 1→4-linked galacturonic acid, with varying degrees of 1→5-linked arabinose, 1→3- linked galactose and/or arabinogalactan side-chains linked to the rhamnose residues. Among hemicelluloses, arabinoxylan is common having a 1→4-linked xylan backbone with arabinose substitutions.

***Cordia myxa* (Gonda, Lasora):** *C. myxa* belongs to the family Boraginaceae and commonly called glue berry, snotty gobbles or scented man jack. It is one of the potential underutilized fruit plants of arid and semi-arid regions due to its drought tolerance ability. It finds uses in health, nutrition and curing certain human ailments in traditional systems of medicine. Unripe fresh fruits are used for vegetable and pickle at a time when availability of conventional vegetables is scarce. The ripened fruit pulp is very sweet (TSS-25-28°Brix) and transparent mucilage surrounds the stone. Mucilage makes the ripened fruit very sticky and unsuitable for consumption.

***Cordia myxa* (Gonda) plant and its fruits**

Mucilage polysaccharide of *C. myxa* is composed of galactose, arabinose and glucuronic acid with traces of rhamnose. *C. myxa* mucilage extraction is done by heating the fruit at 90°C for 0.5 h with water along with sodium metabisulte. The mucilage can also be precipitated using ethanol and dilute acid. Studies on various functional properties of *C. myxa* mucilage have been conducted. Among food applications, the efficacy of *C. myxa* mucilage as edible coating in comparison with carboxy methyl cellulose to retard the oxidation of pine nuts (chilgoza) has been reported.

***Opuntia ficus indica* (Cactus pear):** Cactus pear is a drought resistant plant growing in the dry regions throughout the globe. It is cultivated commercially in countries like Mexico, Argentina, Brazil, South Africa, Italy, France and the US. Its cladodes are succulent in nature and palatable as livestock feed. It can also be used as fruit and vegetable for human consumption. Processed products such as snacks, juices or minimally-processed foods are obtained from the fruit. Mucilage, colouring agents and other bioactive extracts are obtained as by-products of processing. The juice obtained from the pads is viscous due to the presence of mucilage, the viscosity of which depends on the amount of water received by plant. Plants grown in hot arid regions yield a more viscous juice than those of semi-arid region. This is an important consideration for using the plant as a source of mucilage. Among the traditional uses, utilization of mucilage for purifying the drinking water and use of cladode pieces for improving the adhesion properties of the lime paints are known in some countries.

***Opuntia ficus indica* (Cactus pear)**

Potential application of mucilages

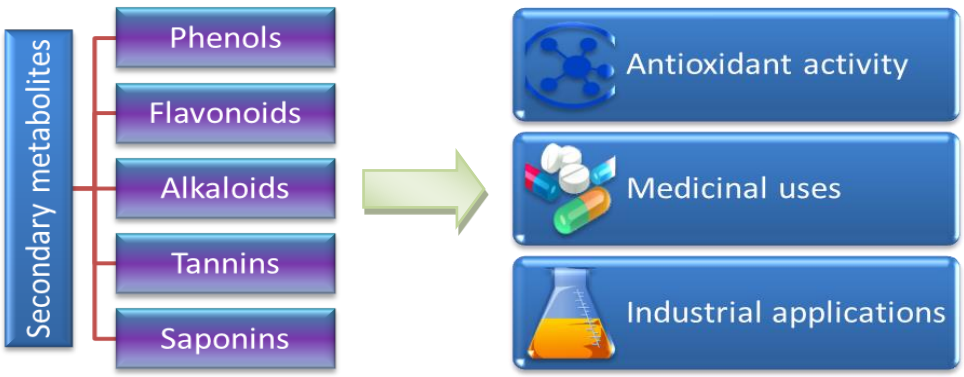
Mucilages have potential applications in industries such as food and pharmaceuticals. In pharmaceuticals, they can be used as binding agent in tablets, gelling agent, demulcent, on mucosa membrane, emulsification and suspending agent. Polysaccharide hydrocolloids market remains a highly active industry experiencing a steadily increasing demand for novel and sustainably produced ingredients. In this context, plant mucilages can be utilized as potential additives in food applications. Several food packaging applications using plant mucilages as eco-green, biodegradable and sustainable ingredients have emerged. Another area of food application of plant mucilage is stabilization of ice-creams. Mucilages have also been used for reduction of fat in bakery products as fat-replacers. Therefore, hot arid mucilaginous plants can be exploited for their high value applications in food and pharmaceuticals.

Saurabh Swami, Mahesh Kumar, Om Prakash
ICAR-Central Arid Zone Research Institute, Jodhpur

Protective Role of Secondary Metabolites in Arid Vegetation

The tolerance capacity of plants depends on various genetic, physiological and biochemical parameters which are involved in modulating the defence mechanism under abiotic stress. Abiotic stress trigger some mechanisms of defence inside the plant system such as change in the gene expression profile of stress associated proteins, which was not expressed under 'normal' condition. Generally, stress factors represent environmental constraints which induce disturbances in cellular homeostasis including imbalances in plant water regime (reduced water uptake by roots; dehydration stress) as well as imbalances in cellular metabolic pathways, especially aerobic respiration and photosynthesis, leading to enhanced formation of reactive oxygen species (oxidative stress).

Further, antioxidative defence system comprises various enzymatic and non-enzymatic molecules, produced to counter the adverse effect of environmental stresses. A sizable number of these molecules belong to the category of secondary metabolites. Plant secondary metabolites are unique sources of drugs, additives, flavours and other important industrial biochemical compounds which are biosynthesized from primary metabolites. Beside changes in primary metabolites such as saccharides, nucleic acids, amino acids and related compounds (betaine), stressed plants may accumulate late embryogenesis abundant hydrophilic proteins and polyols (cyclitols like d-pinitol and mannitol) in addition to accumulating secondary metabolites (phenolics, flavonoids, nitrogen-containing and terpene compounds). This includes different elicitor signal molecules and enhances the adaptation and resistance of plants to the biotic and abiotic pressures imposed by the surrounding environment and, in this specific case, to drought stress. In recent times, phytochemists and biologists are focusing on the isolation and identification of specific lead molecules of arid plant species and understanding their therapeutic significance. The phytochemical composition and the content of bioactive compounds vary within the plant parts. Moreover, various factors such as geographical topographies, climatic condition, growing patterns, and harvesting duration influence the accumulation pattern of biochemical constituents in plants.



Different classes of secondary metabolites

Secondary Metabolites

Phenols: Phenolic compounds, or phenols, are the most abundant secondary metabolites in plants, biosynthesized via the pentose phosphate (PP), shikimate (SK), and phenyl propanoid (PhP) pathways in plants. Phenolic compounds commonly found in plants include the gallic, vanillic, syringic and ferulic acids, catechine, picein and pungenin, taxifolin, coniferyl aldehyde etc.. All these phenolics are strong inhibitors to cellulolytic enzymes. Arid plants such as *Leptadenia* species and *Calligonum* species contain high concentration of phenolic compounds which have valuable medicinal properties.

Flavonoids: Flavonoids are an important class of natural products; particularly, they belong to a class of plant secondary metabolites having a polyphenolic structure, widely found in fruits, vegetables and certain beverages. They have miscellaneous favourable biochemical and antioxidant effects. Flavonoids are now considered as an indispensable component in a variety of nutraceutical, pharmaceutical, medicinal and cosmetic applications. This is attributed to their anti-oxidative, anti-inflammatory, anti-mutagenic and anti-carcinogenic properties coupled with their capacity to modulate key cellular enzyme function. A diverse group of flavonoids are present in *Aerva* species, *Calligonum polygonoides, Indigofera oblongifolia* etc.

Alkaloids: They are structurally diverse compounds generally classified as such due to the basic character of the molecule (from Latin alkali) and a presence of at least one nitrogen atom, preferably in a heterocycle. Many of the naturally occurring alkaloids have biological activity, and some of them are being used as drugs in modern medicine (e.g. morphin, codeine, reserpine, etc.).These compounds present a great interest for the researchers due to their various pharmacological and biological activities. A diverse range of alkaloids are found in *Leptadenia* species, *Haloxylon* species, *Capparis decidua*, *Citrullus colocynthis* etc.

Tannins: Commonly referred to as tannic acid, are water-soluble polyphenols that are present in many plant foods. They have been reported to be responsible for decreases in feed intake, growth rate, feed efficiency, net metabolizable energy, and protein digestibility in experimental animals. Therefore, plants rich in tannins are considered to be of low nutritional value. Tannins can defend leaves against insect herbivores by deterrence and/or toxicity. Tannins are chemically diverse, but are functionally defined by their ability to bind protein. Arid plants including *Acacia* species, *Ziziphus* species, *Prosopis cineraria, Capparis decidua* etc. have considerable amount of tannins.

Saponins: : They are one of the most numerous and diverse groups of plant natural products. They serve a range of ecological roles including plant defence against disease and herbivores and possibly as allelopathic agents in competitive interactions between plants. The biological activity of saponins is normally attributed to the amphipathic properties of these molecules, which consist of a hydrophobic triterpene or sterol backbone and a hydrophilic carbohydrate chain, although some saponins are known to have potent biological activities that are dependent on other aspects of their structure. By expressing a large diversity of structures on both sugar chains and aglycones, saponins exhibit a wide range of biological and pharmacological properties and serve as major active principles in folk medicines. Plant-derived triterpenoid and steroidal saponins have been used in the production of steroid hormones in the pharmaceutical industry, as food additives, fire extinguishers and in other industrial applications. Other interesting biological applications include their use in anti-inflammatory, hypocholesterolemic and immune-stimulating remedies. Among arid plants, *Balanites aegyptiaca* (Hingota) is an important source of steroidal saponins such as Diosgenin.

Antioxidant capacity is the primary measurement to evaluate the state and potential of oxidative stress in aging. Since imbalance between antioxidant and oxidants generates the condition of oxidative stress, estimation of the reducing power/antioxidant capacity the first step in the prediction of oxidative stress. Currently there has been an increased interest globally to identify antioxidant compounds that are pharmacologically potent and have low or no side effects for use in preventive medicine and food industry. The widespread use of traditional herbs and medicinal plants has been traced to the occurrence of natural products with medicinal properties. As plants produce significant amount of antioxidants to prevent the

oxidative stress caused by photons and oxygen, they represent a potential source of new compounds with antioxidant activity. Apart from their protective role as antioxidants, plant secondary metabolites such as alkaloids and tannins find several industrial applications. Similarly, traditional knowledge of medicinal uses of arid plants can be exploited for the development of pharmaceutical products.

Mahesh Kumar, Saurabh Swami and Anil Patidar*
ICAR-Central Arid Zone Research Institute, Jodhpur
*ICAR-Central Arid Zone Research Institute, Regional Research Station, Jaisalmer

Know Your Desert Plant

Paneer-bandh (*Withania coagulens*): An Important Medicinal Plant of Arid Region

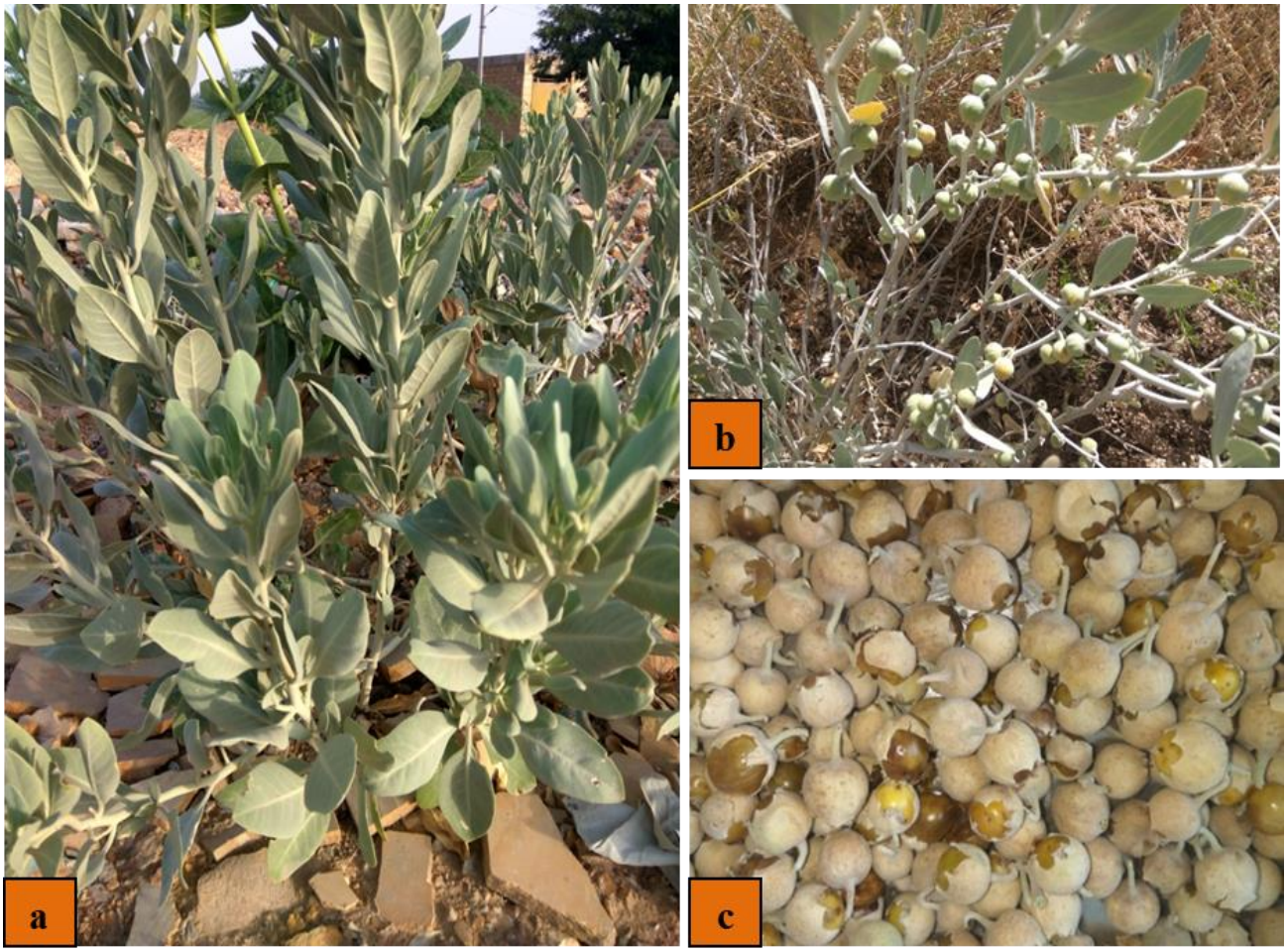
Genus *Withania* Pauq. is one of the important genus belongs to family Solanceae, which is well known for its high medicinal value in indigenous system of medicine in India. The genus is represented by two species in the western Rajasthan i.e. *W. somnifera* (L.) Dunal and *W. coagulens* (Stocks) Dunal. *W. somnifera* locally known as Asgandh or Ashwagandha is common in dry wastelands preferably in fertile soils. It is also cultivated as a medicinal crop in arid and semi-arid region and high yielding crop varieties are available for its large scale cultivation. However, *W. coagulens* is a rare species in wastelands and usually found in vegetative state. In Jaisalmer district, in natural condition sometimes it is associated with *Calotropis procera*.

Withania coagulens locally known as Paneer-bandh or Paneer-Pata or Paneer-doda as it fruit are used in coagulating milk, hence it is also botanically named as *Punneria coagulens* Stocks. It is also commonly known as vegetable rennet, Indian cheese-maker. *W. coagulens* is distributed in Afghanistan, Pakistan and India. In India it is found in Rajasthan and reported from Jodhpur, Jaisalmer, Barmer and Bikaner districts. This ashy-grey undershrub, upto 1 m high, has woody stem, which is densely clothed with mealy, stellate tomentum, sulcate when dry. Leavers are 2-7 x 1.0-2.5 cm, elliptic-lanceolate or oblanceolate, coriaceous. Fruits are globose, smooth, surrounded by the enlarged membranous calyx. Seeds are ear shaped and glabrous. Flowering and fruiting occurs from November to March.

As the local name denotes, its fruits are traditionally used in coagulating milk and preparing the cheese. The fresh and dried fruits are rubbed with a small quantity of milk and then added to the rest of milk. This property in the plant is confined to only the pulp and husk of the fruits. The plant parts like fruits, seeds, leaves and roots are widely used by local inhabitant for the treatment of various diseases. Its fruits are traditionally used as herbal medicine for liver complaints, asthma, biliousness and also in diabetes. In western Rajasthan, the fruits are

extensively used as emetic and diuretic.The fruits are commonly used for the treatment of diabetes mellitus. The seeds are emmenagogue, diuretic, useful in lumbago, ophthalmic, lesion the inflammation of piles. The ripe fruits are sedative, in intestinal infections. Leaves are used as febrifuge and as blood purifier. The tender branches used as tooth brushes.

It became rare in the western Rajasthan desert due to degradation in its natural distribution cover. Its population has decreased to a great extent and only countable collections have been available from the area like Barmer, Jaisalmer and Jodhpur districts. Hence, it is recommended that "*Ex-situ*" conservation and multiplication of germplasm through seeds and also by biotechnological approaches may give desirable results. Further, wild population of *Withania coagulens* should be protected wherever it occurs naturally. It is easily propagated through seeds. First seed are sown in the nursery and then transplanted in the field. Emphasis should be given for the *ex-situ* conservation in Botanical Gardens, National parks and Sanctuaries in the state. Its cultivation is very much required for availability of its fruits for medicine and other purposes and also for ex-situ conservation.



Naturally growing of *Withania coagulens* in wasteland of Jaisalmer (a).Fruiting in *Withania coagulens*(b).Ripe fruits of *Withaniacoagulens*(c).

J.P. Singh and Anil Patidar*
ICAR-Central Arid Zone Research Institute, Jodhpur
*ICAR-Central Arid Zone Research Institute, Regional Research Station, Jaisalmer

ENVIS Activities

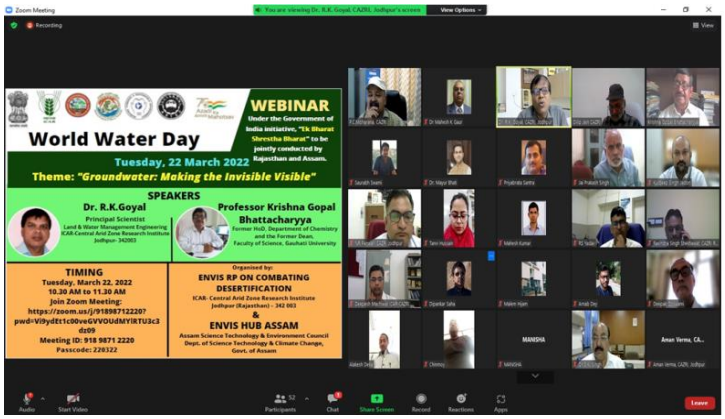
National Science Day

Celebrated National Science Day on February 28, 2022 under the imitative Azadi ka Amrit Mahotsav through webinar on this year theme "*Integrated Approach in S&T for Sustainable Future*". Dr. P.C. Moharana, Principal Scientist & Coordinator ENVIS, ICAR- CAZRI welcomed the guest speaker Professor. M.S. Reddy, Founder & Chairman, Asian PGPR Society for Sustainable Agriculture Entrepreneur & Consultant, Auburn University, Albania, USA who delivered is lecture on "*Sustainable next generation green revolution for global food security and plant health with innovative approaches*" He emphasized on need for Second Green Revolution and Smart Farming Technology and encouraging the farmers to turn on for the organic fertilizer and chemical free food production to meet a sustainable farming approach. Dr. Ritu Mawar, Principal Scientist ICAR- CAZRI, proposed the vote of thanks. The webinar was attended by 63 scientists, technical officers and other officials..

Cleanliness Drive

Conducted an outreach programme at Melba village, Jodhpur on March 14, 2022 on the theme "*Cleanliness Drive*" under Azadi ka Amrit Mahotsav. The event was held at the premises government. Dr. P.C. Moharana, Principal Scientist & ENVIS Coordinator Dr. J.P.Singh, Principal Scientist & Head of Division of Natural Resources, Sarpanch (Head of the village), men and women of the village and ENVIS staff actively participated in cleaning the school ground. A drawing competition was also conducted for the school children from class IV to VIII on the theme "*Cleanliness and Environment*". 77 students of Government Upper Primary School, Melba and Vijay International School, Piparli, Jodhpur enthusiastically participated in the competition

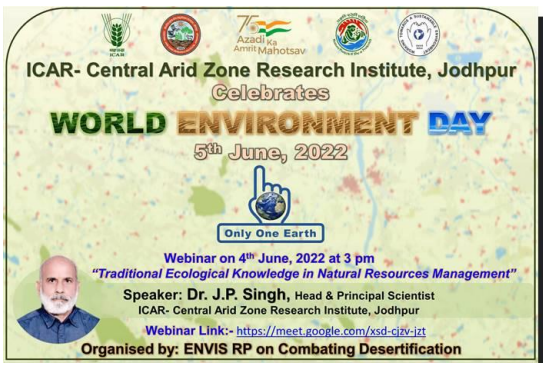
World Water Day

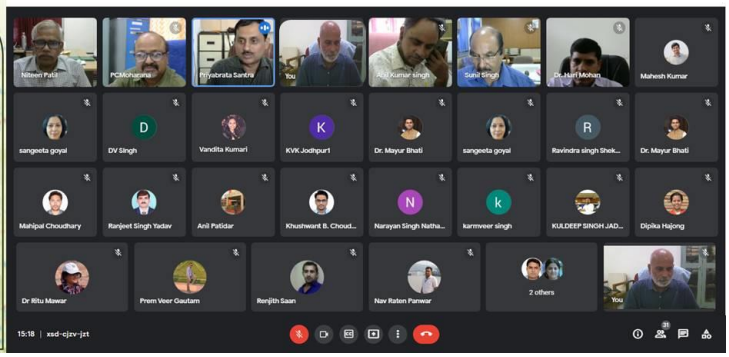


Organized a webinar jointly with ENVIS Hub, Assam Science Technology & Environment Council, Department of Science & Technology, Govt. Of Assam on World Water Day, March 22, 2022 under the initiative " Ek Bharat Shresth Bharat" and also as a part of Azadi ka Amrit Mahotsav on this year's theme "*Groundwater: making the invisible visible*". The guest speaker from Rajasthan Dr. R.K.Goyal, Principal Scientist, Division of Natural Resources, ICAR-CAZRI, Jodhpur gave his presentation on "*Water Resources of Arid Western Rajasthan and its Management Strategies*" while the guest speaker of Assam, Prof. Krishna Gopal Bhattacharyya, Former HoD, Dept. of Chemistry, Former Dean, Faculty of Science, Guwahati University delivered his lecture on this year theme focusing on eastern India specially Guwahati region. The webinar was attended by 63 scientists, officials and other participants from both the states.

World Environment Day

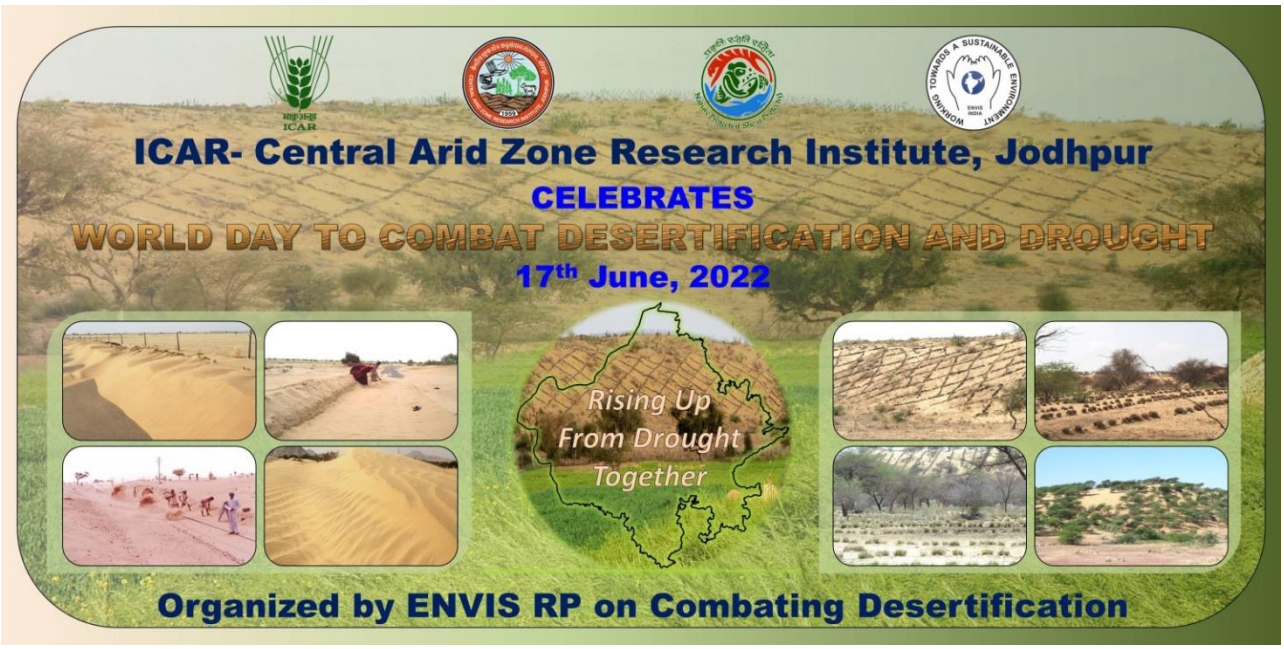
Organized a webinar on World Environment Day on June 04, 2022 on this year's theme "*Only One Earth*" Dr. P. C. Moharana, Principal Scientist & ENVIS Coordinator, at ICAR-CAZRI briefed the importance of environment day. Dr. N. V. Patil, Director (Acting), ICAR-CAZRI, Jodhpur in his opening remarks said that our earth is a livable planet and is endowed with rich biodiversity. He narrated how developmental activities and climate change factors are root cause of land degradation as well as extinction of valuable species. He urged that in order to protect our planet, there is also a need to understand the role of traditional knowledge. Dr. P. Santra, Principal Scientist, ICAR-CAZRI, gave a brief introduction of the guest speaker Dr.J.P.Singh, Head & Principal Scientist, ICAR-CAZRI, Jodhpur who delivered his lecture on "*Traditional Ecological Knowledge in Natural Resources Management*". He elaborated the meaning and importance of traditional knowledge which have ancient roots and keep on passing on from one generation to another. He presented a review of arid shrubs and trees some of which are at various stages of depletion, therefore needs conservation. 37 scientists, officials and other participants attended the webinar.

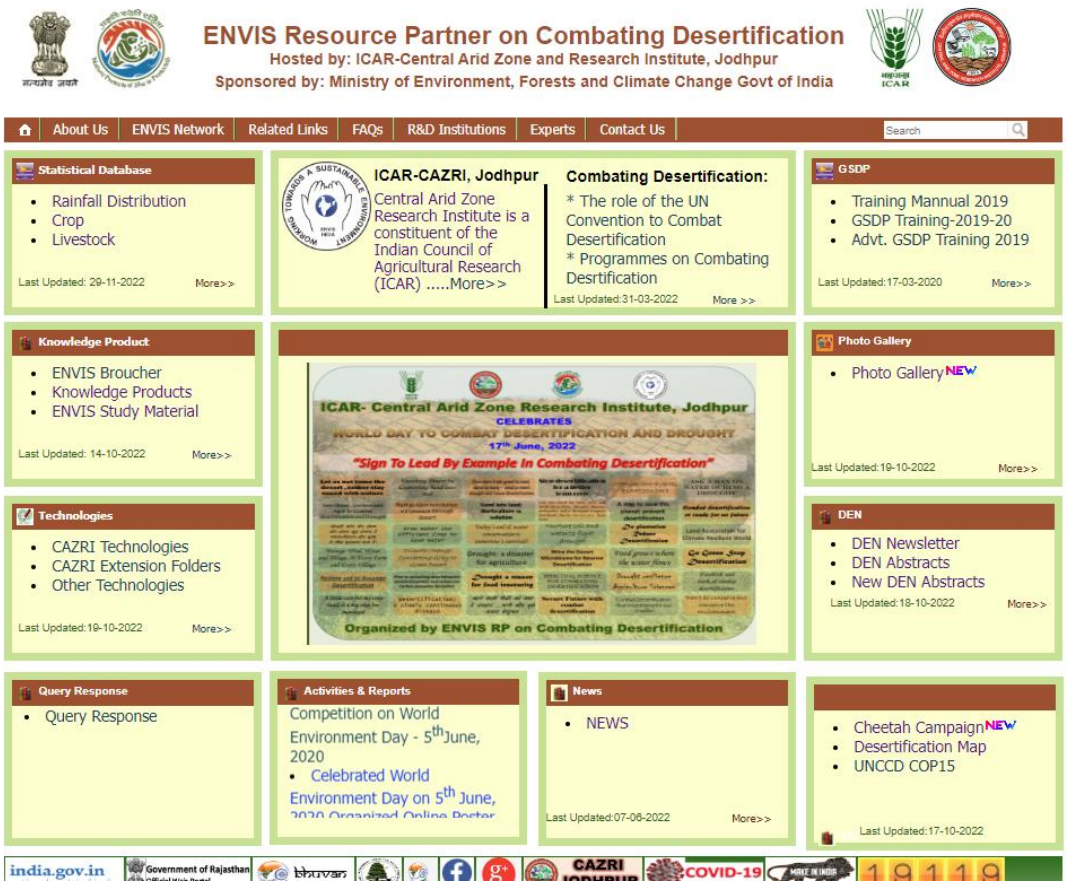




Desertification and Drought Day 2022

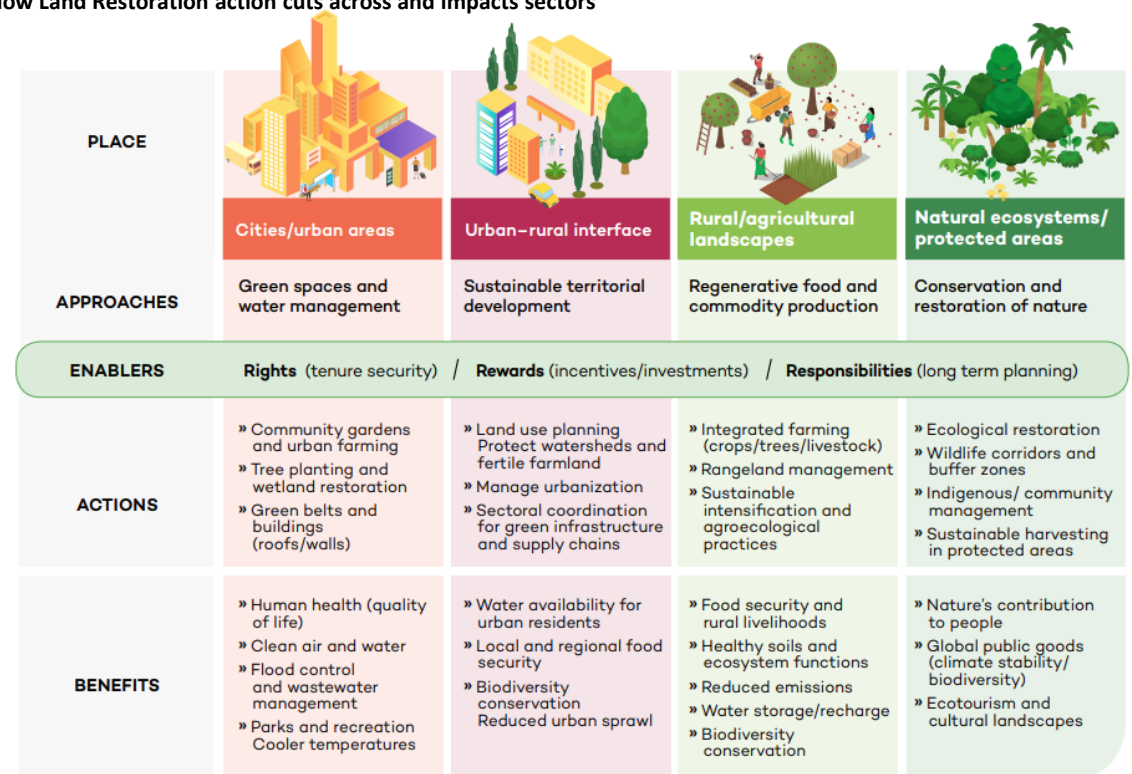
A poster was released on Desertification and Drought Day on June 17, 2022 on this year's theme "*Rising up from Drought together*" showcasing the slogans prepared by the institute scientists reflecting innovative ideas based on this year theme.





Information Around

How Land Restoration action cuts across and impacts sectors



Source: https://www.unccd.int/sites/default/files/inline-files/UNCCD_Solution%20Brief.pdf