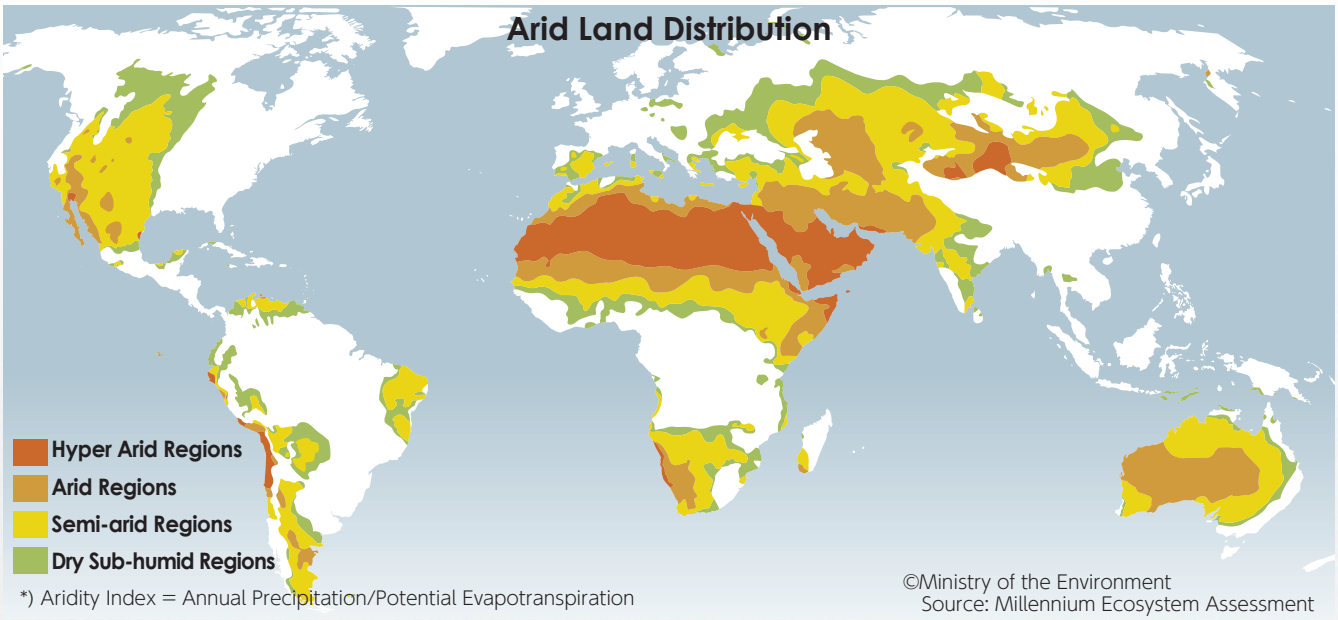
# What are arid lands? What is desertification?

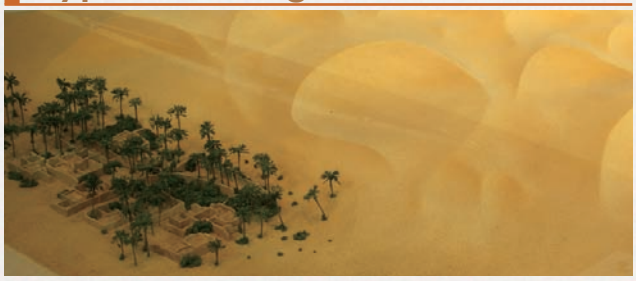
**Arid Lands** are "the lands where the amount of water lost due to evaporation or transpiration from plants is greater than the amount of the rainfall". Arid lands in the world are classified into the following four regions according to the degree of dryness (aridity index*).




*) Aridity Index = Annual Precipitation/Potential Evapotranspiration


Source: Millennium Ecosystem Assessment

## Hyper Arid Regions



**Aridity Index <0.05**
Very dry and plants hardly grow there

## Arid Regions

**Aridity Index 0.05-0.2**
Very dry and not suitable for many plants to grow

## Semi-arid Regions

**Aridity Index 0.2-0.5**
Richer in water and plants, both in kind and quantity, than Hyper Arid Regions and Arid

## Dry Sub-humid Regions

**Aridity index0.5-0.65**
Trees stand along the rivers that flow in a particular season and a large area of the ground is covered with grass

Arid lands covers 41% of the land surface.
**"Desertification"** refers to the degradation of soil in arid regions caused by climate changes and human activities. Desertification is now occurring in about six to twelve million square kilometers, accounting for 10 to 20% of the area in arid regions, and has great influence on local people, animals and plants.


Source : Wisdom and Technology to Save Arid Lands (Maruzen Publishing)

Photo: Tazhong, a town in Taklamakan Desert, China

# What research is in progress at ALRC?

## Research Divisions

### Division of Integrated Desertification Control

Research on technologies and projects to comprehensively handle various problems in arid lands

- Development of the next-generation Sustainable Land Management (SLM)
- Comprehensive studies on Land Degradation Neutral World (LDNW)
- Elucidation of dust (Asian dust) emission mechanism
- Development of Dust Storm Early Warning System
- Studies on sustainable livestock production systems that will contribute to livelihood improvement in arid regions
- Development of effective strategies for inhabitants' livelihood improvement through development projects in arid regions

### Division of Environment Conservation

Elucidation of natural environmental characteristics of arid lands and development of conservation and restoration technologies

- Establishment of advanced methods for monitoring of desertified areas and development of assessment and diagnostic methods of natural disasters in arid regions
- Elucidation of interactions between precipitation, river/lake water, and groundwater in arid lands
- Investigation on drought/salt tolerance mechanism of trees and its application to afforestation
- Elucidation of ecology and functions of plant symbiotic microorganisms and their application to environmental restoration
- Research on drought adaptation strategies of wild animals and plants and establishment of ecosystem conservation methods

### Division of Agricultural Production

Development of sustainable agricultural production technology and biological resources for arid lands

- Elucidation of drought-related stress response mechanism of plants based on physiological and molecular aspects and its application to vegetation restoration
- Investigation on mechanisms for metabolism and regulation of plant hormones related to drought stress and development of drought tolerance inducing compounds
- Exploration of drought stress response genes and development of resistant crops by means of function analysis and genetic recombination technologies
- Breeding of drought-tolerant crop strains by the introduction of genes and chromosomes of closely related wild plants
- Numerical modelling of degradation of agricultural land and development of technology for its prevention and restoration
- Development of water harvesting and water-saving irrigation technology

### Laboratory of Arid Land Plant Resources

Support to research by collection, preservation and condition improvement of food crops and resource plants of arid landss

- Collection, reproduction and provision of arid lands resource plants
- Collection and database creation of information on arid land plants
- Responding to treaties, laws and regulations related to plant use

## Joint Usage/Research with Japanese research institutes and universities

This center is a nationwide Joint Usage/Research Institute which conducts research on arid lands in collaboration with research institutes and universities in Japan and overseas. ALRC hosts annual joint research conferences where researchers share their findings actively exchange their opinions and attend special lectures on relevant topics.

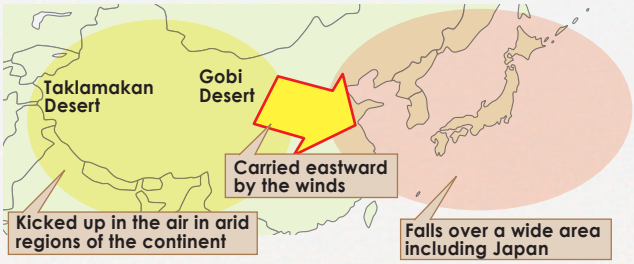
## Selection of drought-tolerant soybeans utilizing sand dune fields

Drought-tolerant soybeans of more than 400 strains collected worldwide are evaluated, considering the characteristics of sand dune fields. By means of genotype analysis and trait characterization of all strains, optimal soybeans that will increase the yield in arid environments are efficiently selected. ALRC is currently conducting a research project adopted as a Core Research for Evolutionary Science and Technology (CREST) with the University of Tokyo.

## Countermeasures for Asian dust emission and assessment of its impact on humans and the environment

Field studies of the Asian dust influence on people and ecological system are underway in the arid areas of Mongolia and China, where damages have increased, and also in Japan which is affected by the Asian dust. In addition, we are studying the dust emission mechanism of Asian dust and dust storms and the measures to be taken at their sources

In recent years, with the progress of desertification in East Asia, the increase of dust storms frequency near the hot spots and the expansion of the damages caused by Asian dust are worsening problems in countries on the leeward.

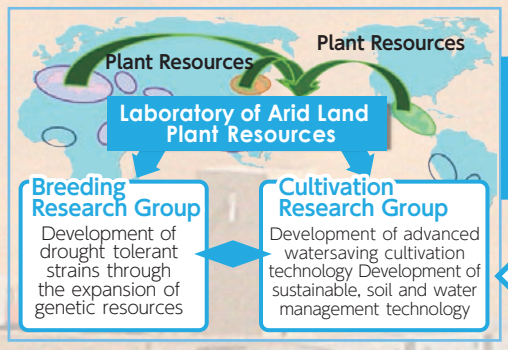


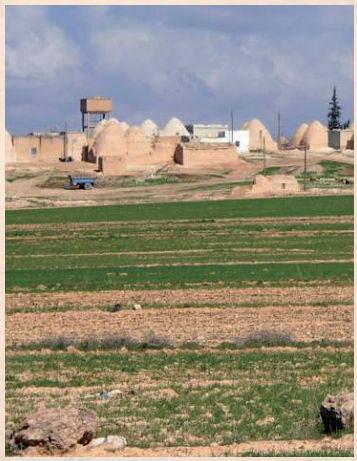

A health survey in Mongolia

## Development of crop husbandry technology utilizing arid land plant resources in marginal rain-fed environment

As there is a concern about further reduction of freshwater resources such as agricultural water, it is very important to establish a strategy of sustainable agricultural development of unutilized arid lands. It is crucial not only for the stable livelihood of inhabitants in the arid regions, but also for the achievement of worldwide stable food supply. In this project ALRC is trying to develop the "Plant & Cultivation Technology Package" which will enable the stable crop husbandry in the marginal rain-fed environment with about 300 mm annual rainfall. That will be achieved through the development of drought-tolerant crops based on useful plant resources provided by overseas partners and the cultivation and afforestation technologies developed by Tottori University,

- **Development of drought-tolerant plants (for food, forage and oil) and their cultivation techniques**
- **Advanced utilization of plant resources and its on-site demonstration in collaboration with overseas research institutes**



# Experimental Facilities and Equipment

## Arid Land Dome

So named after the English word "Arid Land" meaning "dry land". It is a dome-shaped glasshouse in which large scale experiments and simulations are carried out under controlled environmental conditions based on arid regions on-site information.

## Desertification Mechanism Analysis System / Monitoring System for Water and Solute Transport

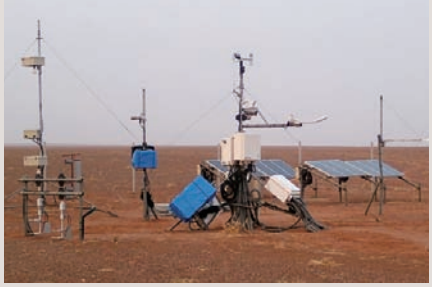
Desertification Mechanism Analysis System, which can simulate dry hot air conditions specific to arid lands, used in combination with the Monitoring System for Water and Solute Transport is used to analyse the drought and salinity stress, under strong evaporative conditions, and to investigate the mechanism of salt accumulation in soil under dry conditions.


## Desert Simulator

The Desert Simulator can simulate high and low temperature arid environment. It is used for the development of sustainable plant husbandry systems for subtropical desert and cool desert as well as for the R&D of soil management technology.

## Dust Monitoring Station (Tsogt-Ovoo, Mongolia)

One of the experimental facilities installed in Mongolia. It measures concentration and meteorological factors of Asian dust pushed up into the air from the ground surface. It also shows the ground surface conditions where Asian dust is generated



## Arid Land Academic Specimen Exhibition Room (Mini Desert Museum)

At the Mini Desert Museum, you can get an insight of arid regions environment with the help of models, images, panels, etc. The process of desertification as well as agricultural and afforestation technologies utilized in arid lands are presented. Materials and specimens collected during field missions and surveys are exhibited as well. It is open to the public on holidays.

## ◆ Events and Visits

ALRC welcomes all those who want to know more about arid lands and our Center through activities listed in the table. Please visit our website for more information.
**http://www.alrc.tottori-u.ac.jp**

| | |
|---|---|
| Open Campus | Arid Land Dome laboratory facilities etc. are open to the public once a year. ALRC is planning more fun events. |
| Public Opening on Holidays | The Exhibition Room (Mini Desert Museum) is open to the public between 12:00 and 16:00 on Saturdays, Sundays and national holidays (excluding New Year's holidays). Walk-ins are welcome. |
| Let's be a "Dr. Desert"! | ALRC annually hosts a hands-on experience event geared toward 4-6 grade elementary school pupils. |