Databases of Oman's Genetic Resources and Intellectual Property Protection

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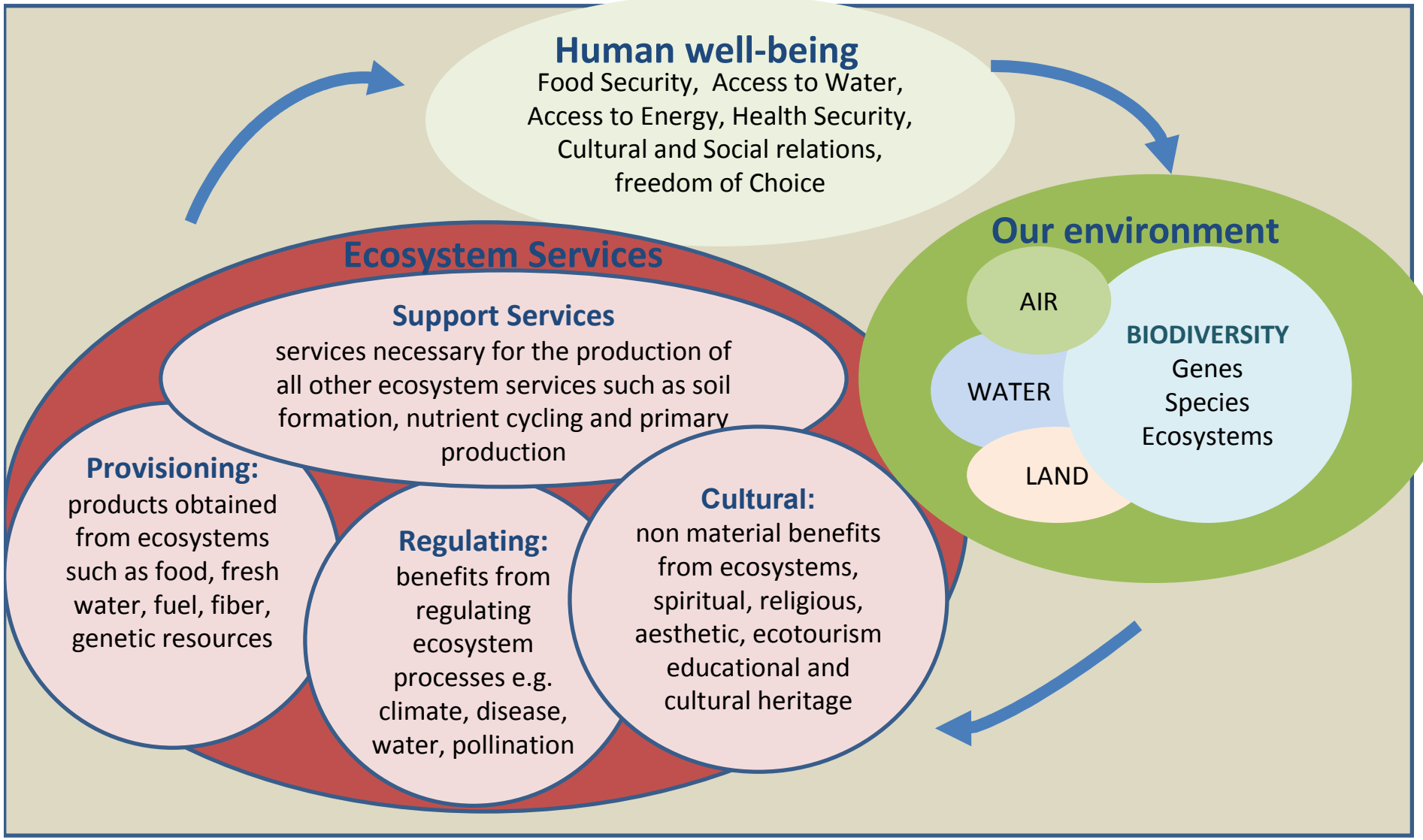
Human well-being is linked to biodiversity, ecosystem services, poverty reduction and sustainable development…

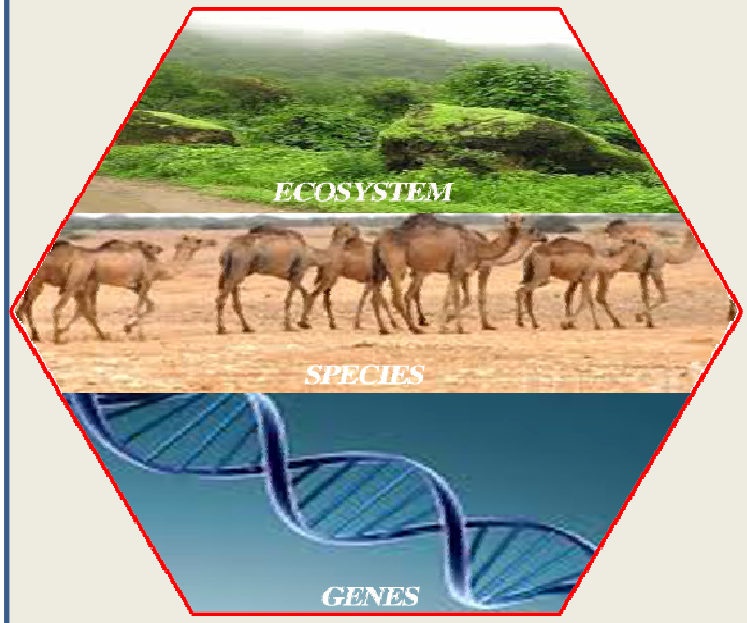


Adopted from IUCN, Conservation for a New Era by: Jeffrey A. McNeely and Susan A. Mainka

Biodiversity, the variety of life form on earth

biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
(CBD, Article 2)

Biodiversity, the variety of life on earth, includes ecosystem diversity, species diversity, and genetic diversity.



Ecosystem

- Deserts, mountains, agricultural land, wetlands , islands and marine areas

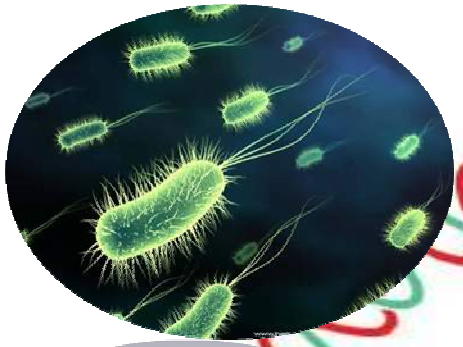
Species

- Mammals, plants, birds, amphibians and reptiles, fish, microalgae, sea grasses, corals, mollusks, crustaceans, and echinoderms, fungi, bacteria, virus

Genetic

- Plant cultivars and land races, crop wild relatives, local breeds of livestock, fish and microbial species

What are Genetic Resources?



Defined as biological materials of actual or potential value containing functional units of heredity

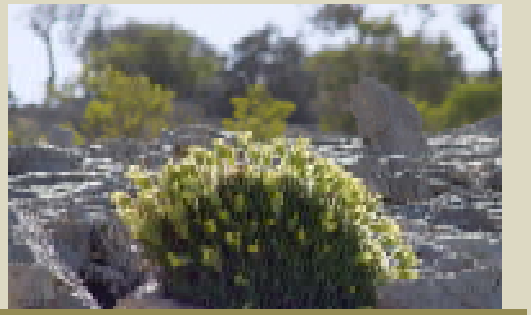
{CBD, Article 2 }

Oman has Diverse Climatic Regions

It is blessed with abundant and unique fauna and floral biodiversity

- **The biodiversity of Oman reflects its position between two bio-geographic regions, the biodiversity of northern Oman more closely resembles that of Asia, whereas further south the principal influence is Africa.**
- **Oman is endowed with 47 species of terrestrial mammal, 19 species of marine mammals, 1,208 species of plants, around 10 livestock species, 128 breeding species of birds, over 130 coral species, and 5 turtle species.**

Humpback Whale (Megaptera novaeangliae)

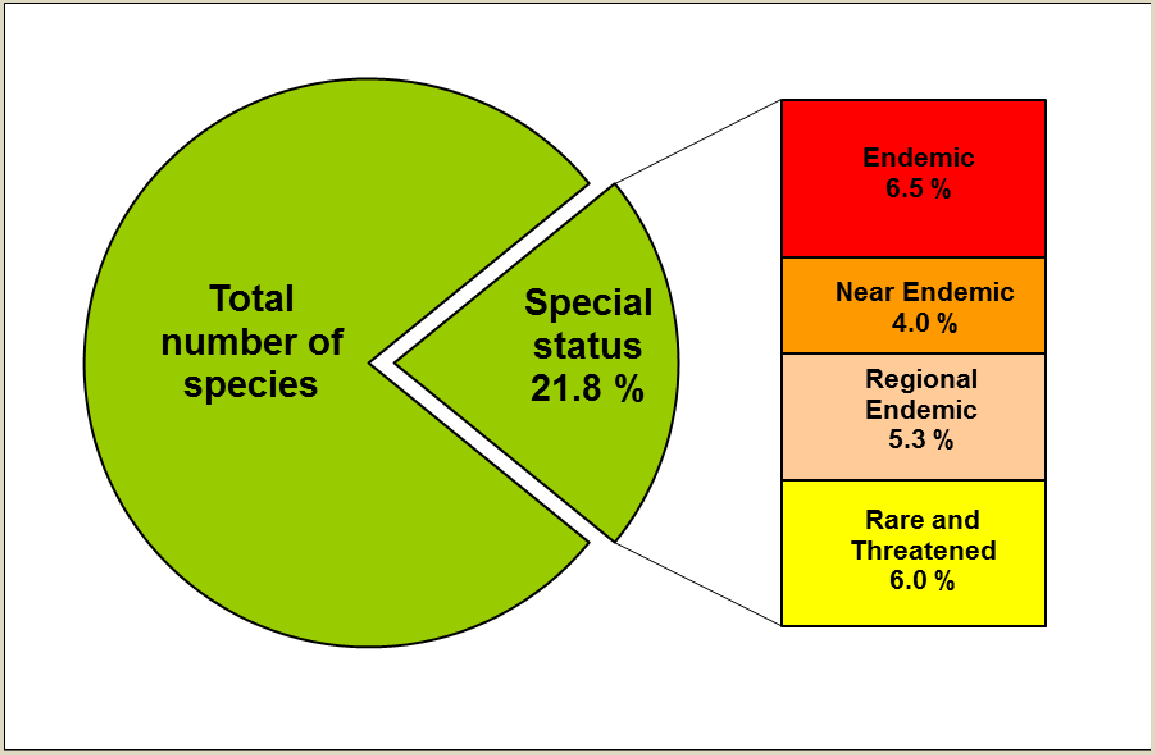


Dionysia mira (Primulaceae) A endemic species.

Found in some localities in the high altitudes of the Jabal Akhdar range in Northern Oman. Photo Courtesy of Dr R Victor (SQU)

Arabian oryx (*Oryx leucoryx*)
Courtesy: Office for Conservation of the Environment, Diwan of Royal court

Oman is an important centre of endemism



Exacum aff. *affine*
Endemic,
Endangered

Gladiolus italicus
Rare, Near Threatened

Barleria samhanensis
Endemic, Critically
Endangered

Source: A. Patzelt, Oman Plant Red Data Book, Oman Botanic Garden

Aquatic

Terrestrial

Animal

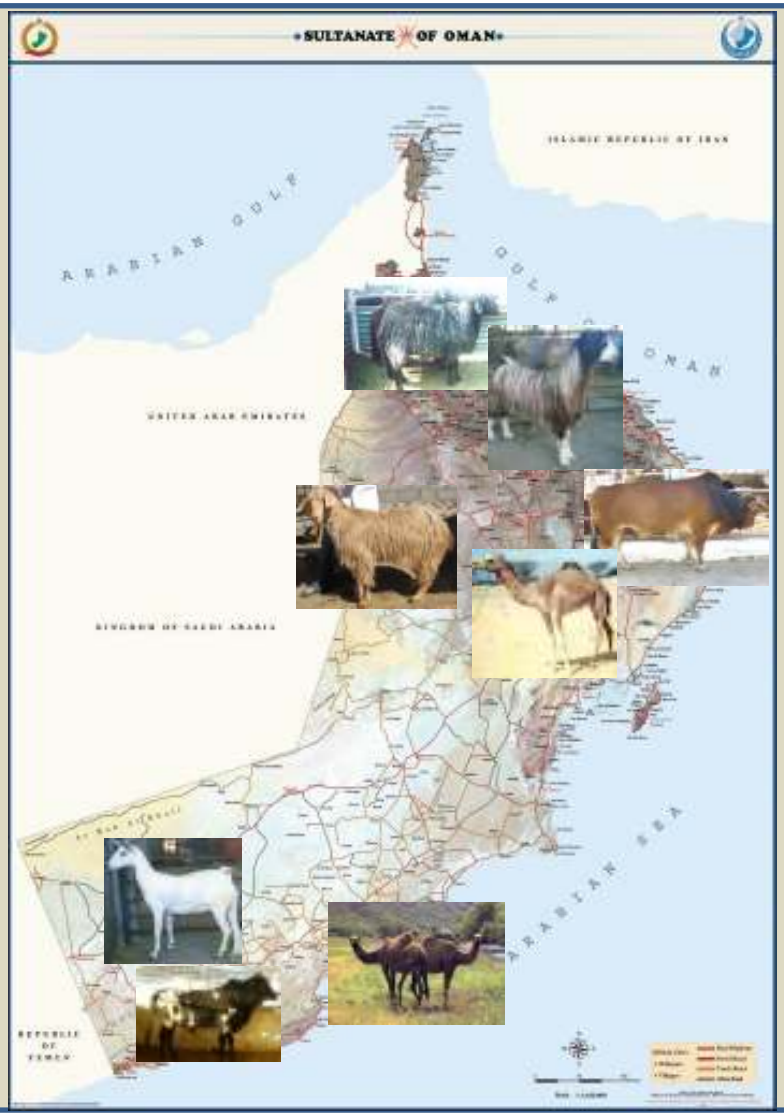
Plant

Micro-organisms

Despite its arid climate, Oman possesses abundant domesticated animal genetic diversity…

Species	Population	Breeds
Goats	1,619,990	6
Cattle	313,580	2
Sheep	380,000	1
Camels	124,520	8?
Donkeys	28,500	1
Total	**2,466,590**	

Livestock (FAOSTAT 2008-2009)



(Courtesy: Professor Osman Mahgoub)

A unique marine genetic diversity is accessible from the long shores of Oman recognized by scientists around the world

- Many fish only found in specific parts of the Omani coast

- *Amphiprion omanensis*
- Omani clownfish: found only in Dhofar between Mirbat and Masirah in two distinct populations one north one south

- *Acanthatreas maxima.*
- This species was discovered in Muscat but later found along most of the NE Arabian Sea and Gulf of Oman.

- *Ferdina sadhensis*
- An unusual starfish endemic of the Eastern Indian Ocean and named after Sadh.

- Oman is endowed with beautiful coral reefs.

Monospecific bed of Montipora sp. at Bar Al-Hikman.

(Photos: Courtesy Dr . M. Claereboudt)

The unique geo-conditions have given birth to a diverse range of plant genetic resources…

Category	Crop Species
Field Crops	***Wheat, Barley, Oats, Sorghum, Maize, Chickpeas, Cowpea, Sesamum, Safflower, Sunflower, Cotton, Sugarcane, Alfalfa, Elephant grass, Tobacco***
Vegetable Crops	***Garlic, Onion, Watermelon, Muskmelon, Carrot, Sweet potato, Cucumber, Radish, Okra, Tomato, Lettuce, Cabbage, Cauliflower, Squash and Potato***
Fruit Tree crops	***Date palm, Mango), Acid lime, Sweet lime, Pomegranate, Grape, Papaya, Banana, Guava, Coconut***
Pasture trees, shrubs and grass species	***Prosopis cineraria, Acacia tortilis, A. ehrenbergaina, A. senegal, Anogeissus dhofarica, Maerua crassifolia, Ziziphus, Olea europaea, Blepharispermum hirtum, Calligonum comosom, Euclea schimperi, Pteropyrum scoparium, Maytenus dhofarensis, Cenchrus ciliaris, C. setigerus, Apluda mutica, Themeda quadrivalvis, Dactyloctenium aegypticum, Panicum turgidum, Pennisetum divisum.***

..as well as multiple land races that go way beyond the typical palm tree expected in the Arabian peninsula

Crop	Local cultivars/landraces	Crop	Local cultivars/landraces
Acid Lime (*Citrus aurantifolia)*	Local (Lomy)	Mango (*Mangifera indica)*	Al-ward, Al-khokh, Al-halqoom, Quriate-15, Rumais-89, Muscati .
Alfalfa (*Medicago sativa*)	Bathini, Interior, Sharqiya, Rustaq, Quriati	Onion (*Allium cepa)*	Local
Banana (*Musa sp.)*	Fard, Barshi, Nagal, Somali, Malendi, Red	Papaya (*Carica papaya)*	Local seedy strains
Barley (*Hordeum vulgare)*	*Bathini, Doraqui*	Pearl millet (*Pennisetum glaucum)*	Tall local
Ber (*Zizipus mauritiana)*	Seeded, Seedless (Maqatmani)	Pomegranate (*Punica granatum)*	Malasi, Jabal akhdhar
Carrot (*Daucus carota)*	Local	Radish (*Raphanus sativus)*	Local
Chickpea (*Cicer arietinum)*	Local	Safflower (*Carthamus tinctorius)*	Local
Coconut (*Cocos nucifera)*	Local, Al-Malki	Sesame (*Sesamum indicum)*	Local
Cotton (*Gossipium arboreum)*	Brown	Sorghum (*Sorghum bicolor)*	Red, White
Cowpea (*Vigna unguiculata)*	Brown, Black, Mottled	Sugarcane (*Saccharum officinarum)*	Bahlawi, Nizwawi, Dhofari
Cucumber (*Cucumis sativus)*	Local, Dhofari	Sweet Lime (*Citrus limetta)*	Burgab, Daire
Datepalm (*Phoenix dactylifera)*	186 landraces	Sweet melon (*Cucumis melo)*	Local
Garlic (*Allium sativum)*	Bahla, Rustaq, Tanuf, Jamah	Sweet Potato (*Ipomoea batatas)*	Red, White
Grape (*Vitis vinifera)*	Black and White	Tobacco (*Nicotiana tabacum)*	Suwaida, Musdaria, Fannashia, Omlaein, Hitathi
Guava (*Psidium guajava)*	Red and White	Wheat (*Triticum aestivum)*	Coolah, Saraya, Hamira, Waledi, Missani
Maize (*Zea mays)*	White, Red, Yellow		

The climatic conditions and multiplicity of ecosystems also mean that Oman has a rich microbial life

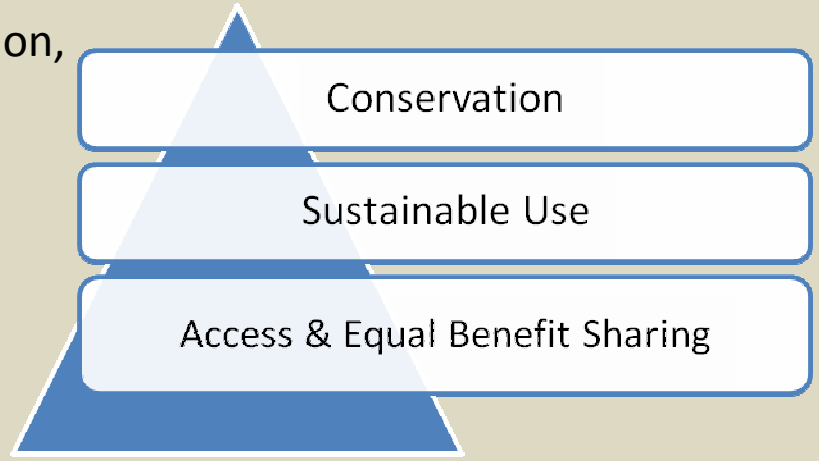
- In addtion, Oman's desert soils contain unique species of bacteria Inclluding "water tracking cyanobacteria" – hydrotaxis
- Marine Microalgae and diatoms adapted to growth in Oman's Costal waters are also a useful resource for future biotechnological Projects
- The role of microbes in soil stabilisation and water retention is also important

Oman is committed to global initiatives in biodiversity conservation in general and genetic resources in particular…

- Royal Decrees were issued on the ratification of international treaties such as:
  - The convention of Biological Diversity (CBD) (Royal Decree No. 119/1994)
  - The Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (Royal Decree No. 10/1997)
  - The International Treaty on Plant Genetic Resources for Food and Agriculture (57/2004)

- The overall aim of the CBD focuses on conservation, sustainable utilization and fair and equitable benefit sharing as per the Nagoya Protocol.

- A National Biodiversity Strategy and Action Plan (NBSAP) was published in 2001…



Why are Genetic Resources important

VALUE FROM GENETIC RESOURCES COULD BE CREATED THROUGH FOOD SECURITY, HEALTH PRODUCTS, BUSINESS OPPORTUNITIES AND TOURISM

Uses of Genetic resources

Use of genes in modern agriculture

Enzymes for industrial manufacture

New pharmaceutical drugs

Intellectual Property Business Opportunities

Food security

Over the next 40–50 years, the world's population is projected to reach 9 billion, up from 6.8 billion today.

"Genetic resources in agriculture are the key to food security"

New varieties of wheat discovered that have adapted to arid conditions

Genetic resources are the raw materials of many health benefits…

Quinine a common malaria drug
was first manufactured from the bark of a
cichona tree, a rainforest tree

The first well known antibiotic penicillin, effective against infections such as syphilis and staphylococcus was extracted fro the *Penicillium* fungi

Health benefits

Franckincense

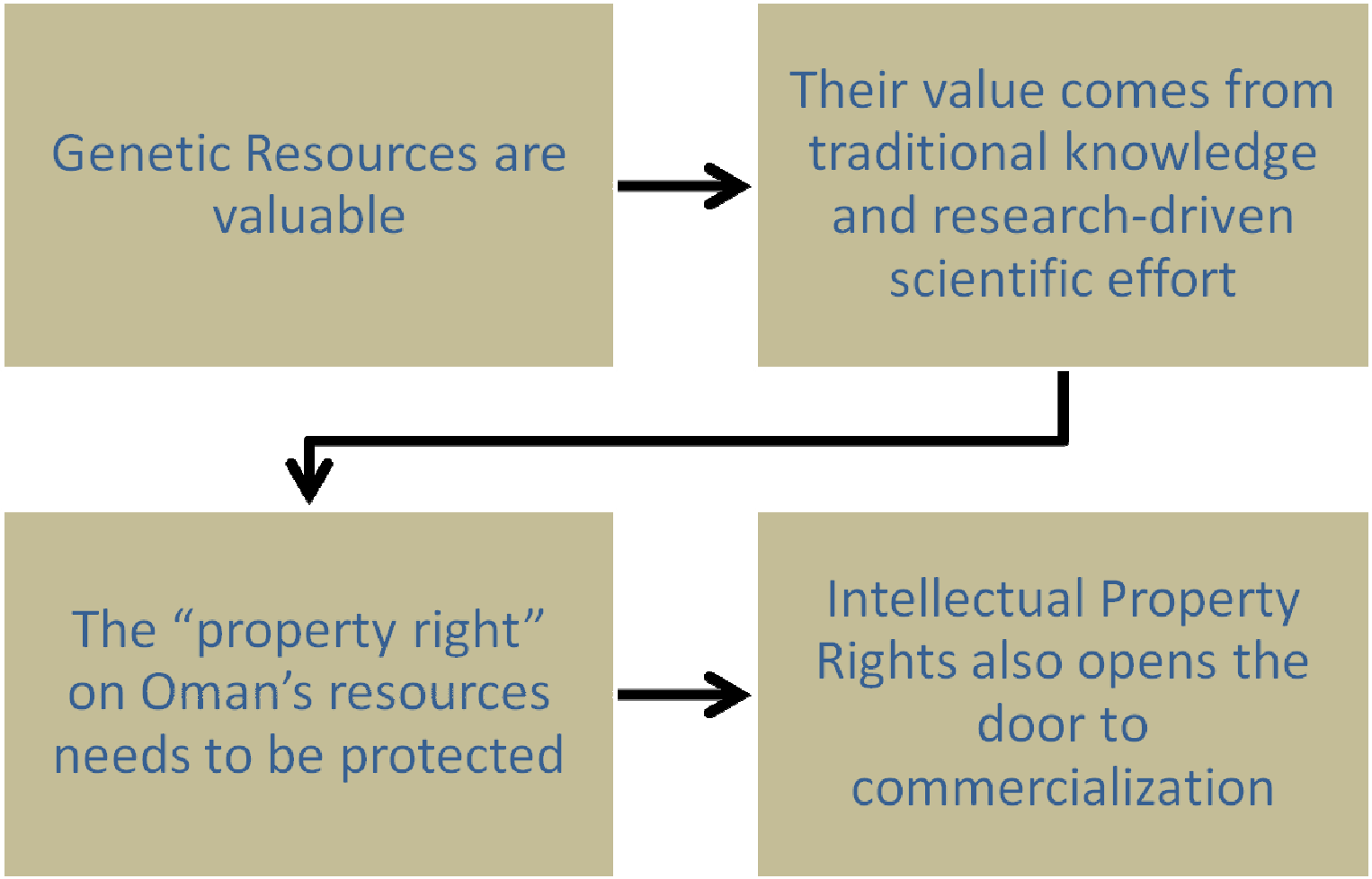
(*Boswellia Saca.)*

Frankincense oil is one of the most highly prized essential oils in the world, used since antiquity for its medicinal, energetic, cosmetic, and perfumery applications.

It is used in clinical aromatherapy for a wide range of symptoms, including skin diseases, respiratory and urinary tract infections.

UNIQUENESS AND DIVERSITY ARE THE SOURCES OF VALUE IN GENETIC RESOURCES

The creation of Intellectual Property Rights related to genetic resources would protect and enhance Oman's assets



Documentation of genetic resources

Documentation of genetic resources is referred to as the process of identifying, acquiring, sorting, storing, managing and dissemination of information on the genetic resource or germplasm. It implies the collection of data and organization of a system to store and conserve the data (painting et al. 1993).

Benefits of Documentation of genetic resources

Benefits from documenting information are manifold including;

- setting priorities
- planning activities
- management of the genetic resources.

This allows for easy access to the information and hence efficient use of the genetic resources.

The Characteristics of a Good Documentation System

- valid information,
- easy to retrieve data,
- easy to operate
- well organized data.

The data collected would include :

- collection or passport data i.e. collection date, collectors name, location and site description and the nature of the sample.
- Also the registration data including the accession number, scientific name, common names etc.
- As well as, in case of plant species, the seed data, viability number of seeds.
- Regeneration, multiplication and characterization data, such as morphological, physiological and molecular, is also stored in the information system.

Importance of National Databases

Standardization and sharing of information

- With the development of genetic resource databases comes an important aspect of the potential of standardization of information to international standards for documentation of information in a computerized format.
- A national database allows all information pertaining to the genetic resources registered in the database to be uniform amongst the different organization.
- The national databases can also serve as a tool Knowledge and information sharing and for communication and coordination amongst different national stake holders.

Importance of National Databases

Protection of GR and TK in the IP system

- Documentation of genetic resources or their associated traditional knowledge is controversial
  - bio piracy
  - “Prior art“ information.
- Databases are evolving to include molecular data
- Transparent systems need to be established to bring about a sense of trust amongst the providers and users of the genetic resources and their associated traditional knowledge.

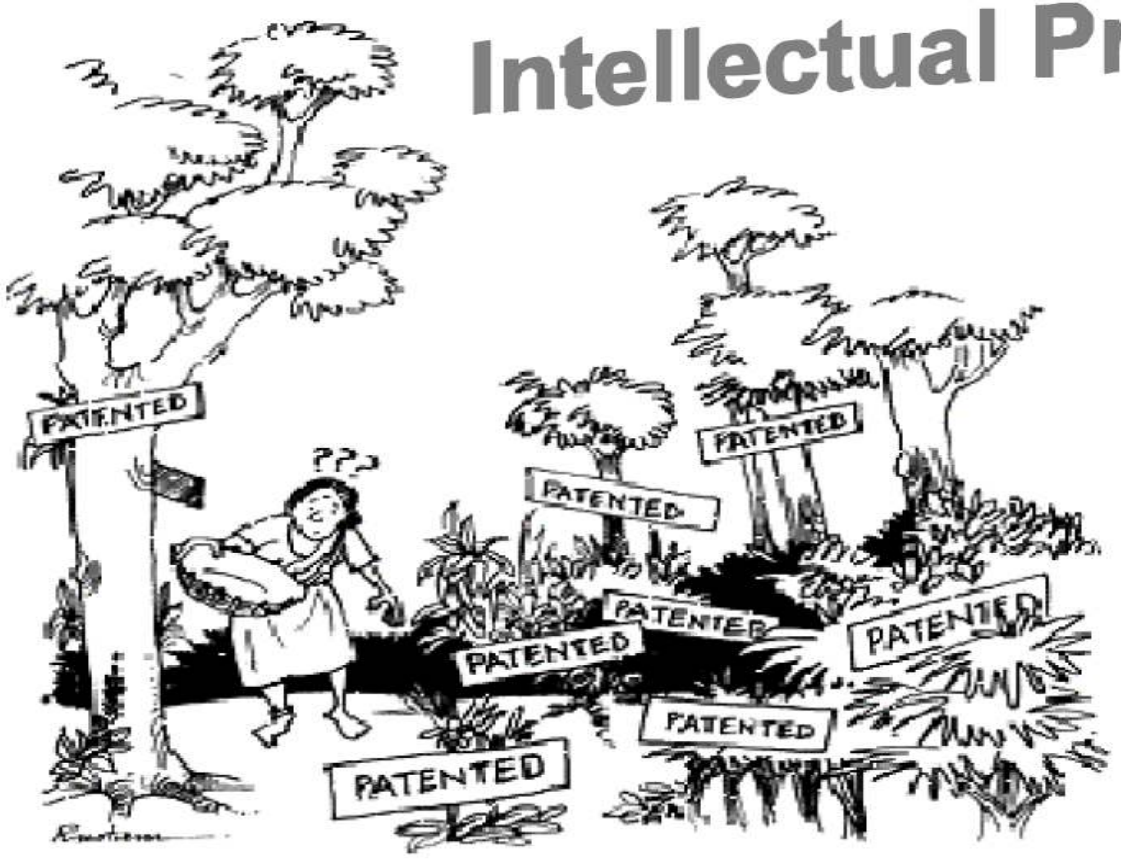
Know what you have

"Bio-piracy is about unlawful use, not only about patents. Users of biological resources and traditional knowledge must comply with the provisions of the Convention on Biological Diversity, especially those relating to Prior Informed Consent on Mutually Agreed Terms, including in relation to Benefit Sharing."

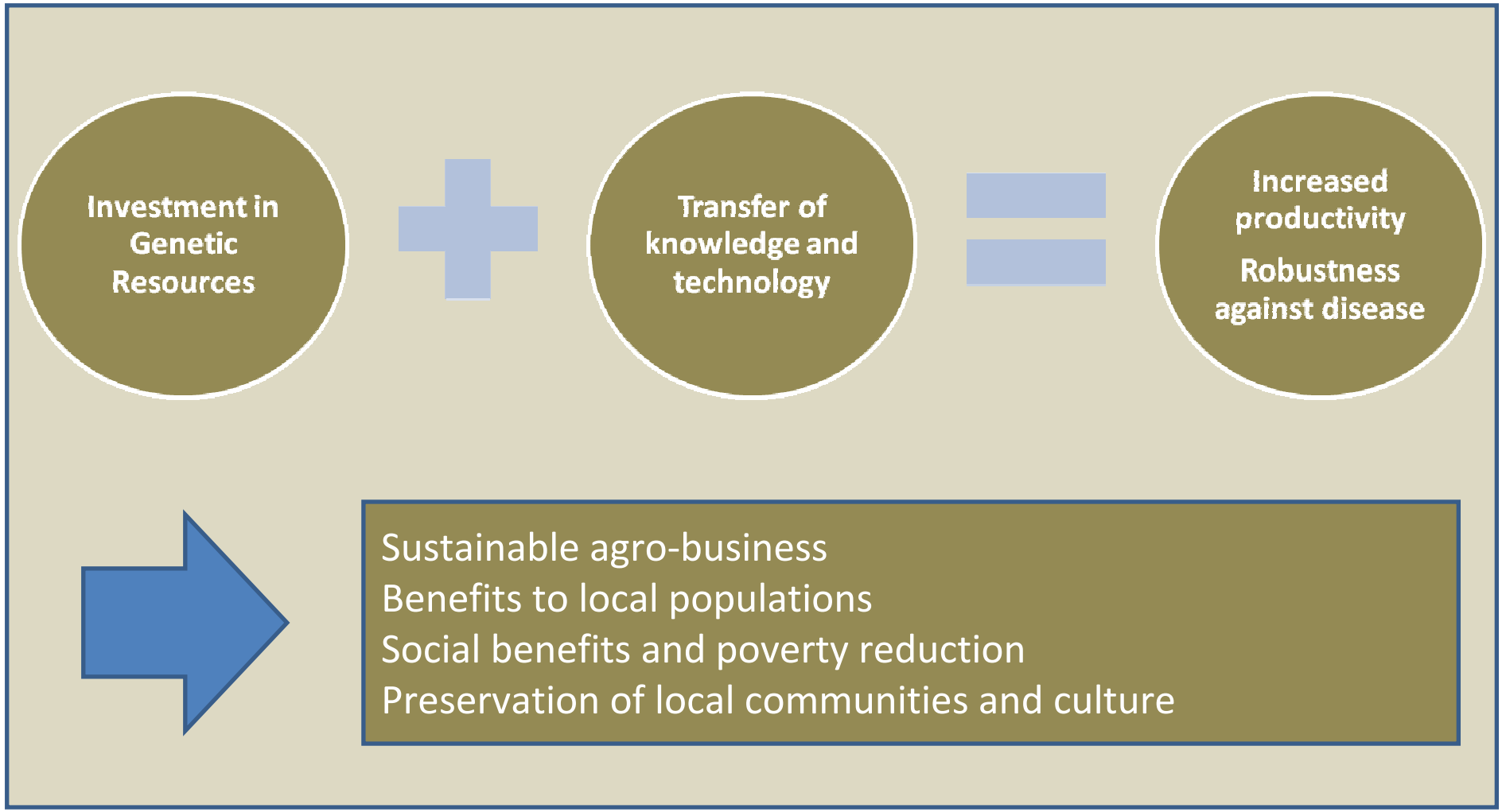
African Center for Biosafety (ACB)

Intellectual Property Rights related to genetic resources would protect and enhance Oman's assets

Traditional Knowledge and Intellectual Property



Protecting and studying Oman's genetic resources, would lead to many economic benefits



The National Plant Genetic Resource Database

Oman uses the National Mechanisms portal and databases on the conservation and sustainable use the PGRFA which was established by 64 countries worldwide with the participation and contribution of more than 1,000 public institutions, non-governmental and private organizations, including farmers' associations, from the PGRFA world community that, are involved in the conservation, monitoring, multiplication, improvement, exchange of genetic resources.

The National Plant Genetic Resource Database

The Plant Genetic Resource database for Food and Agriculture aims:

- Improve the ability of the countries to make decisions about plant genetic resources including establishing objectives, defining needs and allocating resources;
- Build stronger partnership among stakeholders in plant genetic resources management within each country;
- Increase understanding by stakeholders in each country about the status of their plant genetic resources;
- Increase the ability of countries to monitor changes in the status of their plant genetic resources over time;
- Improve the quality of information about plant genetic resources on national, regional and global levels; and
- Enhance the capacity of countries to meet international reporting obligations (GPA, Second Report on the State of the World's PGRFA, CBD etc)

Other Databases in Oman

The Ministry of Regional Municipality Environment and Water Resources (MRMEWR)

has two databases one for the Marine Turtles and one for Animals. They use two forms MS-Access and Oracle and their data is shared amongst numerous users.

The National History Museum (NHM)

possesses several databases on insects, animals and shells. The databases are developed with MS-Access are stored in standalone computers. More that forty years of data have been entered and updated with out gaps. These databases are used for the specific use of the museum.

The Environment Society of Oman Whale and Dolphin Research Group

The database contains geographical, ecological and behavioural data of live sightings and stranding cetaceans of Oman. Their database is assessed by members of many organizations.

Other Databases in Oman

Sultan Qaboos University Herbarium (Plants)

contains an MS-Access database with information on geographic, location, habitat and scientific names of plants. It carries data of more than 20 years.

Sultan Qaboos University (Birds)

This is a database maintained by the center on Environment Studies and Research (CESAR).It is a *Profox* database with data on birds from 1832 to present updated once a week. The data includes geographic locations, scientific names and authorities.

Constraints

- Lack of coordination
- Lack of information sharing
- Lack of infrastructures
- Lack of human resources
- Financial constraints

Animal and Plant Genetic Resource Center

Vision
The APGRC's Visions is to sustain human well-being and wealth creation through the description, conservation, characterization and use of Oman's genetic resources.
Mission
To promote the recognition, exploitation and valuation of the genetics diversity inherent in its animals, plants and microorganisms as a natural heritage resource

Goals				
Documentation	**Conservation**	**Coordination**	**Utilization**	**Services**
Research	**Education**	**Advice**	**Innovation**	**Investment**

Conclusion

Oman has unique and diverse genetic resources and associated traditional knowledge

It should be protected and valued

Its our legacy for the future and wealth for the present