



Biological Interventions for Sand Storm Management in Oil Wells in Kuwait

Dr. P.P. Bhojvaid, Senior Fellow

Models and strategies for afforestation of difficult sites

- ◆ **Developed models for rehabilitation of wastelands**
- ◆ **Developed models for reclamation of saline and alkaline soils**
- ◆ **Developed models for rehabilitation of waterlogged areas**
- ◆ **Developed technology for reclamation of mined area and mining dumps**
- ◆ **Prepared a comprehensive plan for combating desertification in Thar desert areas**

- **Restoration Through**
 - **Assisted Natural Restoration**
 - **By grasses, NWFP and**
 - **Other economical plants**



Eco-restoration of mined areas

Rock Phosphate mined area

Initial Biomass- Negligible

Species introduced- 16

Before



After



Biomass after 10 year

Tree- 41 tones/ha

Under shrub- 2.8
tones/ha

Species diversity- 46

ECO-RESTORATION OF MINE DUMPS

Quartz dumps, magnesite / lime stone mine spoils
at Madukarai, Tamil Nadu

Casuarina and Acacias



Rehabilitation of Red mud ponds



Before treatment

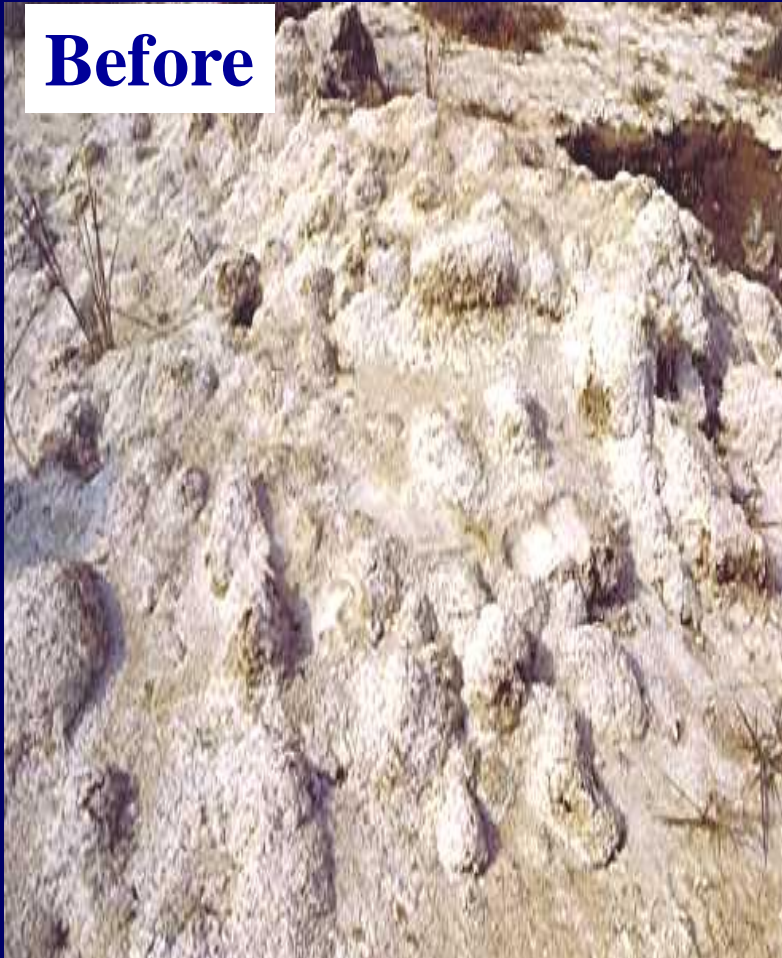


After treatment

SODIC SOIL RECLAMATION

- Soil amendments with Gypsum, Rice husk and Mulch
Prosopis, Acacia, Tamarix and Pongamia

Before



After



Desert afforestation

Problems

- **Shifting sands**
- **Lack of water**
- **Large diurnal temperature variation**



Desert afforestation

- ◆ Strategy

- ◆ Controlling movement of sand

- ❖ Brushwood vegetation barriers
- ❖ Windbreaks and shelterbelts

- ◆ Choice of species

- ❖ Hardy, drought resistant, nitrogen fixing, etc

- ◆ High quality planting stock

- ❖ Favorable root:shoot ratio

Desert afforestation



Strategy

- ◆ **Appropriate planting techniques**
 - ❖ **Pit planting and covering with agronet, geomat**
 - ❖ **Water conservation and judicious use**
- ◆ **Bacterial and mycorrhizal inoculation**

Past efforts in Thar sand dunes



Tree Growth acts as barrier & checks moving dunes



Alianthus excelsa Plantations





Tamarix articulata: Acknowledged desert Plant



Salinity and Aridity



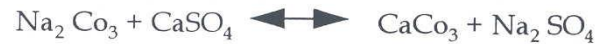
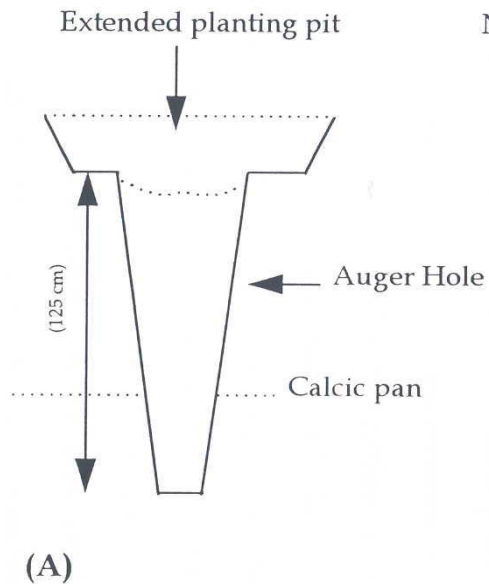
Salinity is Characterized by accumulation of salts on soil surface



Invariably saline/alkaline areas have hard calcium pans



Root Zone management for restoration of sodic soils

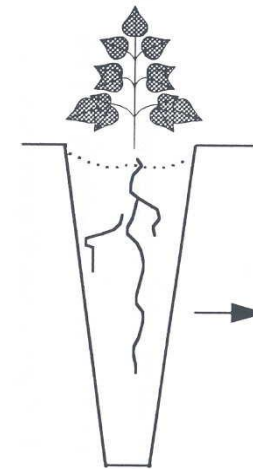


Role of gypsum

Soil aggregates, moisture
aeration, substrate

Role of compost

(B)



Initial establishment
& rapid early growth

(C)

Six months old seedlings on Sodic- Soils



Five year old Plantation



Seven year old Plantation



Thirty year old Plantation



Roots 5 year old tree



Roots 7 year old tree



Roots 30 year old tree



Shelter Belts Restrict sand Movement



Acacia Plantation in arid environments

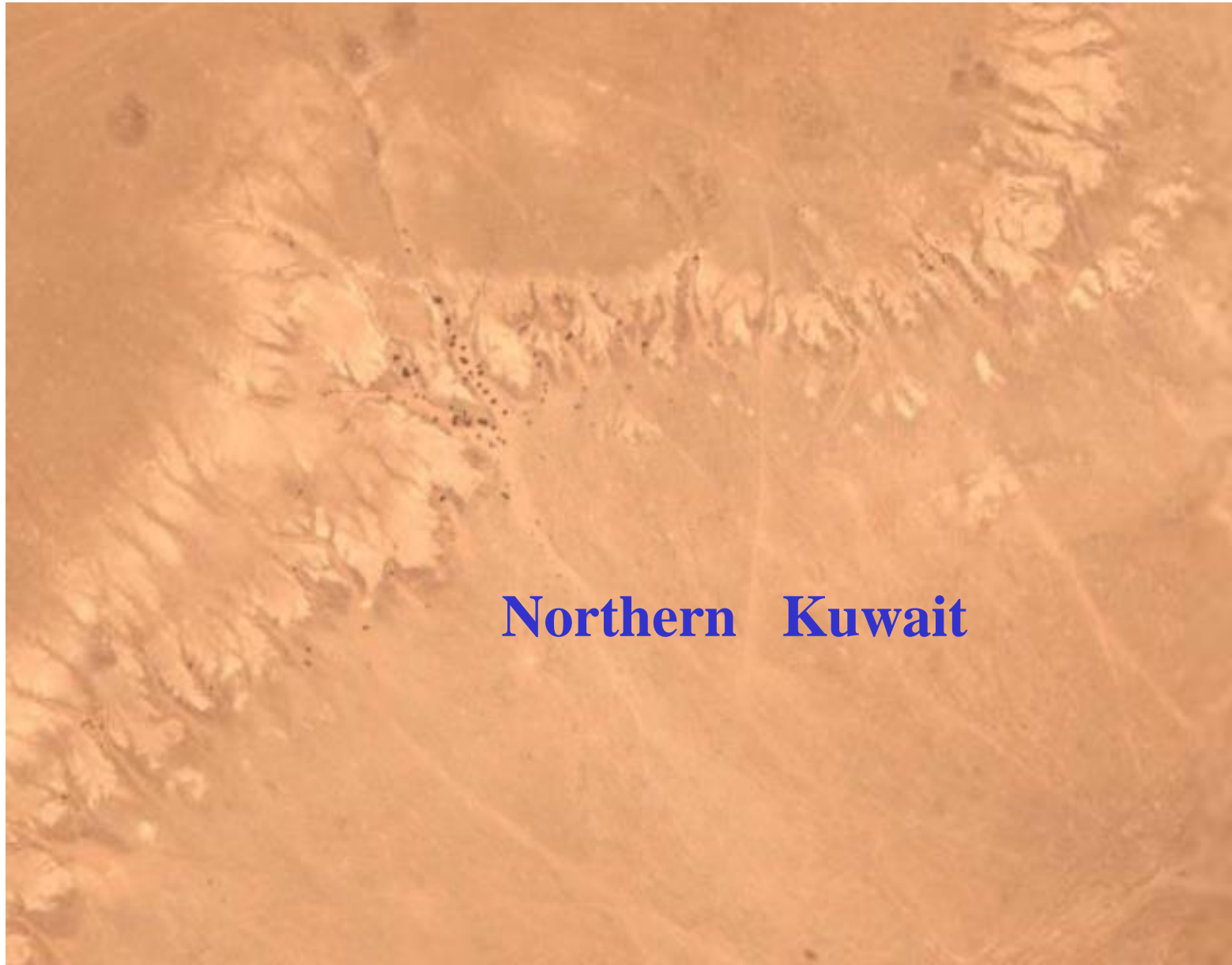


***Accacia tortilis*: A proven desert species**



Prosopis juliflora : Flourishes well in arid and Saline Areas

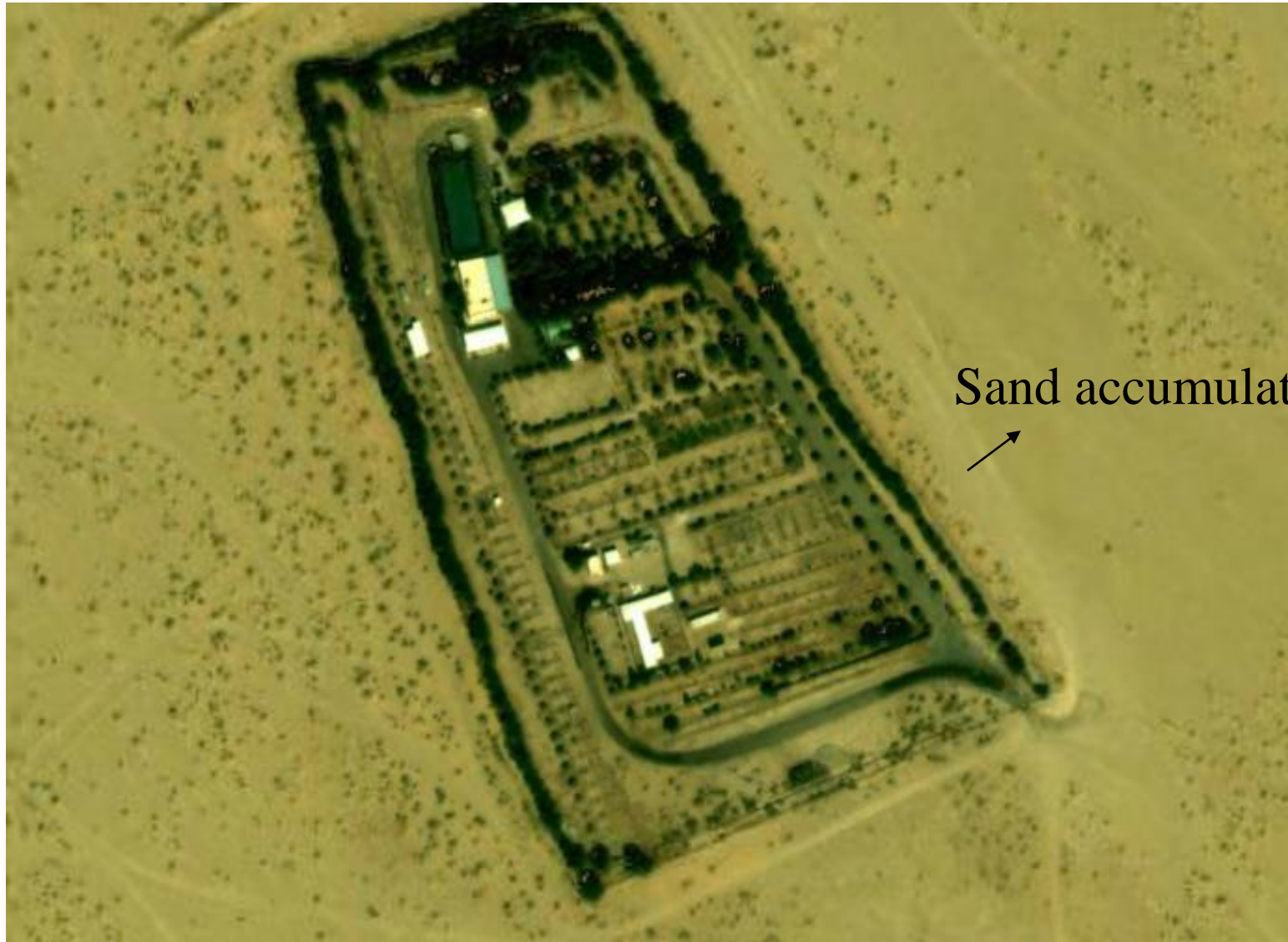




Northern Kuwait



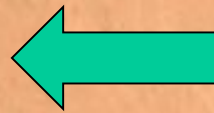
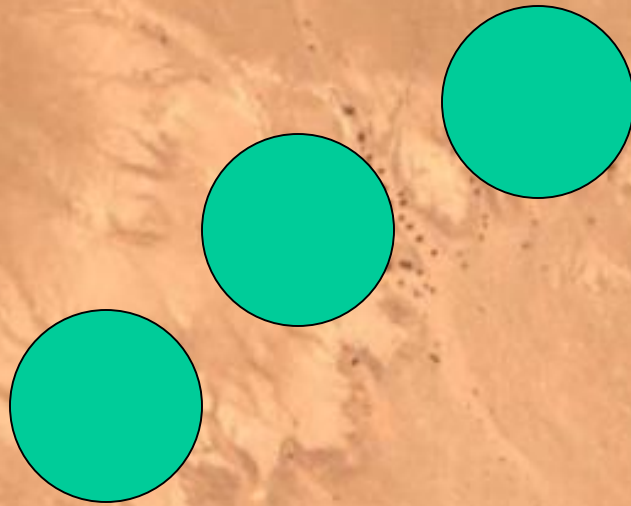
A Micro Intervention



Sand accumulations



Approach



Strategy

- Reconnaissance
- Action Plan
- Nurseries and other logistics
- Hardy and tall plants
- Water harvesting?
- Desalinization...dilution
- Amendments

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Strategy

- Pilot scale
- At least two locations
- Mixture of Rows and Blocks
- Learn from experiences
- Fine tune
- Replication



Thank you...
ppbhoj@teri.res.in