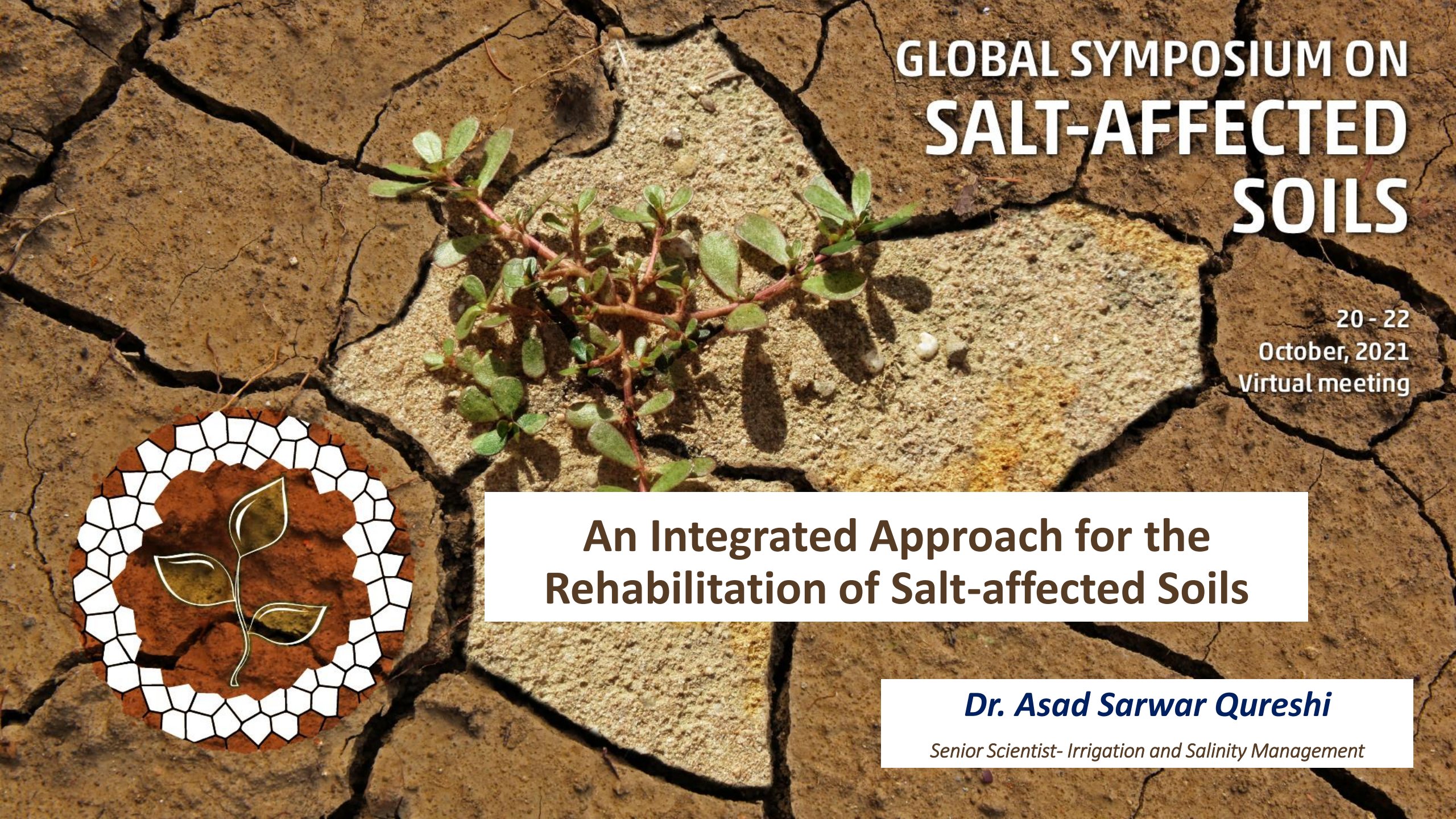

An Integrated Approach for the Rehabilitation of Salt-affected Soils

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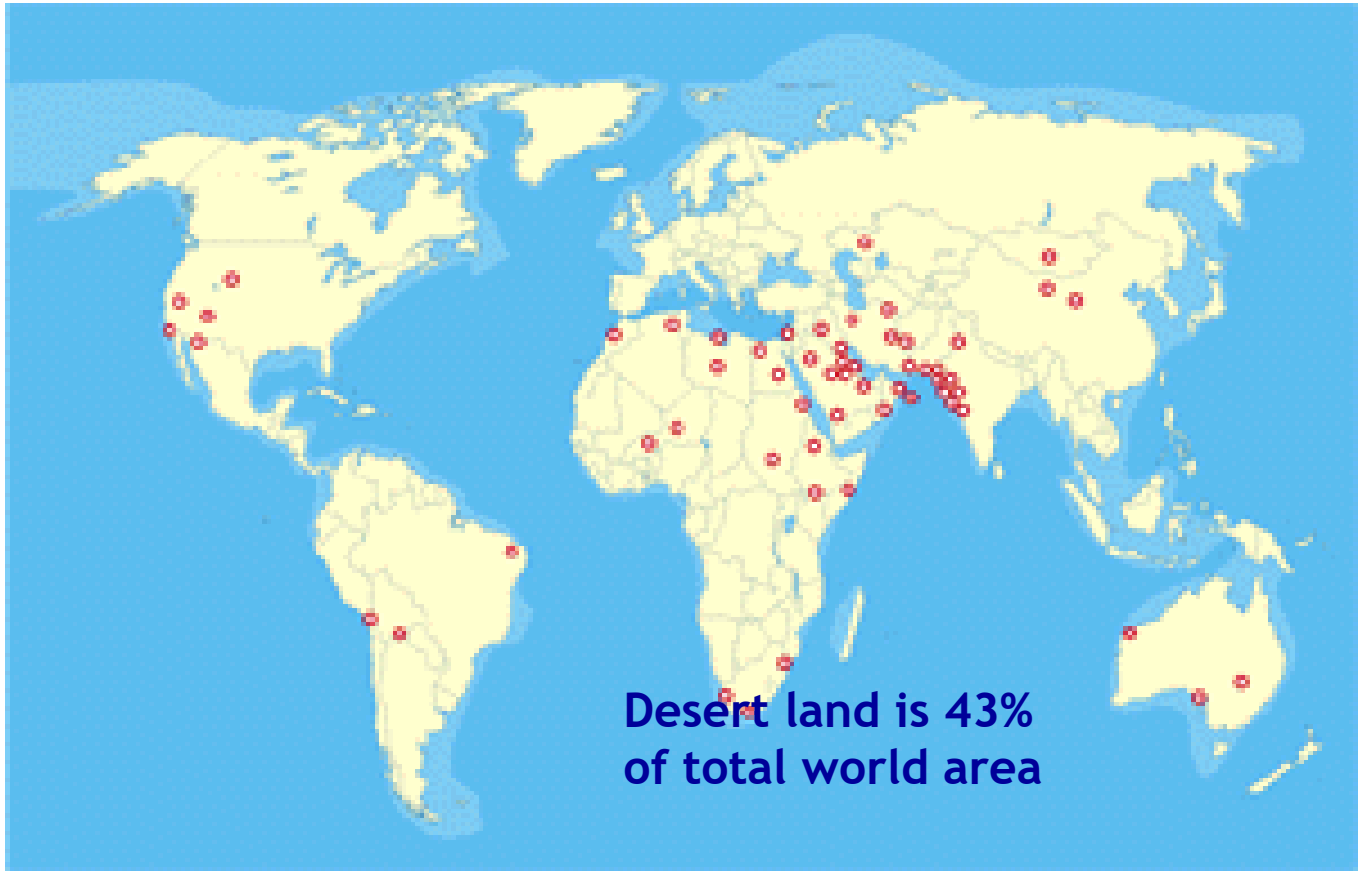
Basic needs in developing countries

Challenges

- Water Scarcity
- Land Degradation
- Climate Change
- Pollution

Global extent of soil salinization



	000,000 ha
Australasia	357,330
North & Central Asia	211,688
S. America	129,163
S. Asia	87,608
Africa	80,538
Europe	50,804
S.E. Asia	19,983
N. America	15,755
Mexico & Cen. America	1,965
TOTAL	954,834

1000 million ha is salt-affected
3200 million ha is desert area

Sources of salts

- ✓ Parent material (weathering of rocks & minerals)
- ✓ Irrigation water (quantity & quality issues)
- ✓ Poor on-farm water management practices (poor land levelling, over-irrigation-uneven salt distribution)
- ✓ Shallow and saline groundwater tables
- ✓ Fertilizers and chemical amendments applied)
- ✓ Irrigation-induced salinization (secondary salinity) in (semi-) arid regions
- ✓ Dry land salinity in humid regions (land clearing, replacing native trees with shallow rooted trees)

Problems of salinity are complex and needs different solutions

Potential interventions to avoid soil salinization

- Technical and engineering interventions
- Agronomic interventions
- Political and policy interventions
- Management interventions

All these solutions are applicable at different scales e.g., field or farm level, system level, basin or regional level

Technical and engineering interventions

- Construct additional storages for water (dams) and salts (evaporation basins).
- Improve irrigation infrastructure to improve water delivery
- Conserve water at all levels and from all sources (canal, GW)
- Improve drainage facilities at field and farm levels
- Re-use drainage and wastewater to reduce disposal problems
- Reduce seepage losses from canals (lining)

These solutions are applicable mainly at farm and system levels

Agronomic interventions

- Crop diversification, different crop rotations, less water demanding crops, drought and salt-tolerant crops.
- Irrigate according to crop water requirements and leaching requirements.
- Improve on-farm land levelling and watercourses to improve water use efficiency
- Apply soil amendments, where necessary.

These solutions are applicable mainly at field and farm level

Policy interventions

- Introduce water and power pricing policy.
- Set limits for groundwater pumping (quantity and quality)-- - zoning of areas.
- Provide incentives for land reclamation e.g., gypsum and other amendments.
- Improve and extend extension services to remote farmers.

These solutions are applicable at all levels

Management interventions

- Improve the operation and maintenance of existing irrigation infrastructure.
- Improve coordination between different agencies managing water and land resources.
- Enhance farmers' participation in management and maintenance of irrigation and drainage facilities.

These solutions are applicable at system level

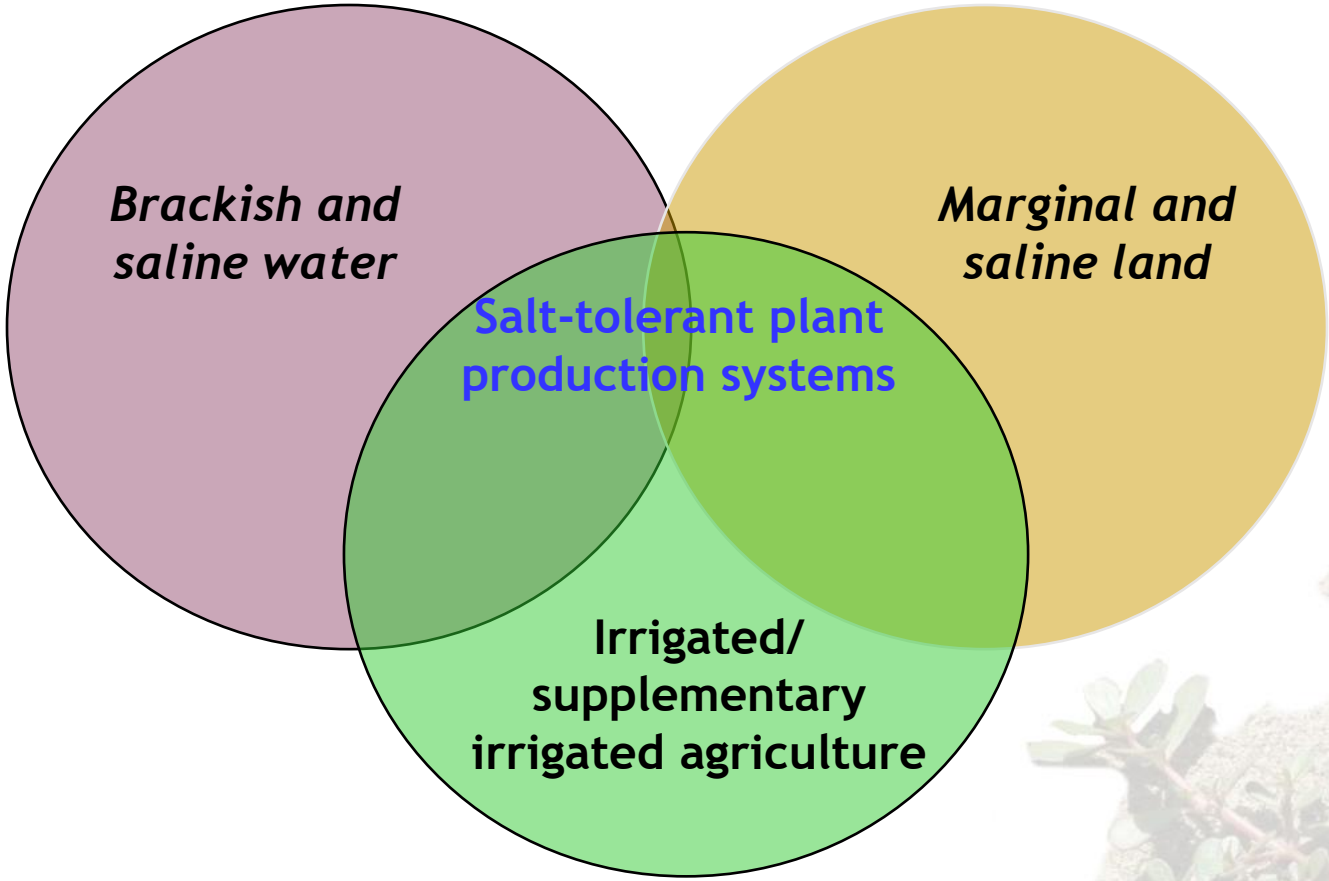
Management approaches for salt-affected soils

- ***Low to moderate salinity areas*** - introducing improved soil and water management practices.
- ***Highly saline areas*** – introducing *Biosaline Approach based on i*ntegrated crop-forage-livestock feeding systems to small farmers.
- Salt-affected genotypes include Barley, Sorghum, Quinoa. Cowpea, Sesbania, Pearl Millet, Rhoades grass, Panicum and Cynchrus fodder crops.
- Halophytes (for extremely saline conditions) may include Salicornia, Atriplex, Sesbania etc.

Potential Options: Low to moderate salinity areas

- Modify irrigation practices to conserve water *(increase water productivity)*.
- Effective management of marginal water quality for irrigation *(maintain salt balance)*.
- Techno-economics of conjunctive water *use (sustain irrigated agriculture)*.
- Soil systems should be monitored to halt soil degradation processes due to salt build-up *(stop expansion of salinity)*.
- Select crops best suited to soil and water conditions *(manage crop growth)*.

Potential solutions: High to extreme salinity areas
(Marginal Environments)



Potential solutions: High to extreme salinity areas

Conserve fresh water for domestic, industrial and agriculture purposes (for crop cultivation)

Use marginal saline land and water for growing:

- Salt tolerant crops
- Forage/Fodder crops
- Timber value trees

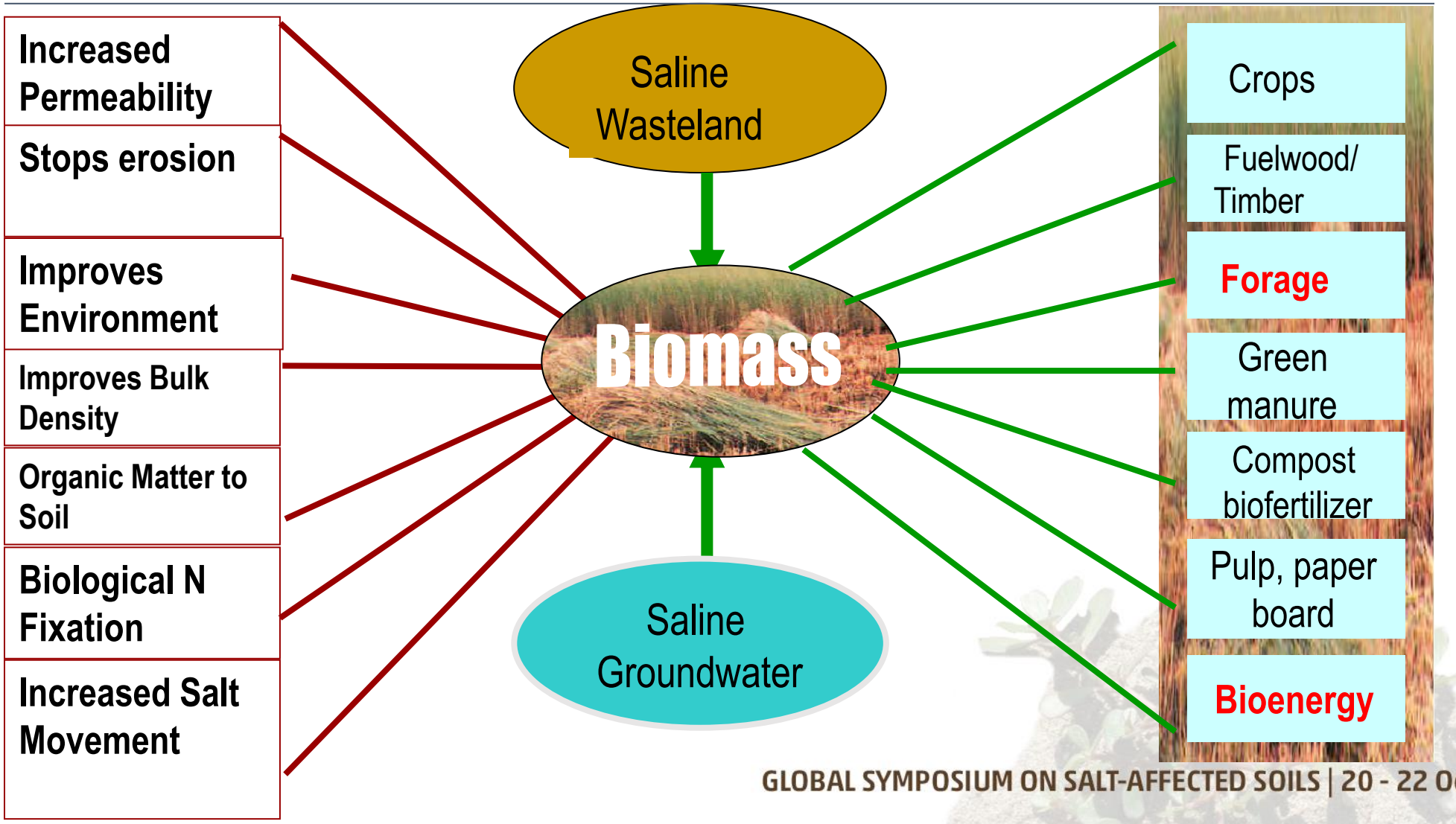
Use highly saline/sea water for growing halophytes for:

Forage/Fodder species

- Timber value trees
- Oil producing species
- Landscaping

GLOBAL SYMPOSIUM ON SAL

Biosaline Agriculture for marginal environments



Crop management for salt-affected soils

Salinity Type	Salinity Levels	Production system
Slightly saline	<5 dS/m (<3500 ppm)	Salt tolerant crops
Moderately saline	5-15 dS/m (3500-10,500 ppm)	Salt tolerant crops
Highly saline	15-25 dS/m (10,500 – 17,500 ppm)	Salt-tolerant and halophyte crops
Very highly saline	>25 dS/m (> 17,500 ppm)	Salt-tolerant and halophyte crops
Seawater	40-60 dS/m (28,000-42,000 ppm)	Halophyte crops

Where Biosaline agriculture can be practiced?

- Salt-affected irrigated agricultural lands
- Only marginal quality irrigation water is available.
- Marginal lands (abundant saline soils in dry regions).
- Sub-coastal saline lands (20,000 – 25,000 ppm).
- Coastal lands with salinity up to sea levels.

Summary

- Conserve water at all levels (*save water to grow more crops*).
- Shift to more water-efficient technologies and water-efficient crops (*increase land and water productivity*).
- Evacuate salts from the root zone (*control soil salinity*).
- Manage land and water quality (*maintain rootzone salt balance*).
- Improve irrigation water distribution (*increase reliability and uniformity*).
- Select appropriate cropping patterns *(sustain crop growth)*

GLOBAL SYMPOSIUM ON SALT-AFFECTED SOILS

20 - 22
October, 2021
Virtual meeting

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