



# Transformation through climate resilient agriculture for salinity management

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# Overview of Pakistan agriculture

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- Landscape of over 79.6 Mha
- Agrarian economy with 21% annual GDP
- Arid to semi arid climatic conditions
- 3rd-largest groundwater user globally
- Employment 43%
- Export earnings of products 70%
- Industrial production 51%



# Climate Change

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- Substantial and long-lasting variations in earth
- an increase in global temperatures, over a period of decades.
- natural variability and human interventions.



# Key Climate Challenges

- **Water security:** Increased irrigation requirements as population increased
- **Weather changes:** intensity of extreme events (floods and droughts)
- **Food security:** crop cycle change decrease Agricultural productivity
- **Threats to Indus delta:** sea intrusion deteriorate surface/groundwater quality



# Climate change effect on Agriculture

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- Effects on water cycle
- Green house gas (GHG) production
- Low water productivity
- Increased Salinity and water logging



**Temperature increases of more than 4°C will risk the crop productivity and ecosystem**



**Fig 2: Critical threshold of temperature**



**Changes in intensity and frequency of precipitation**



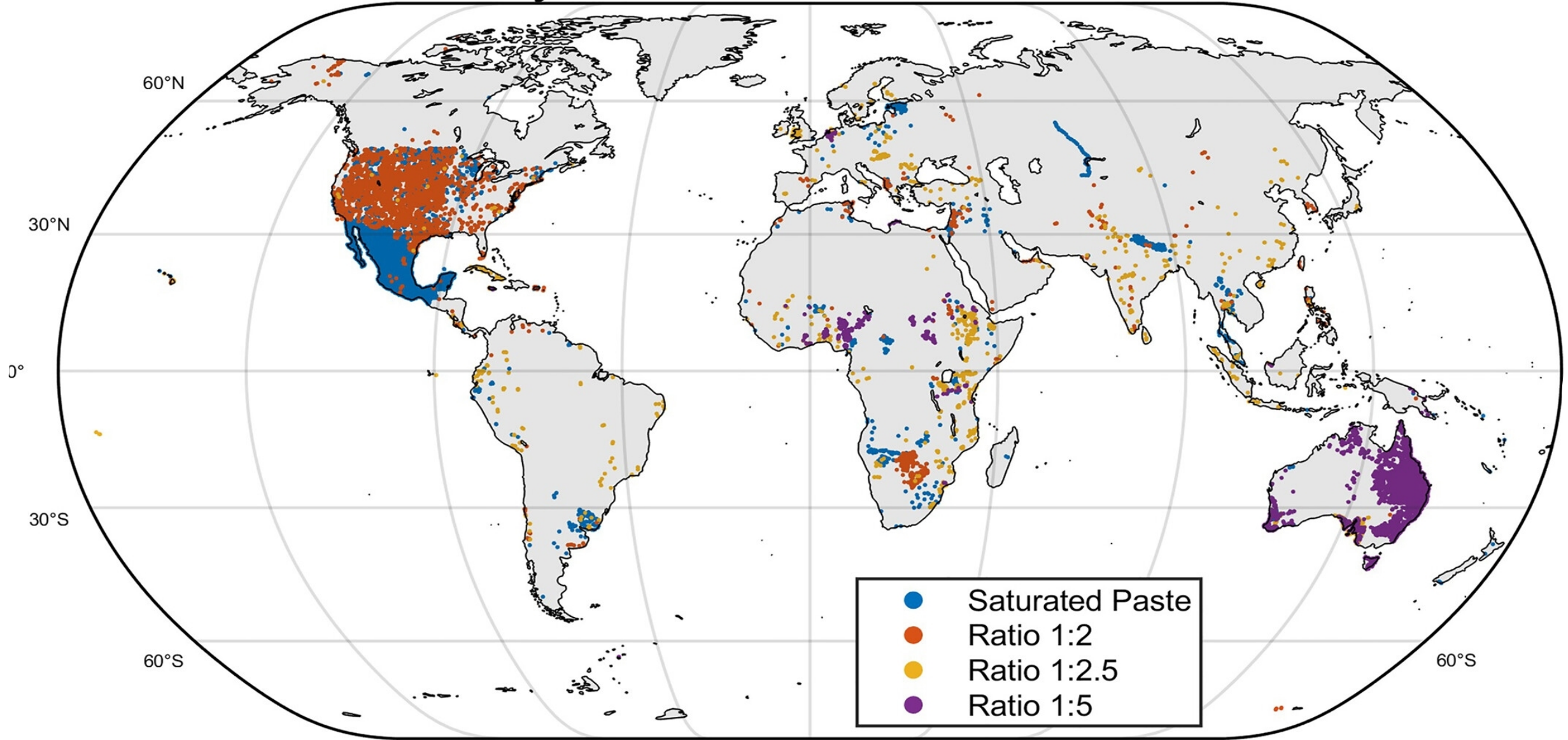
**Sea level rises and glacier melting**



**Changes in ground water and river flows**

**Fig 2: Water may pass critical threshold**

# Soil Salinity - World Soil Information Service Dataset





- Salinity affects more than 1 billion ha of land globally
- In Pakistan around 31.6 Mt salts transported annually through Indus River system
- An average of 1.25 tons/ha are deposited annually with the canal contribution of 19.95 Mt



# Factors contributing salinity

- Large annual deposits of salt from the Indus River and its tributaries
- Excessive pumping of groundwater leading to build-up salinity
- Human activities and how policy settings affect it



# Challenges on salinity management

Limited efforts by national or provincial organizations

several gaps in salinity management includes lack of:

- policy guidance
- consolidation and sharing of knowledge and practices
- farmer participation in decision-making



# Climate Resilient Agriculture (CRA)

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- An approach for transforming and reorienting agricultural development under the new realities of climate change.



# Why CRA?

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- By 2050 about 70% excess food must be produced for growing population
- weather extremes will reduce global food production
- Environmental degradation



# Efficient Irrigation Management

- Precision irrigation
- Conjunctive use of water
- Bio saline agriculture
- Drought Tolerant plants
- Water Conservation (HEIS, Rainwater harvesting, mulching, laser leveling).





# Managing salinity through tree planting

- Has the potential to help farmers in several ways.
- Only possible if local communities are empowered to take responsibility for site-appropriate techniques.





# Small Research Activity (SRA)

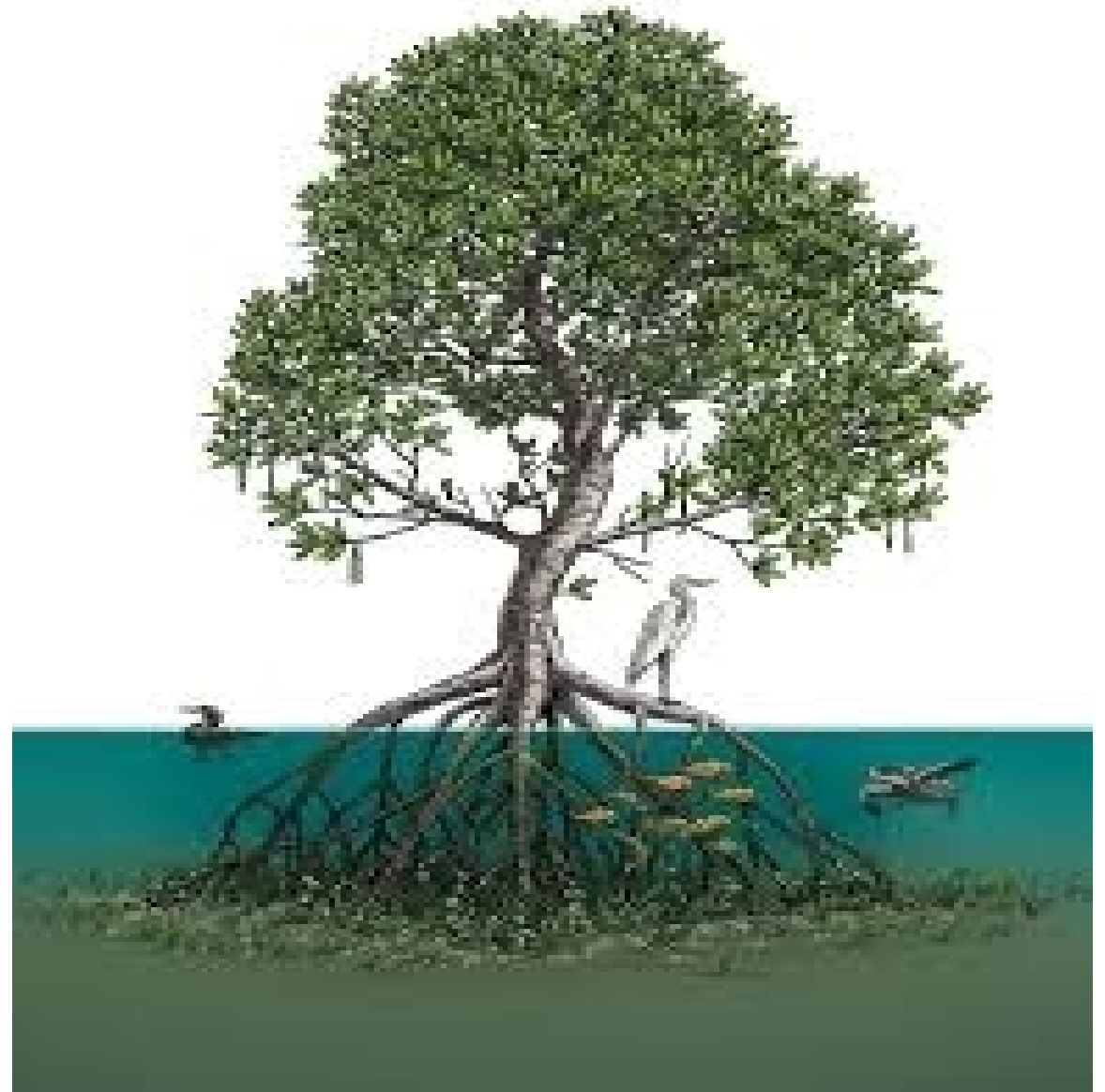
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- Consolidated existing knowledge on growing trees in salt affected landscapes through FGD
- Developed strategies for saline tree/shrubs
- Identified alternate livelihood options for farming communities



# Trees and shrubs for Salinity

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# 1. Spunge Tree/*Prosopis cineraria* L.

- Local Name:** Druce (Khejri /Kandi) Jand, Shami and Ghaf
- Origin:** South Asia (3 to 5 m height)
- Habitat:** Lowe Indus Basin (LIB)
- Tolerance:** Salinity 10-15 dS/m, drought, high temperature
- Uses:** Fodder, charcoal, firewood,
- Sources:** PARC (AZRC, AZRI) forest dept.



## 2. Mesquite / *Prosopis juliflora*

**Local Name:** Vilaiti kekar, devi

**Origin:** An exotic (South and Central America) with an average height of 7-12 meters

**Habitat:** LIB, Cholistan & Thar deserts

**Tolerance:** Highly salt tolerant with EC 10-15 dS/m, drought, waterlogging, temperature

**Uses:** Medicinal values including skin sores

**Source:** PARC (AZRC, AZRI)





### 3. *Acacia jacquemontii*

- Local name:** Desert Acacia/Bavri, Bable, Kikar, Rata bouli, Babri
- Origin:** Native tree with an average height of 2-4 m
- Habitat:** SIB, Cholistan & Thar desert
- Tolerance:** Salinity EC 4-6 dS/m
- Uses:** Medicinal, fodder, soil & land reclamation
- Source:** PARC ( AZRI), forest dep.



## 4. Conocarpus Erectus

**Local Name:** Green Buttonwood, Cono  
**Origin:** South America  
**Habitat:** Tropical/subtropical regions  
**Tolerance:** Salinity (10-12 dS/m), waterlogging  
**Uses:** Timber, firewood, hedges, agro-forestry,  
**Source:** PARC (IPI KHI, AZRC UK, AZRI BWP, Forest Dep., Commercial nurseries)

*Hitches: Some environmental issues are reported*





## 5. Eucalyptus Camaldulensis

<b>Local Name:</b>	Green Buttonwood, Cono
<b>Origin:</b>	Australia
<b>Habitat:</b>	Tropical/subtropical
<b>Tolerance:</b>	Salinity (4-8 dS/m), & waterlogging
<b>Uses:</b>	Medicinal (essential oil, antiseptic), Timber, firewood
<b>Source:</b>	PARC (IPI, KHI, AZRC Forest Deptt;



## 6. *Atriplex nummularia* Lindl

- Local Name:** Blue-green saltbush
- Origin:** Australia grows to a height of 1-3m adopted in Sindh.
- Habitat:** SIB, Cholistan & Thar desert
- Tolerance:** Drought and salinity  
(EC 10-15 dS/m)
- Uses:** High protein, livestock forage  
Supports land management
- Source:** PARC, AZRC and forest deptt;



## 7. *Avicennia marina*

- Local Name:** Mangrove
- Origin:** Southeast Asia, 2-3 meters
- Habitat:** Coastal areas of Sindh & Baluchistan
- Tolerance:** Salinity (EC 30-50 dS/m)
- Uses:** Serving as wildlife habitats, its timber used for fuelwood.
- Source:** Forest dept.;





## 8. Quinoa (*Chenopodium quinoa*)

**Local name:** Quinoa

**Origin:** An exotic crop (Andean region of south-America)

**Habitat:** SIB, Cholistan & Thar desert

**Tolerance:** Drought & Salinity tolerance EC 30-40 dS/m

**Uses:** High protein cereal, rich in fiber, gluten free, source of vitamin B, zinc & iron


**Source:** PARC ,PGRI, UAF, AARI)



# Way Forward



- Awareness campaigns for salinity management through adaptation and mitigation.
- Promotion of efficient water conservation technologies
- Comprehensive process of reforms to activate the full expertise of salinity management.
- Sindh Agriculture Policy (2018) and Sindh Water Policy (2023) will be pursued with local adaptation plan.
- Innovation towards agricultural development through science & technology.



*The battle against salinity is both  
an ecological challenge and an  
opportunity to learn about the  
incredible resilience of life.*

**David R. Montgomery**

*Thank you*