Battling drought and desertification

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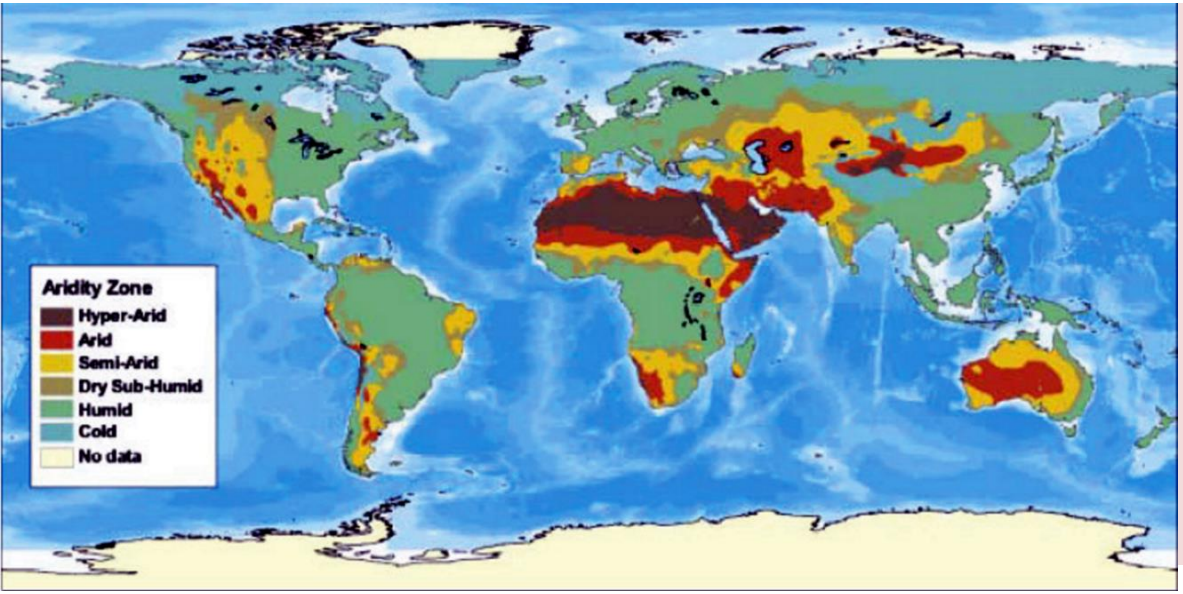
Drylands – a home of drought and desertification



- About <u>41% of land area is drylands</u>
- Within drylands
  - **<u>42% is arid</u>**
  - 37% is semi-arid
  - 21% dry sub-humid

Some of the large arid regions of the world are:

Asia	Australia	Africa	North America	Central America	South America
The Middle East	Central Deserts	Sahara Desert	Parts of Western USA	The Pacific Coast	Atacama Desert
Indian or Thar Desert		Sahel	Sonoran Desert		Serrano of Brazil
Namib Desert		Kalahari			
Karakum					
Gobi					

Challenging features of drylands and arid regions

- **Climatic stresses**
  - Low & erratic rainfall (<450 mm, 40% CV)
  - Temp. extreme (45-48°C; 0-4°C)
- **Fragile resource base**
  - Soils with low OC and Water Holding Capacity
  - Low water availability
- **Demographic**
  - More human and livestock pressure
  - Conflict with ecology
- **Prone to desertification**
- **Agriculture/Farming**
  - Inherent low productivity and highly risky
  - Favourable pockets scattered
- **Vulnerability of arid regions to climate change**

- Sensitivity index
- Exposure index
- Adaptive capacity
- Vulnerability index

Distinct advantages of drylands

- Adapted plant and livestock species
- Rich traditional knowledge towards minimization of risk and conservation of resources
- High solar radiations – 5.6 kWh/m^2/day
- Presence of man-made canals in arid areas

Four verticals for battling drought

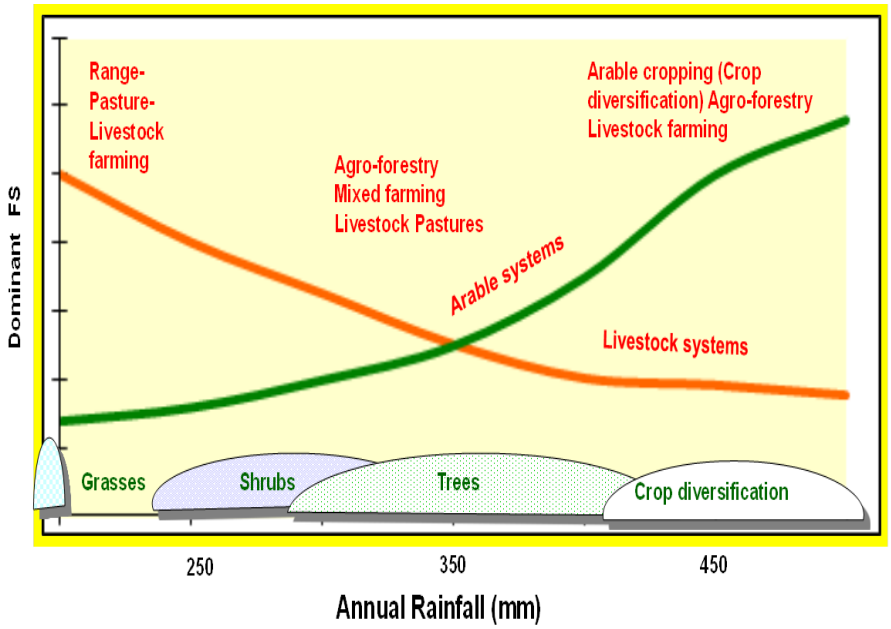

Building upon
traditional
knowledge

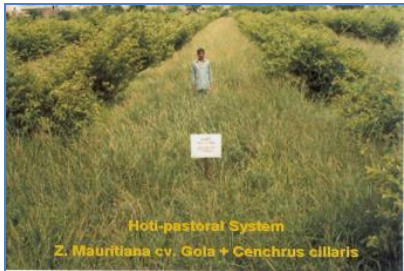
Integrated Farming Systems: **Good for People and Planet**

- To **widen** the base of commodities to **absorb** greater risk in farming (Annual Crops> Grasses> Shrubs> Trees> Livestock)
- To **meet** the year round food, fodder, fruit, fuel requirement
- **Combination** of annual and perennial components
- **Diversification** within each component

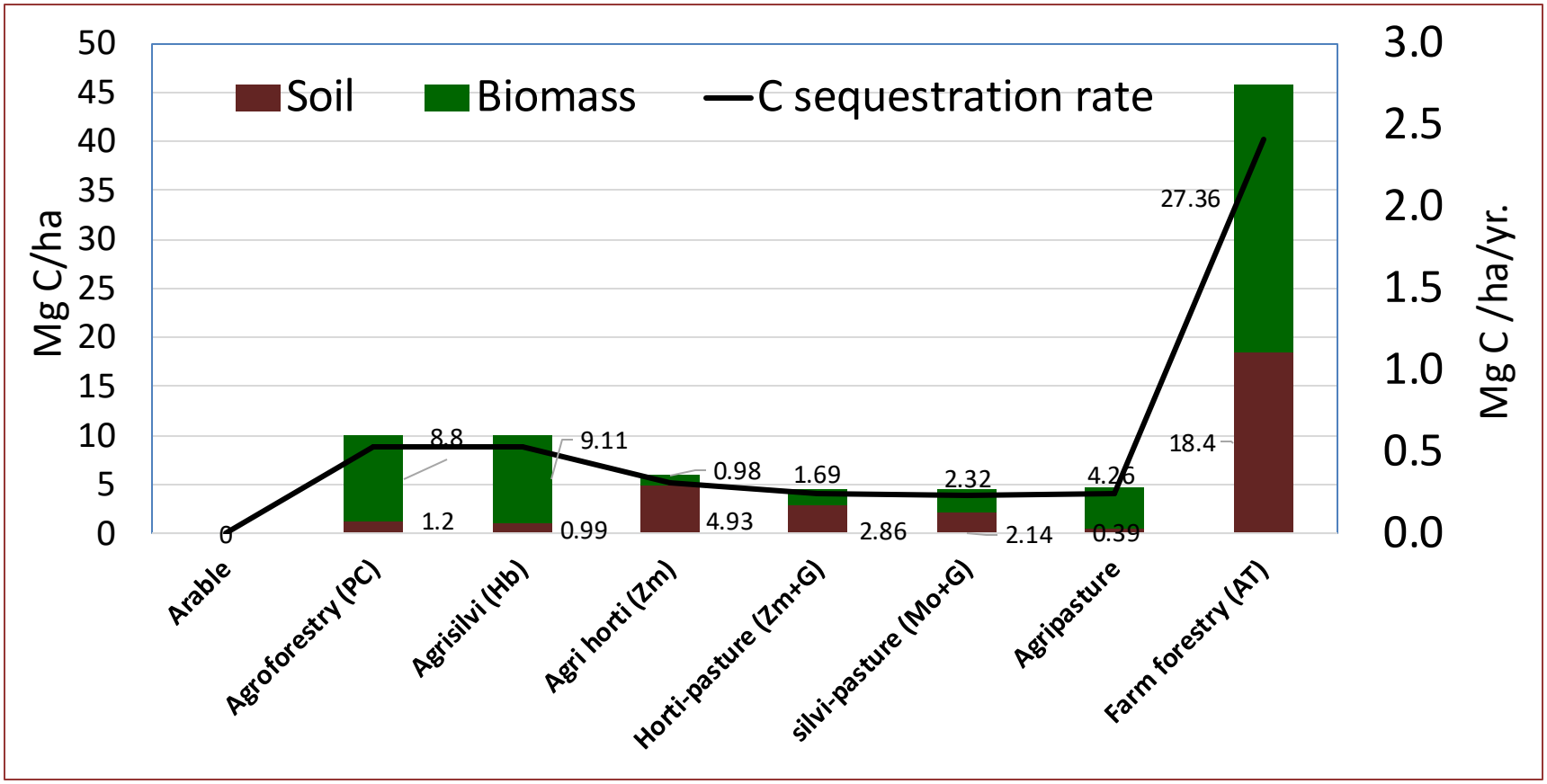
- Reduced climatic risk
- More income
- Better livelihood

Strategies pathway of IFS





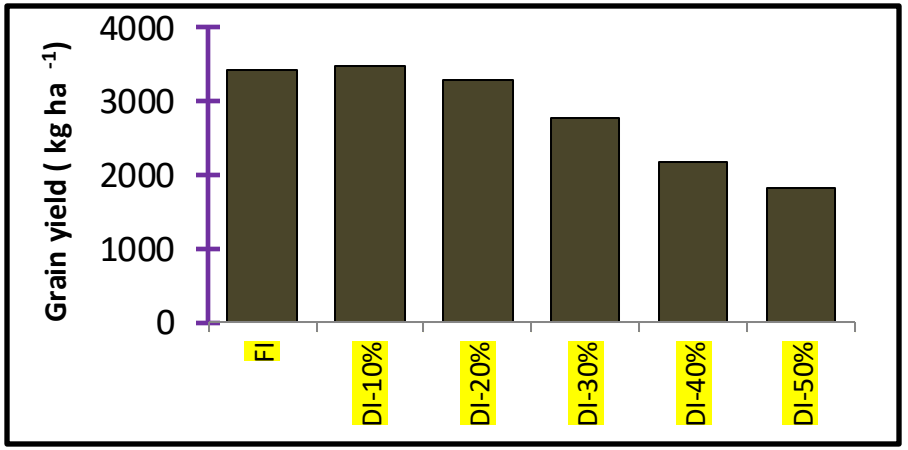
IFS for Planet: Carbon Sequestration



- Over a period of 19 years Total C stock under arable cropping decreased by 0.72 Mg/ha
- Although biomass is the major C sink, agroforestry systems also sequestered C in soil both as SOC and SIC and was proportional to the litter fall and its decomposition rate.
- In farm forestry, higher tree density, no soil disturbance and higher leaf litter fall caused a higher C accumulation both in biomass and soil.

More Crop, Per Drop: Efficient irrigation

- **Micro-irrigation system**
  - **Sprinkler system** is suitable for undulated terrain
  - **Drip system** is ideal for light textured soils, even moderately saline water may be used
  - Saves about 30% water compared to check basin method
- **Deficit irrigation** @ 80% of FI save 1/5th water and had greater water productivity (16%) with acceptable yields (only 4% less)
- ***Ex-situ* and *in-situ* water harvesting**
  - Khadin (run-off farming)
  - Inter-row WH



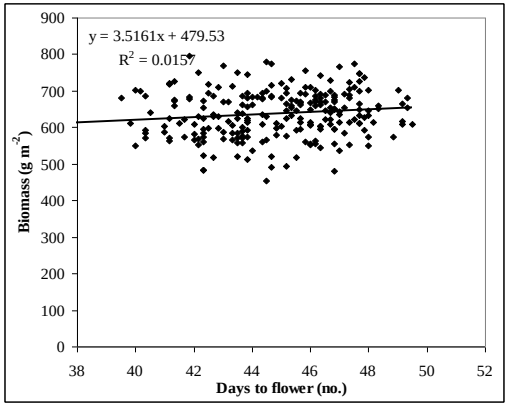
Irrigation innovations from Bikaner (NW India)

- In canal irrigated areas farmers/Govt. has constructed Diggies (water storage structures) e.g. 50m x 20m x 3m size
- The mode of irrigation is micro-irrigation operated by solar panels.
- Farmers mandatory contribution for solar panels is USD 875 and USD 4000 for diggies and remaining cost is borne by the govt.
- In case of diggies Govt. reimbursed the farmer contribution after 3 years.


Climate adaptation
options

Right choice of crops, cultivars and cropping systems

- Matching the rainfall pattern of the region and length of growing season (millets, legumes)
- Further choice of cultivars
- Differential water requirement of selected crops, cultivars and cropping systems
- Further enhancing climatic resilience
- Shortening duration of crops for enhanced adaptation



Enhancing Fodder Supply: Key to battling drought

- Participatory development of rangelands
- New fodder crops:
  - Fodder beat gave a fresh fodder yield of 245 ton/ha
  - *Opuntia ficus-indica* cactus
  - Napier Pearl Millet Hybrid yield is 400 ton/ha when planted at recommended planting spacing (75 cm x 60


Harnessing the
natural strength

Green Energy: minimizing carbon footprint

- Agri-voltaic system – to amalgamate farming, electricity generation and water harvesting
- Supportive government policies (KUSUM)
- Use of solar thermal photovoltaic devices for water heating and cooking

Combating desertification

- **Understanding the process and reasons of desertification**
- **Technological solutions (Sand dune stabilization)**
  - Fencing
  - Fixing barriers
  - Afforestation
  - Planting of grass slips
  - Participatory approach (Continuous and proper management)
- **Sand dunes cover reduced from 54% in 1990s to 48% to 2020.**
- **Sand dune stabilization technology spread in about 440,000 ha**


Enhancing
adaptive capacity

Technology Demonstration Modules of NICRA

Demonstration of proven agricultural technologies developed by NARS

NRM

In-situ RWHS

Ex-situ RWHS

TDC NICRA

Crop Production

Livestock & Fisheries

Institutional Interventions

Tolerant cultivars

Contingency interventions

Planting time

Crop diversification

Tolerant Breeds

Shelter Mngmt

Health

Feed/ Fodder

CHC

Seed/ Fodder bank

Empowering Farmers through DSS

- Mitigation of the adverse weather events
  - Contingency planning based on weather forecast
  - Advisories
    - Crop and cultivar selection
    - Re-sowing of crops
    - Fertilizer application
    - Spraying of pesticides
    - Weeding/thinning
    - Irrigation Scheduling
    - Harvesting
    - Diseases management

Way forward

- Challenges due to climate change are predicted to be further intensified
- New opportunities are emerging
- Science-led solutions to further enhance resilience
- Adequate policy and proper implementation

Thanks