DryArc – Australia Dialogue

Agro-silvo-pastoral systems in low rainfall areas

Challenge 2.1: Improving and managing rangeland systems resilience for delivering food and feed, biodiversity conservation with local communities and market linkages for livestock and dryland products

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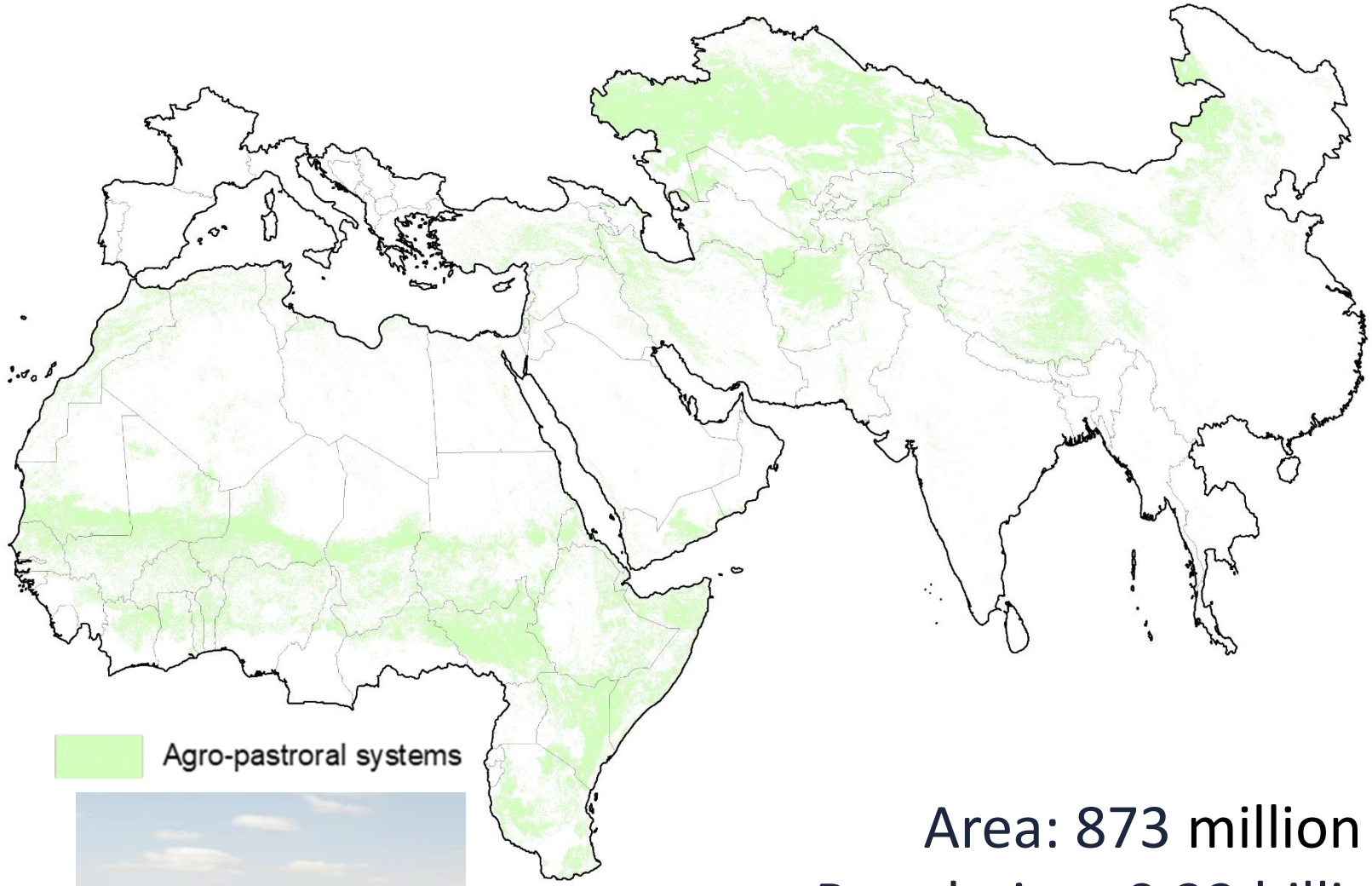
Agro-sylvo-pastoral systems



Area: 873 million ha (42%)

Population: 0.22 billion people

Bio-physical environment of agro-silvo-pastoral systems

- **Arid and semi-arid:**
  - highly variable and unpredictable rainfall patterns, long dry seasons
  - unprecedented high frequency of extreme weather events
  - highly vulnerable to climate change
  - hot, high evaporation rates resulting in high moisture deficits
  - grasslands represent largest land use

- **Often on poor, shallow soils, prone to erosion:**
  - depleted soil organic carbon in overused landscapes

- **Natural vegetation well adapted to these conditions:**
  - fragile vegetation types: dominated by annual species and therefore low biomass productivity
  - system is prone to invasive/unpalatable plant species
  - significant seasonal feed shortages

Mountainous drylands in Ethiopia

Rangelands in Tunisia

Challenges related to the fragile environment

Water scarcity: triggered by low rainfall (coupled with low surface and/or groundwater influx) exacerbated by erratic occurrence

-> inability to exploit scarce rainwater sources efficiently and/or high risk of crop failure

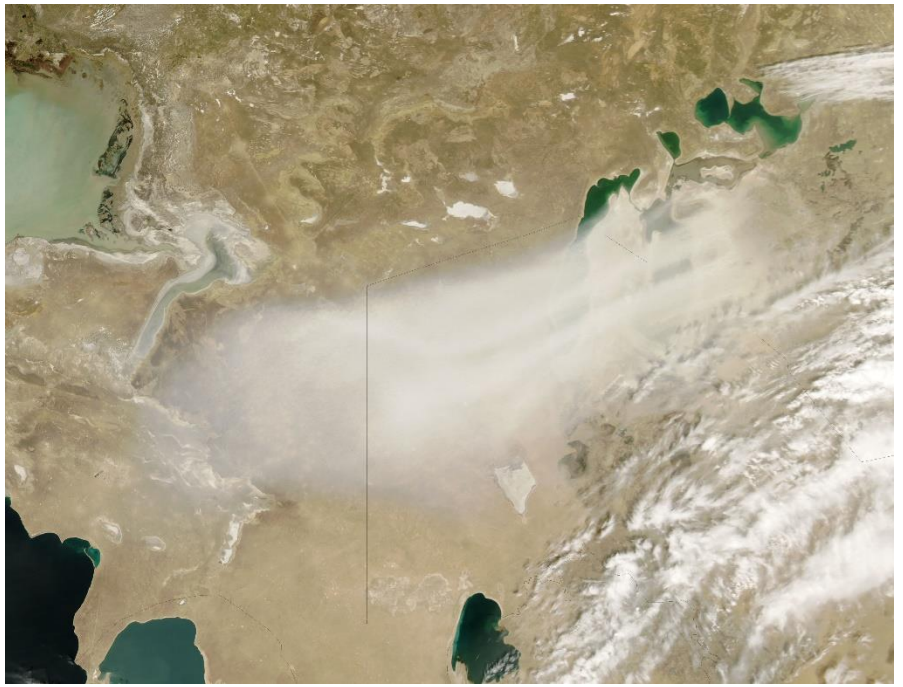
Soils depleted of SOC: with reduced infiltration (e.g. surface crust, compaction, …) and low ability to store moisture (poor soil structure, porosity, connectivity, soil depths, …)

-> surface runoff and soil erosion lead to formation of surface rills and gullies changing the dryland's hydrology, draining water from the agro-pastoral watersheds, and gullies interrupting pathways for human, livestock and agricultural machinery.

Severe land degradation (declining vegetation and erosion): due to unsustainable grazing strategies, mismanagement and encroaching cultivation, e.g. of depressions

-> evaporation from bare soil surface, unprotected from erosive forces of water and wind accelerating physical degradation

-> unavailability of well adapted range and forage seeds (seed system)



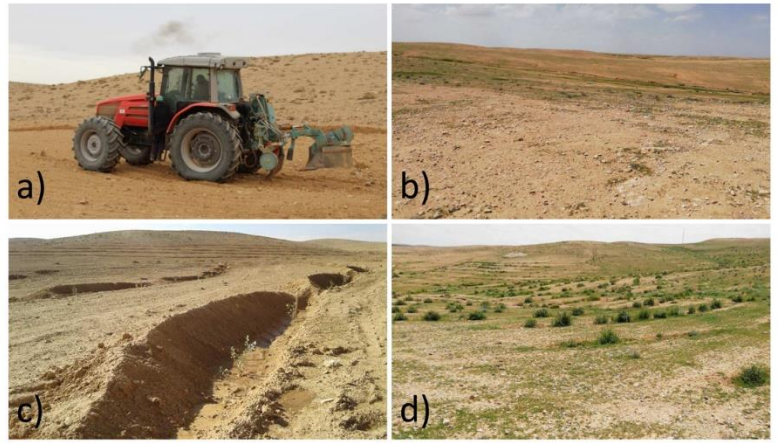
Dry Aral seabed in Uzbekistan: Dust storm observed by NASA satellite image

Dust and floods in Jordan

Research questions addressing the biophysical challenges

- **How to** restore landscapes and soil health?
  - Design of integrated watershed management (incl. fitting crops/varieties, adaptive management)?
  - Restore vegetative cover (resting, reseeding, shrub/tree plantation)?
  - Restore soil health to better infiltrate, store and release water (enhancement of soil water characteristics/capabilities through soil cover and rebuilding SOM)?
  - Develop an adaptive way to revitalize the landscapes with species diversification and enriched native biodiversity?

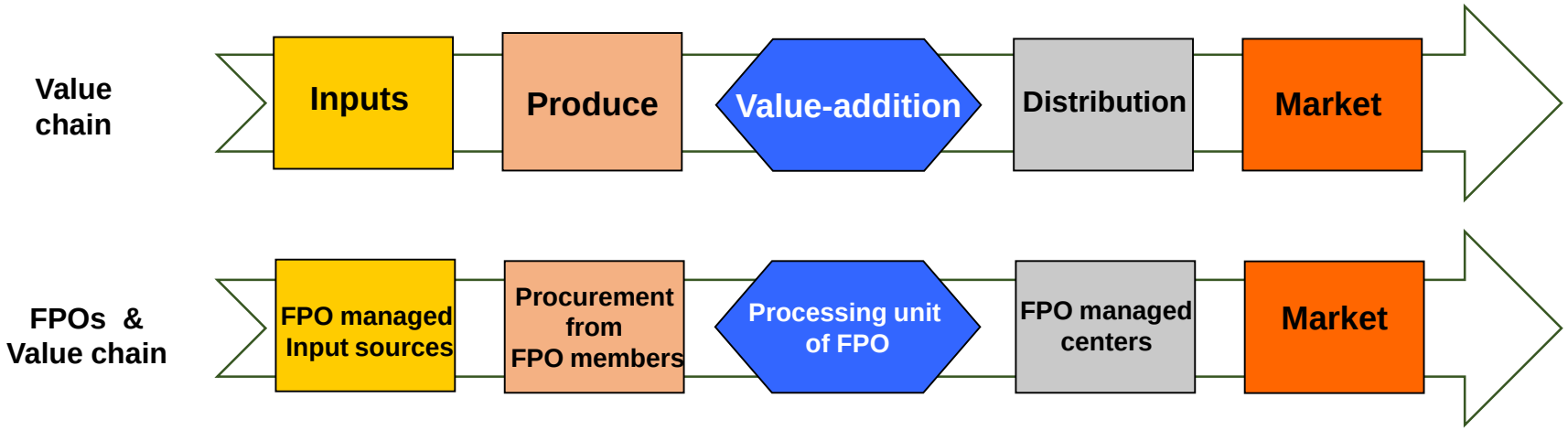
- **How to design and implement** sustainable utilization of rehabilitated rangelands and watersheds?
  - Livestock management for enhanced productivity and income (grazing, water points, herd management, mitigation strategies for animal feed shortages and disease outbreaks, improved marketing strategies)
  - Enhanced governance mechanisms (see challenge 2.2): Identification of pathways for enhancing rangeland governance under constraining land tenure systems



Research questions addressing the biophysical challenges

- **How to** address climate risk (erratic rainfall and droughts)
  - Water harvesting and storage options?
  - Digital Advisories and Early Warning Systems (DAEWS) that address the needs of the research community and user segments and are easily accessible?
  - Insurance solutions for crops and livestock for smallholders (e.g. index-based insurance)?
  - More diverse livelihood options through value addition in crop, range and livestock value chains (researchers' role)?

- At **what scale/level** are interventions most effective?
  - Rehabilitation measures at watershed level versus community-based approaches?
  - Mediation between upstream and downstream rehabilitation?
  - How to mediate between sedentary and commuting actors (landscape connectivity)?



Higher level research questions

- How much and what modeling and monitoring is needed (versus investment in development/ scaling)?
  - Downscaling climate to higher spatial resolution for various climate change scenarios?
  - Mapping and monitoring ecosystem carbon dynamics and water regimes?
  - Biophysical modeling of soil, water and vegetation dynamics?
  - Valuation and pricing of ecosystem services? …

- What are critical success factors for adoption and sustainability?
  - What are the critical parts of the system (strong leverage points and/or high return on investments)?
  - How do we develop adaptive capacity of all stakeholders incl. researchers?
  - What are incentives for behavioral change of the different actors?
  - How do we foster knowledge, learning, campaigning and self-organization to build resilience?

- Scalability
  - How to scale very context specific pilot projects?
  - Do we have tools to target interventions or do we need more research on suitability mapping/assessment?
  - What are the minimum requirements for an enabling governance/institutional setting before embarking into a rehabilitation program?