Obtaining agro-hydrological datasets in the marginal drylands of Jordan: two-sided lesson shared by scientists and farmers

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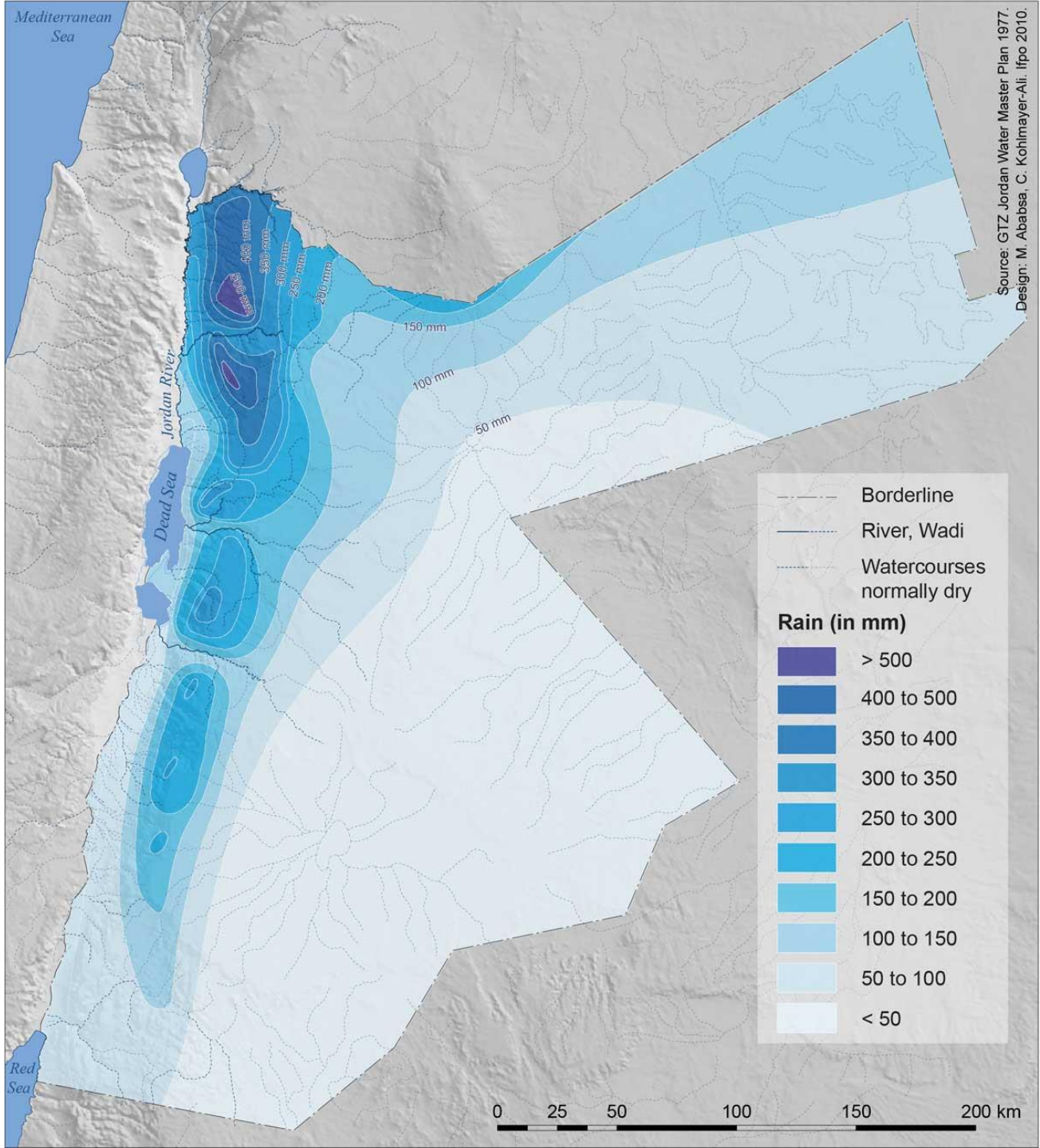
Jordan's Badia: rehabilitation of the once productive dry-rangelands



Torrential rain, snow storms and flooding hit the Middle East

People drive past vehicles stranded on flooded streets in the Jordanian capital Amman

Picture: KHALIL MAZRAAWI/AFP/Getty Images

Rehabilitation:
retain rainwater in the landscape

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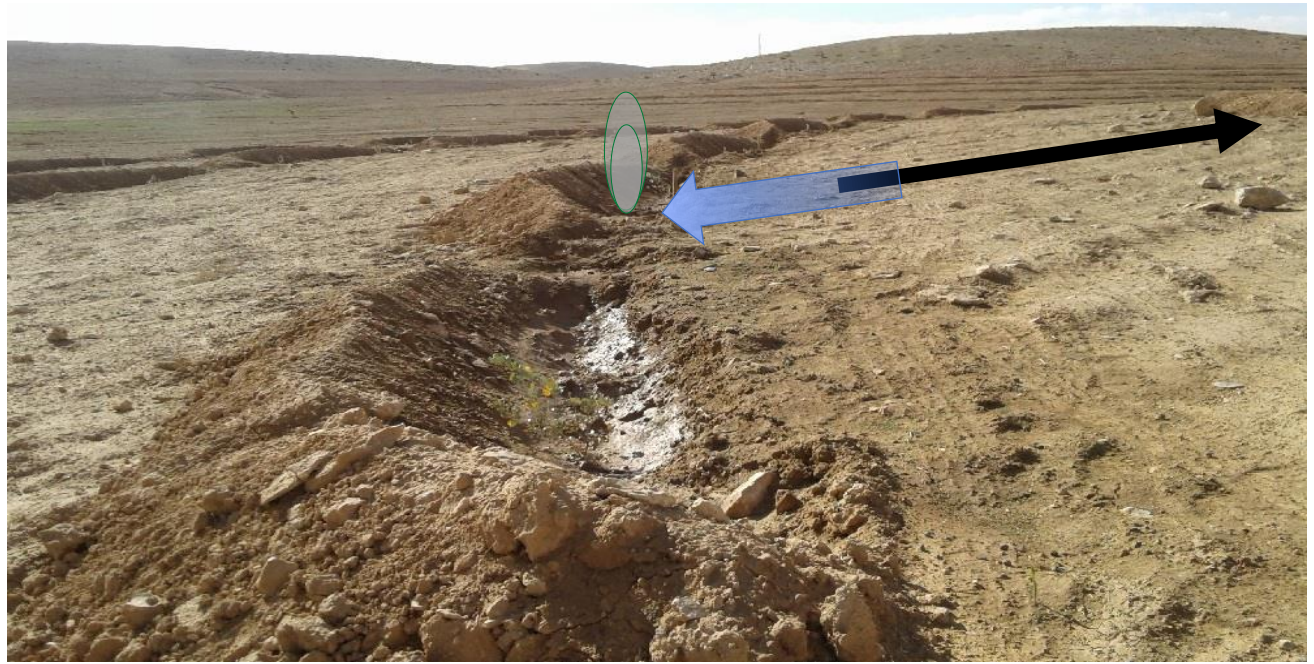
Mechanized micro-water harvesting

- Tractor plow (laser guided) -> fast & cheap implementation along the contour
- Deep-ripping of degraded soil -> fostering deep infiltration
- Water harvesting pits collect water, sediments and seeds -> boost vegetation-patches development



Rehabilitation:
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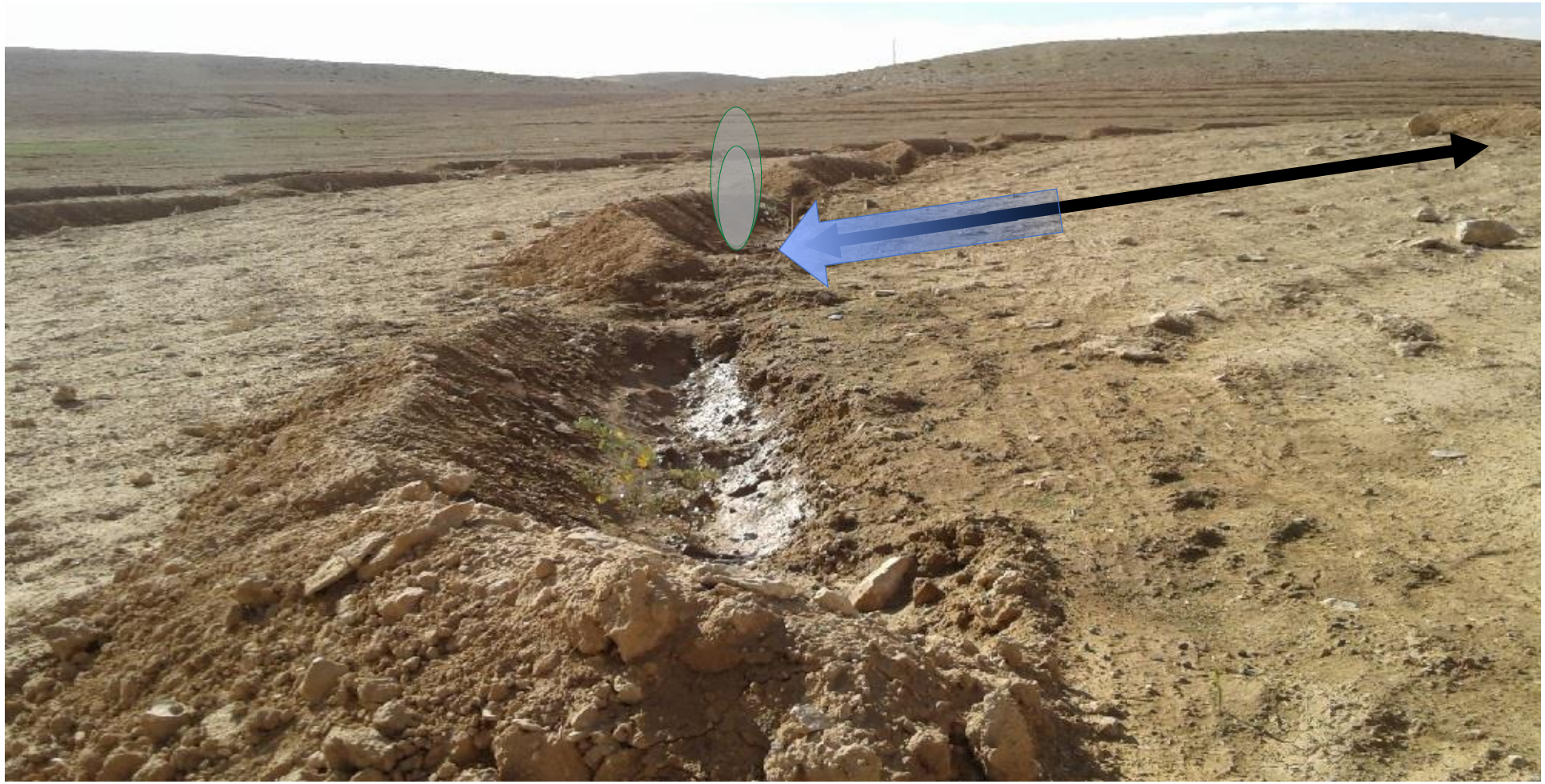

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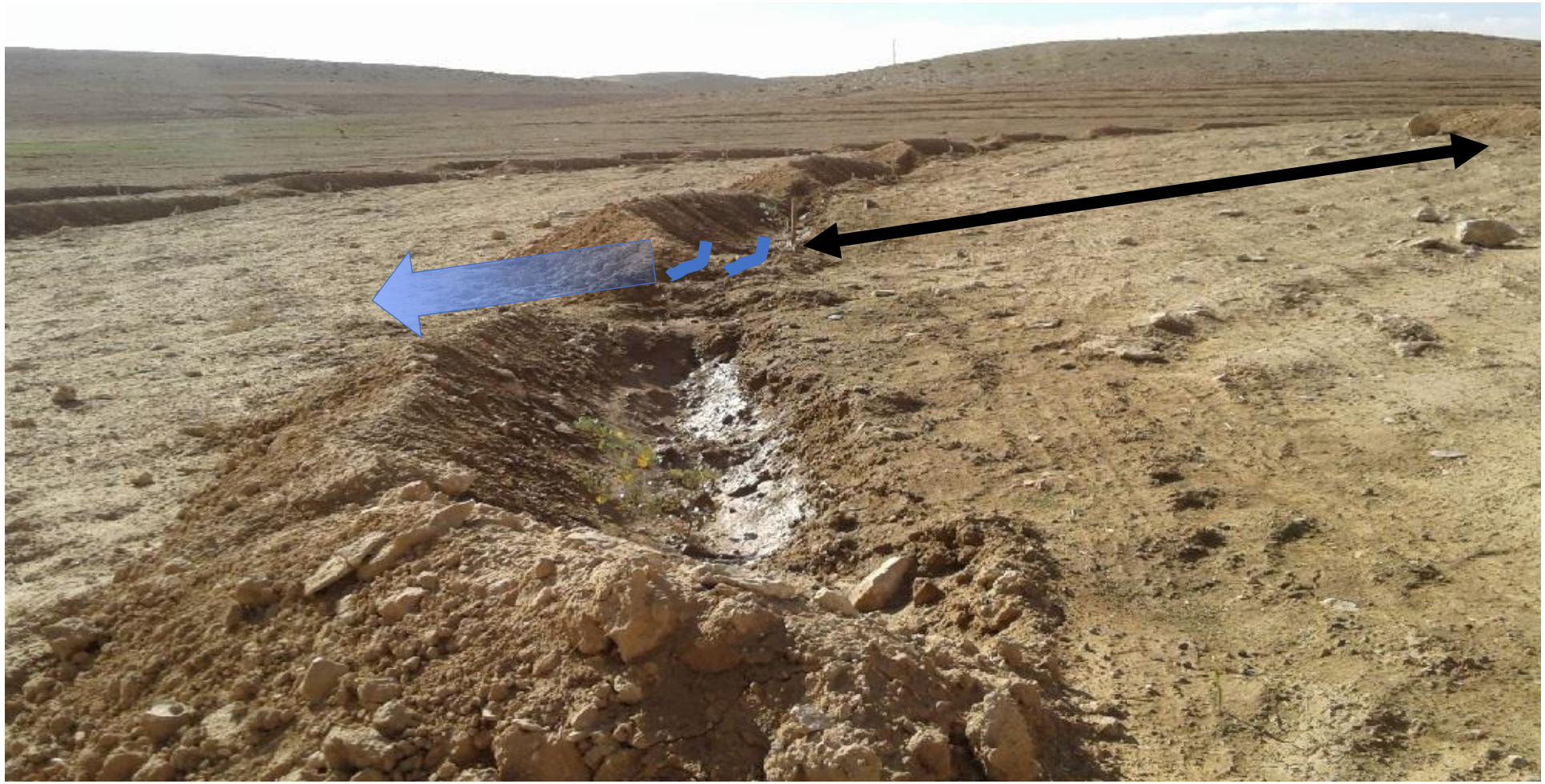
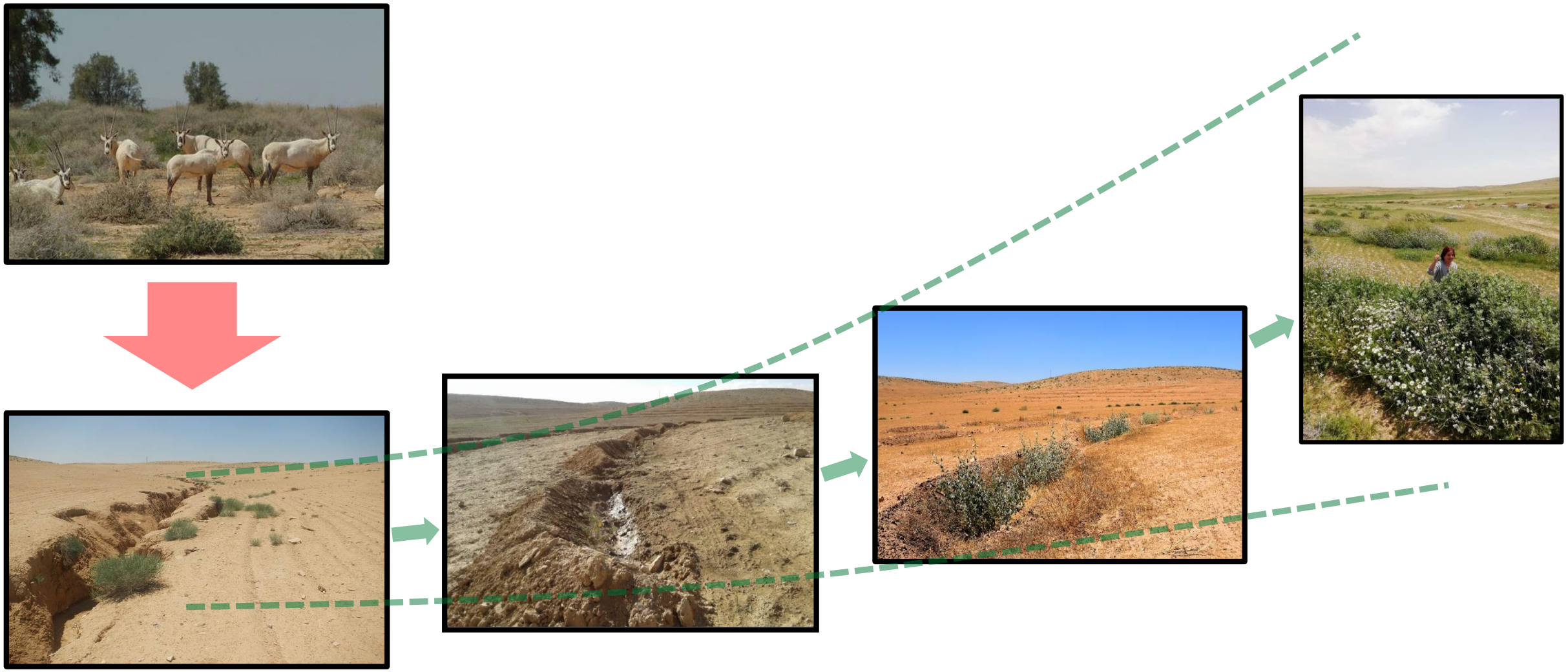


Rehabilitation:
retain rainwater in the landscape

Rehabilitation:
retain rainwater in the landscape

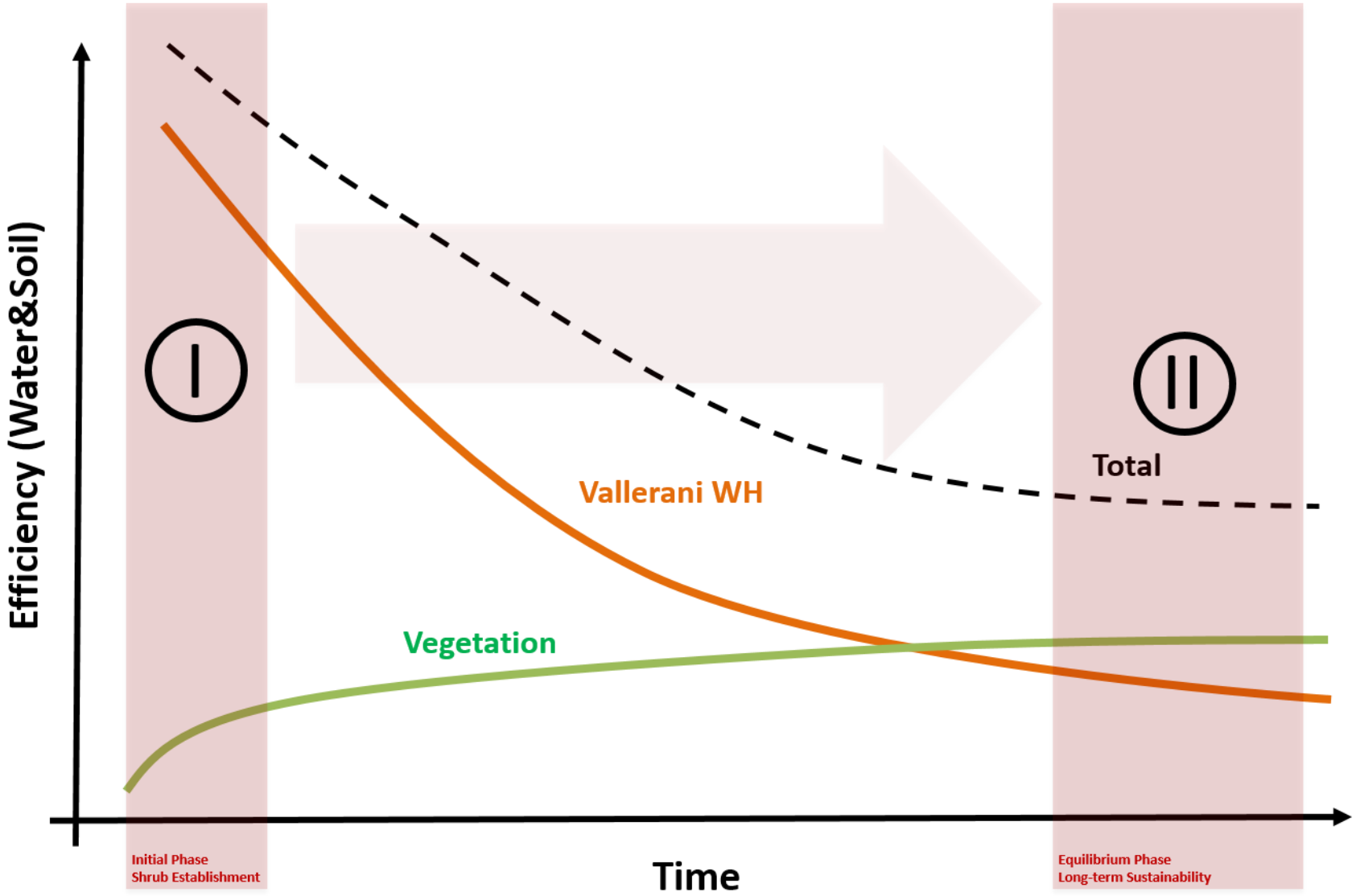
Hypothesis: ecosystem transition



Degradation (**red**) and rehabilitation (**green**) of marginal drylands

‘Restored’ vs. ‘Degraded’

Effectivity over time: transition states



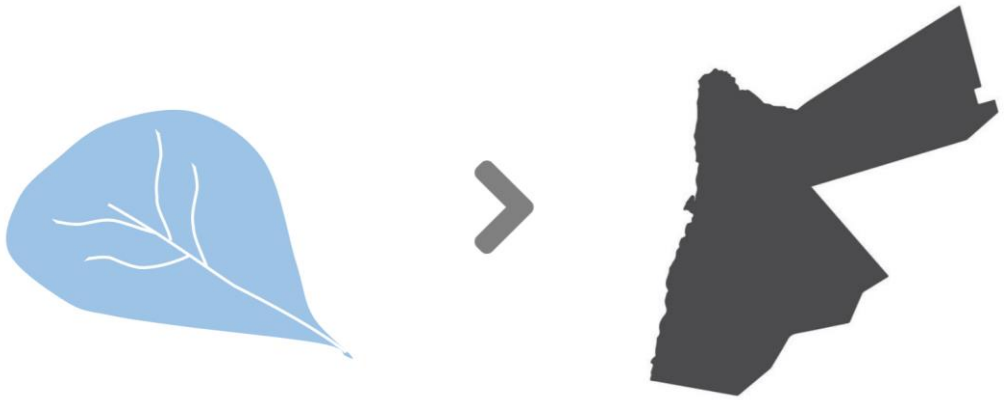
Out-scaling the practice

Scientific sound vs.
Common language and guidance

Out-scaling the practice

Scientific suitability

- Advanced experiments and monitoring
- GIS
- Computing (e.g. dynamic processes)
- …

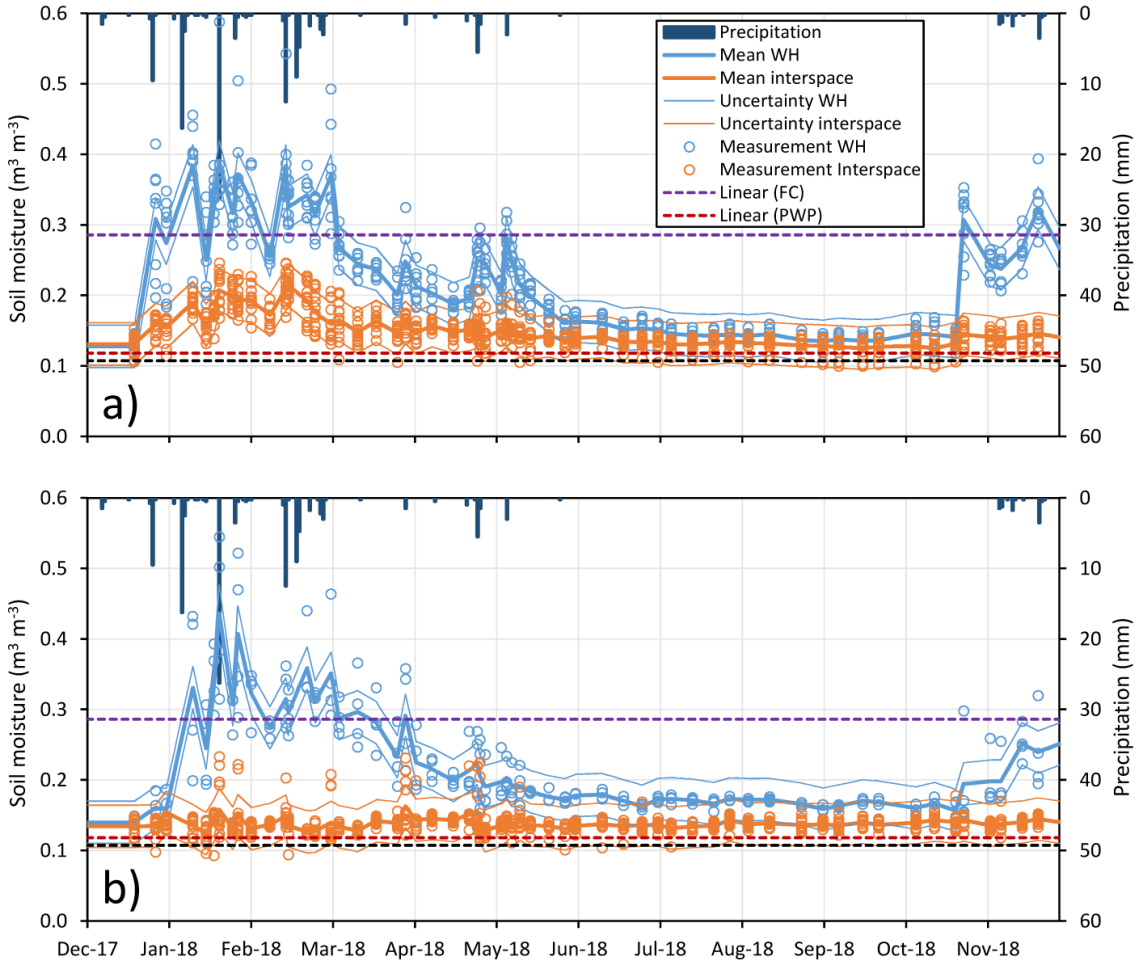


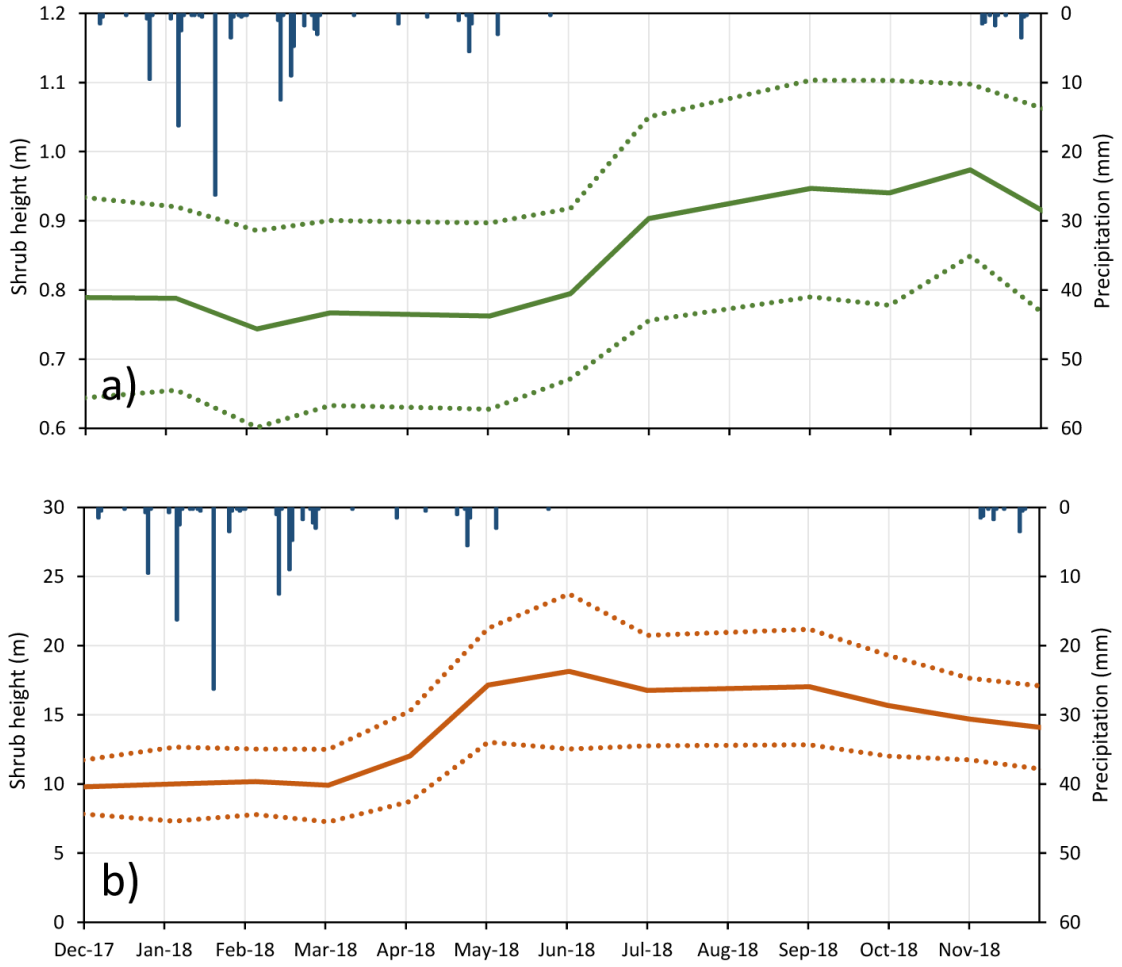
Mainstreamed message and guidance

- Robust experiments and monitoring
- Merging local knowledge with standards
- Common language
- …

Monitoring

Merger, share & harmonization of data





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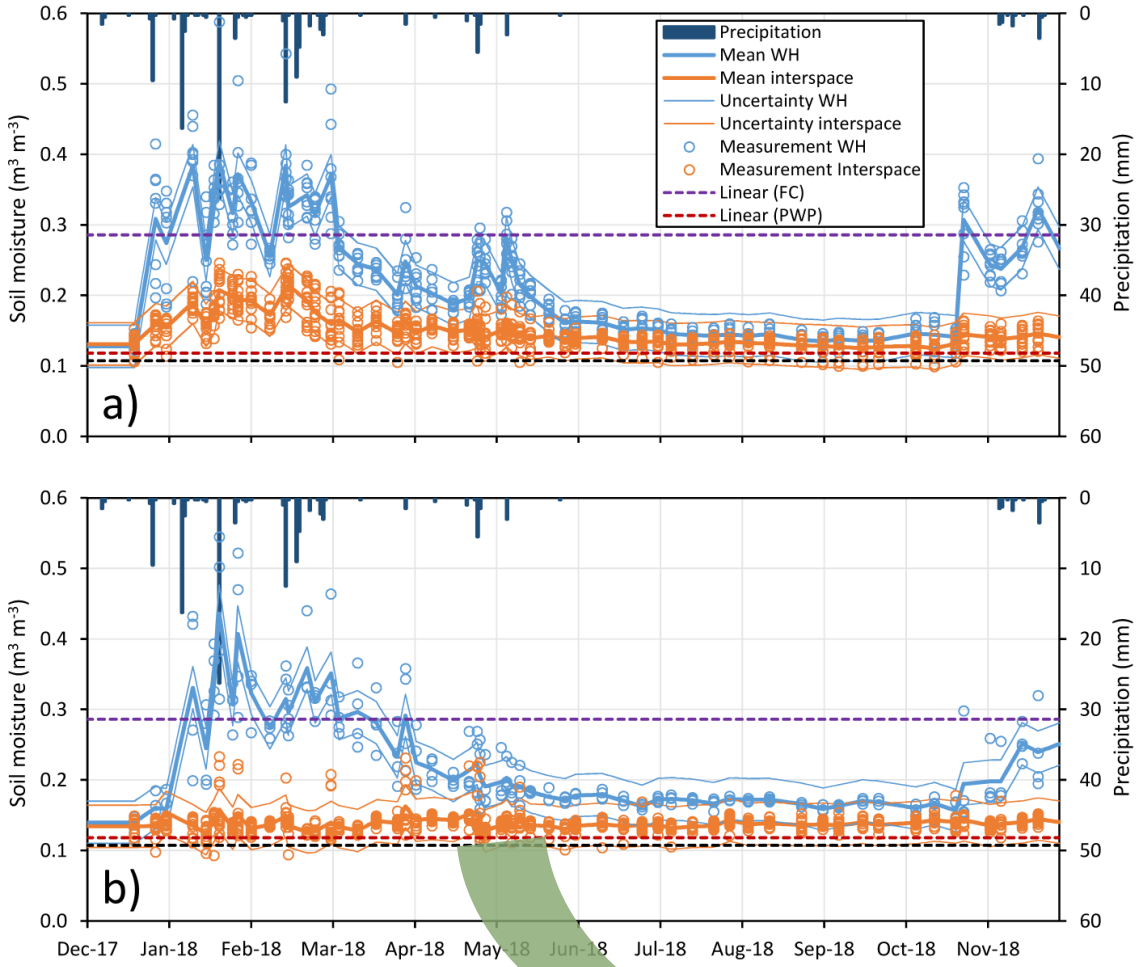
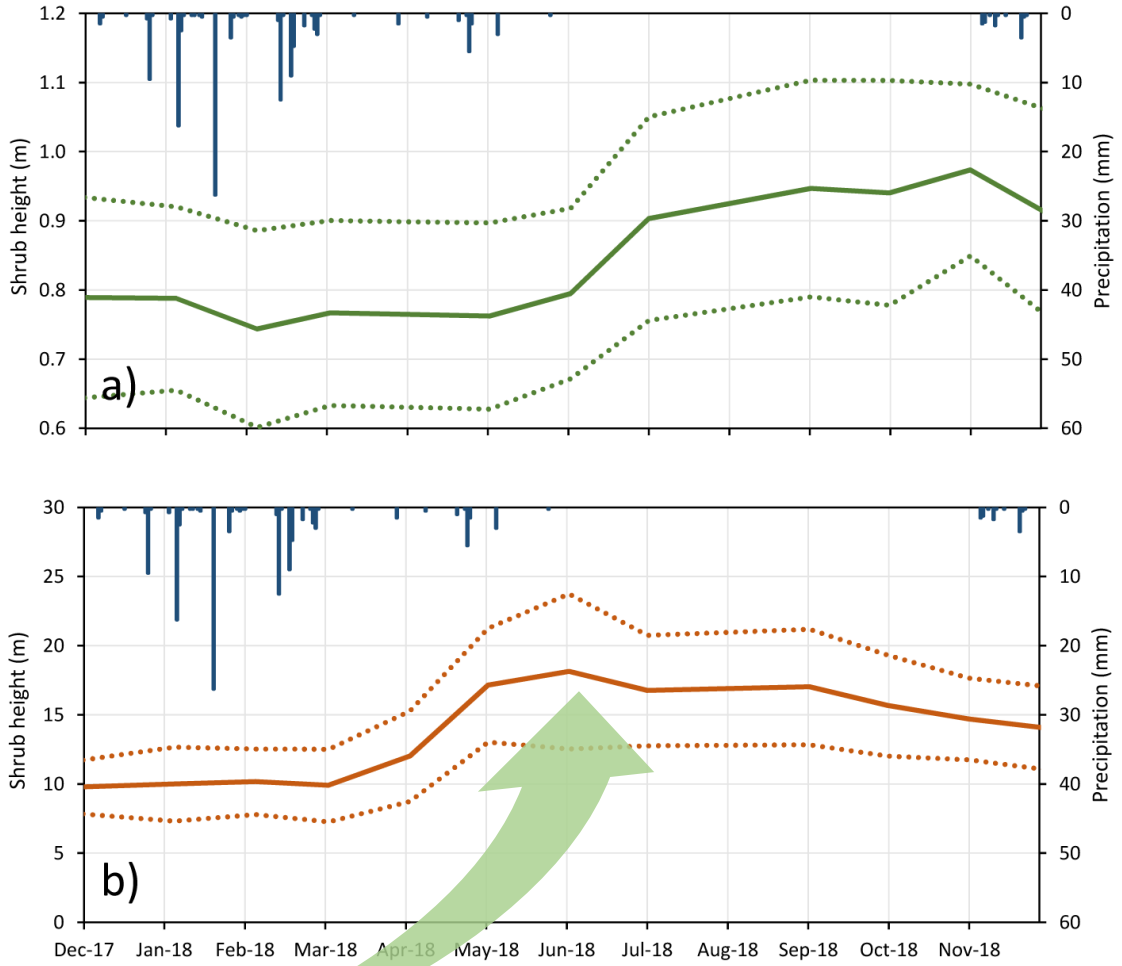




Data for out-scaling the practice

Remote science approaches

- Advanced biophysical assessment methods
  - Modeling tools
  - Statistics
- …

Target & advantages

- Detailed biophysical processes
- Harmonized, availability, costs,
- Scalability to (very) large scales (ex-ante)

Limits

- Unknown underlying processes
- Values often not directly usable

Local & robust approaches

- Local knowledge and processes
  - Verification tools
  - Robust assessment methods & memory
- …

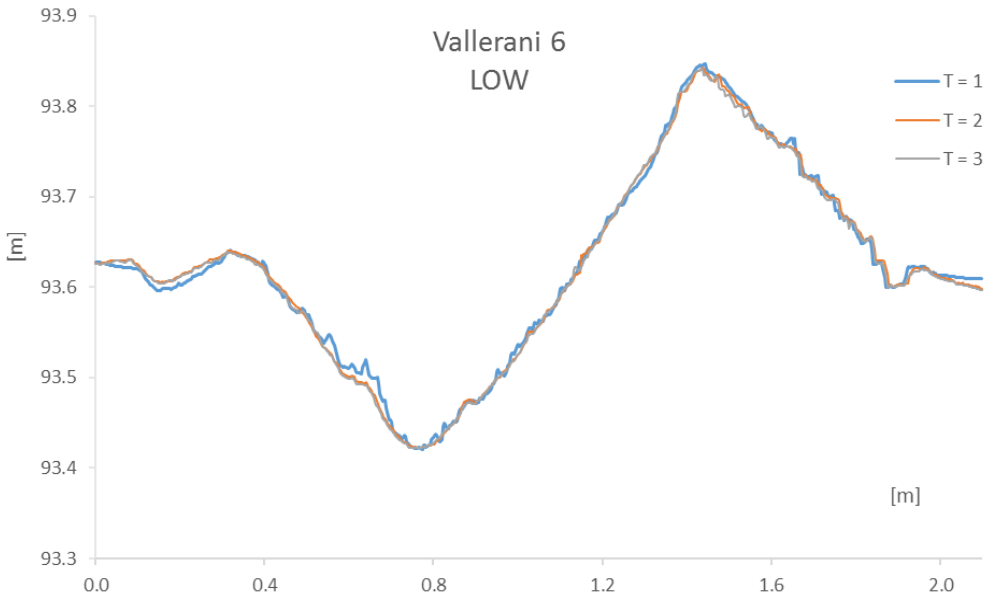
Target & advantages

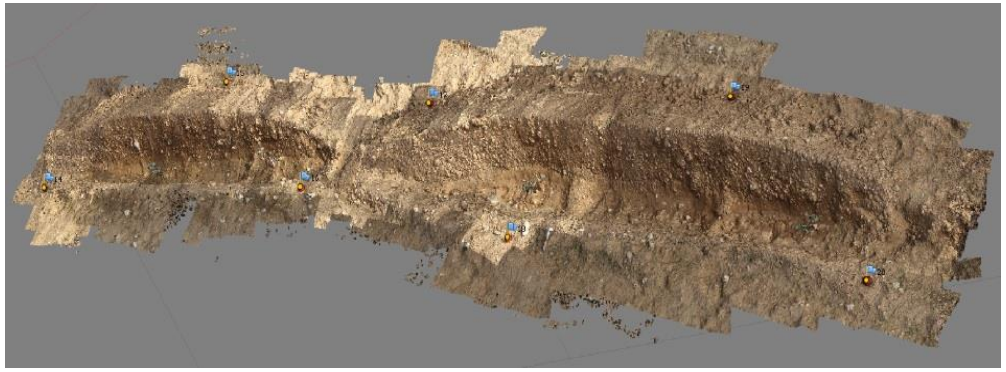
- Local input and verification of complex processes
- Back-up data (e.g. no access, covid-19)
- Buy-in from locals

Limits

- Uncertainty/translation issues
- Limited (techy) detail
- Labor intensive

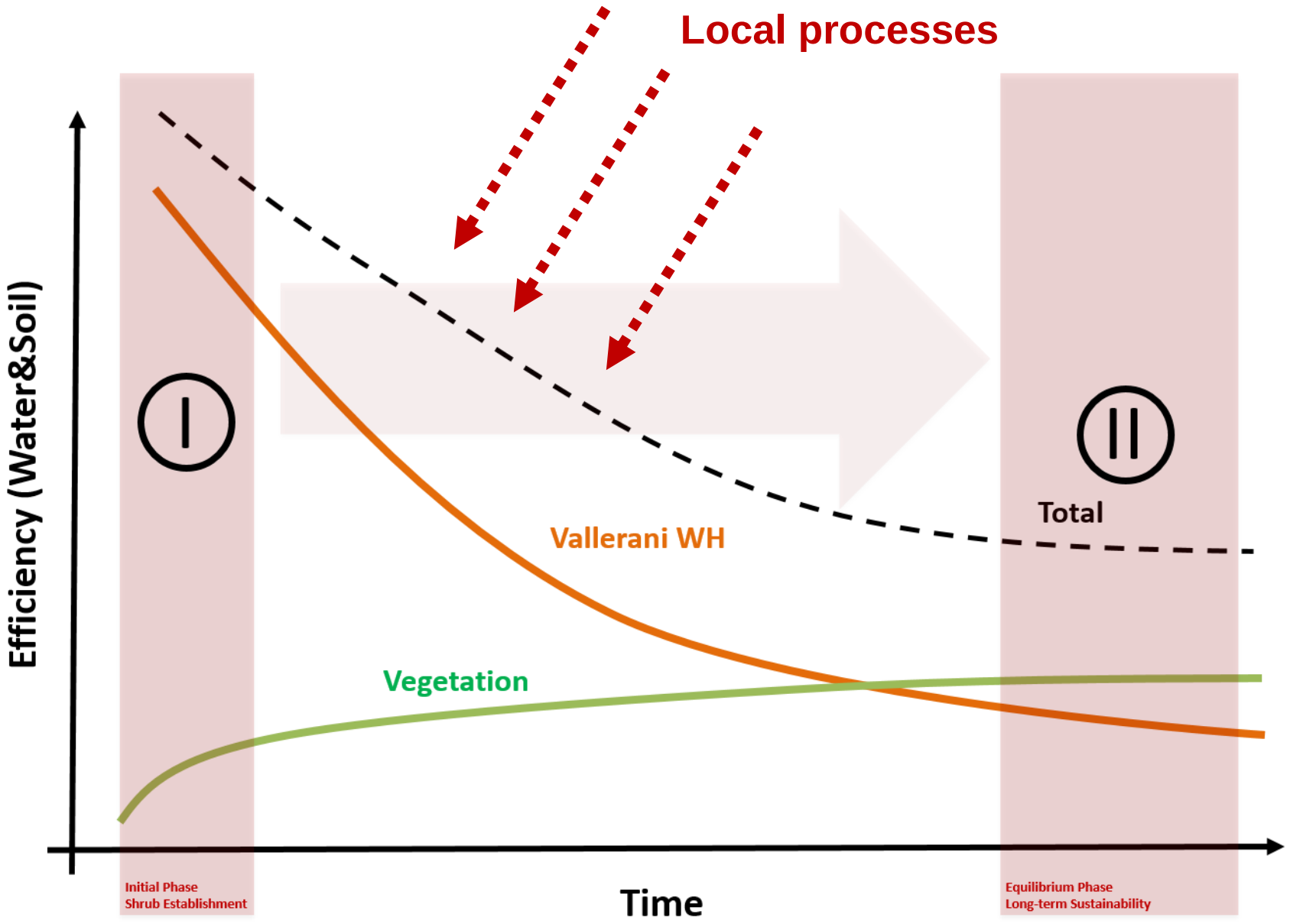
Robust data
… **where science …**
… meets the local process





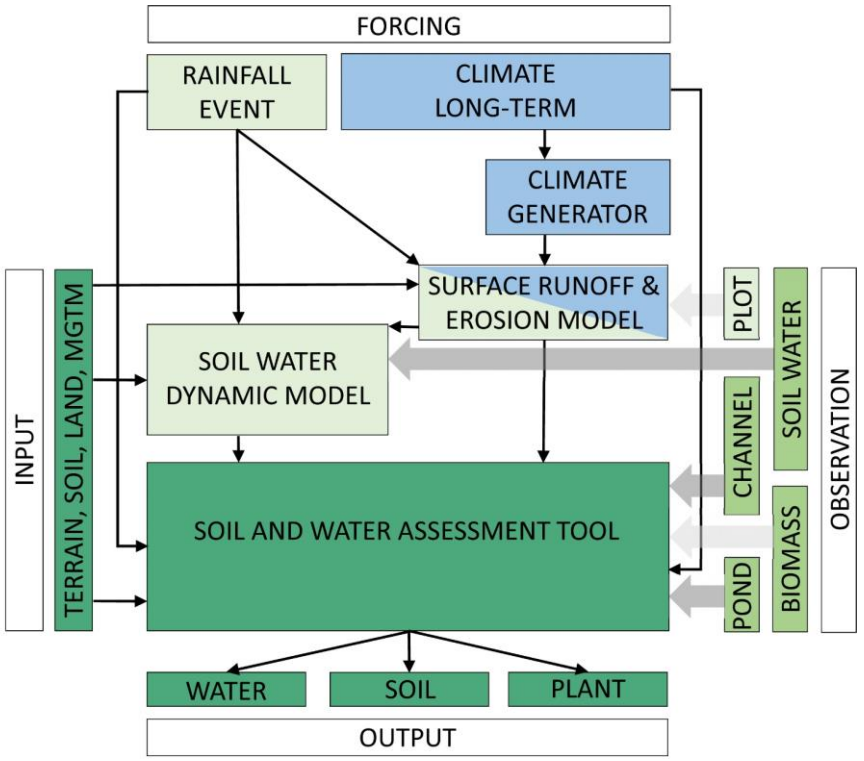
Robust data
… where science …
… meets the local process

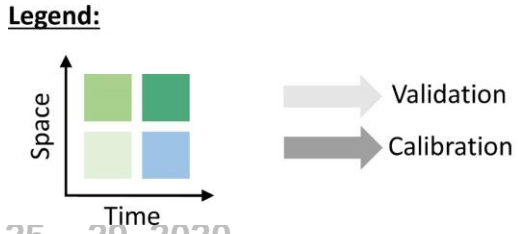
Transition states



Local inputs and back-up

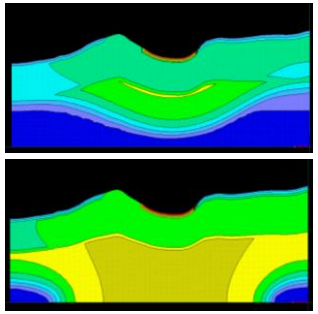
Robust science tools and data

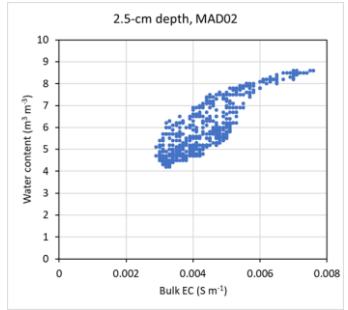




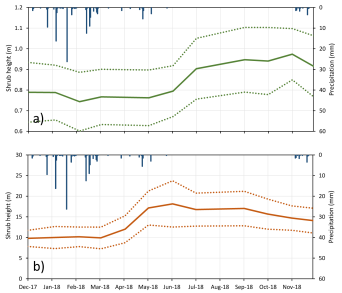
Scale

Water Harvesting

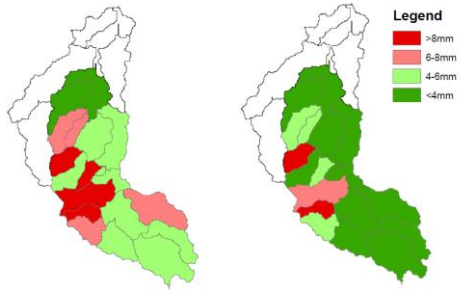




Uplands



Watershed



Common language products

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Platforms and proven approaches for e.g. decision support
Community engagement, feedback and local awareness

government)

Area used per household
- < 0.5 ha
- 0.5-1 ha
- 1-2 ha
- 2-5 ha
- ✓ 5-15 ha
- 15-50 ha
- 50-100 ha
- 100-500 ha
- 500-1,000 ha
- 1,000-10,000 ha
- > 10,000 ha

Scale
- small-scale
- ✓ medium-scale
- large-scale

Land ownership
- state
- company
- communal/ village group
- individual, not titled
- ✓ individual, titled

Land use rights
- open access (unorganized)
- communal (organized)
- ✓ leased
- ✓ individual

Water use rights
- open access (unorganized)
- communal (organized)
- leased
- individual
- ✓ NA

Access to services and infrastructure

health	poor ✓	good
education	poor ✓	good
technical assistance	poor ✓	good
employment (e.g. off-farm)	poor ✓	good
markets	poor ✓	good
energy	poor ✓	good
roads and transport	poor ✓	good
drinking water and sanitation	poor ✓	good
financial services	poor ✓	good

IMPACTS

Socio-economic impacts

fodder production	decreased	✓ increased	Quantity before SLM: 80kg.ha Quantity after SLM: 5ton/ha
fodder quality	decreased	✓ increased	
animal production	decreased	✓ increased	
production area (new land under cultivation/ use)	decreased ✓	increased	Due to the dikes (but very limited)
water availability for livestock	decreased	✓ increased	
expenses on agricultural inputs	increased	✓ decreased	Relative input (Input with respect to yield) has been reduced
farm income	decreased	✓ increased	
workload	increased ✓	decreased	Due to possible maintenance

Socio-cultural impacts

food security/ self-sufficiency	reduced	✓ improved	
SLM/ land degradation knowledge	reduced	✓ improved	

Ecological impacts

harvesting/ collection of water (runoff, dew, snow, etc)	reduced	✓ improved	
soil moisture	decreased	✓ increased	
soil cover	reduced	✓ improved	
soil loss	increased	✓ decreased	
soil accumulation	decreased	✓ increased	
soil crusting/ sealing	increased	✓ reduced	
soil organic matter/ below ground C	decreased	✓ increased	
vegetation cover	decreased	✓ increased	
biomass/ above ground C	decreased	✓ increased	
flood impacts	increased	✓ decreased	
drought impacts	increased	✓ decreased	

Off-site impacts

downstream flooding (undesired)	increased	✓ reduced	Reduced downstream flooding is desired
downstream siltation	increased	✓ decreased	Reduced downstream siltation is desired

COST-BENEFIT ANALYSIS

Lessons learnt and shared

Non-local experts (incl. students)

- Understanding local processes
- Uncertainty and reliability of data
- Framing and targeting a research question
- Value of scenarios
- Interest & awareness
- ….

Local partners

- Awareness of local knowledge and value
- Awareness of processes
- Technologies (e.g. monitoring)
- Administration (e.g. data)
- Communication
- Openness and exchange
- ….

Thank you

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