Modelling impacts of SLM: bottom-up approaches to regional assessments

26 September 2013, Luuk Fleskens

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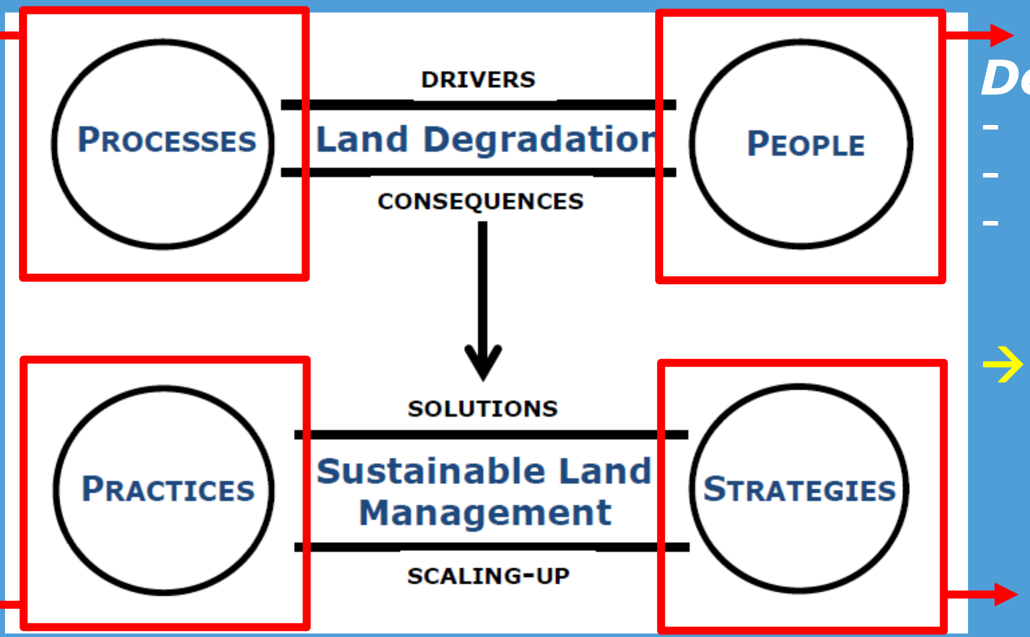
Impact modelling entry points

Effects:
- Magnitude
- Location/time
- Impacts

→ **Simulation**



Decisions:
- Theory
- Past actions
- Hypothetical (stated) choice

→ **ABM**

Potentials:
- Effectiveness
- Applicability
- Efficiency

→ **(Spatial) CBA, MCA**

Goals / constraints:
- Problem definition
- DM preferences
- Framework conditions

→ **Optimization**

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Why modelling impact of SLM practices?

- experimental conditions limited

  (weather & environmental conditions)
- trial duration too short

  (long-term impacts not tested)
- opportunity of scenario analysis

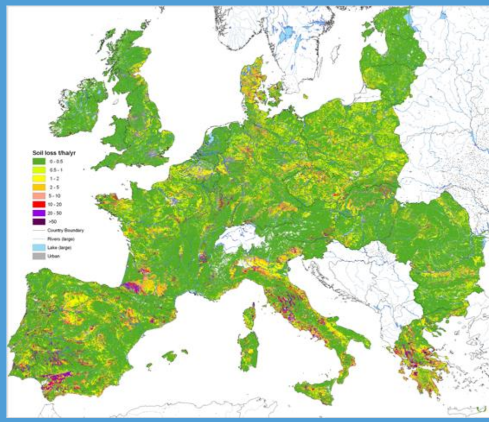
  (evaluating performance under extreme circumstances)
- effects across larger scales

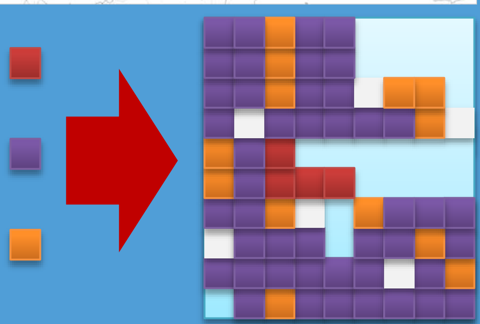
  (aggregate effects study site)
- alternative and complimentary approach

Why bottom-up modelling?

- better reflection of local realities
  (starting point local resilience rather than global vulnerability)
- opportunity to interact with stakeholders
  (incorporation of decisive factors; scope for collective learning)
- counterweight to top-down models
  (e.g. GCM impact modelling; often doom messages)
- solution-oriented rather than driver-oriented
  (hybrid models incorporating decision-making perspectives)
- understanding bottlenecks to upscaling SLM
  (direct policy relevance)

PESERA-DESMICE modelling framework



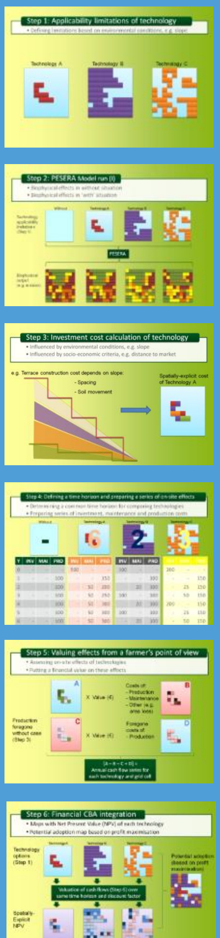


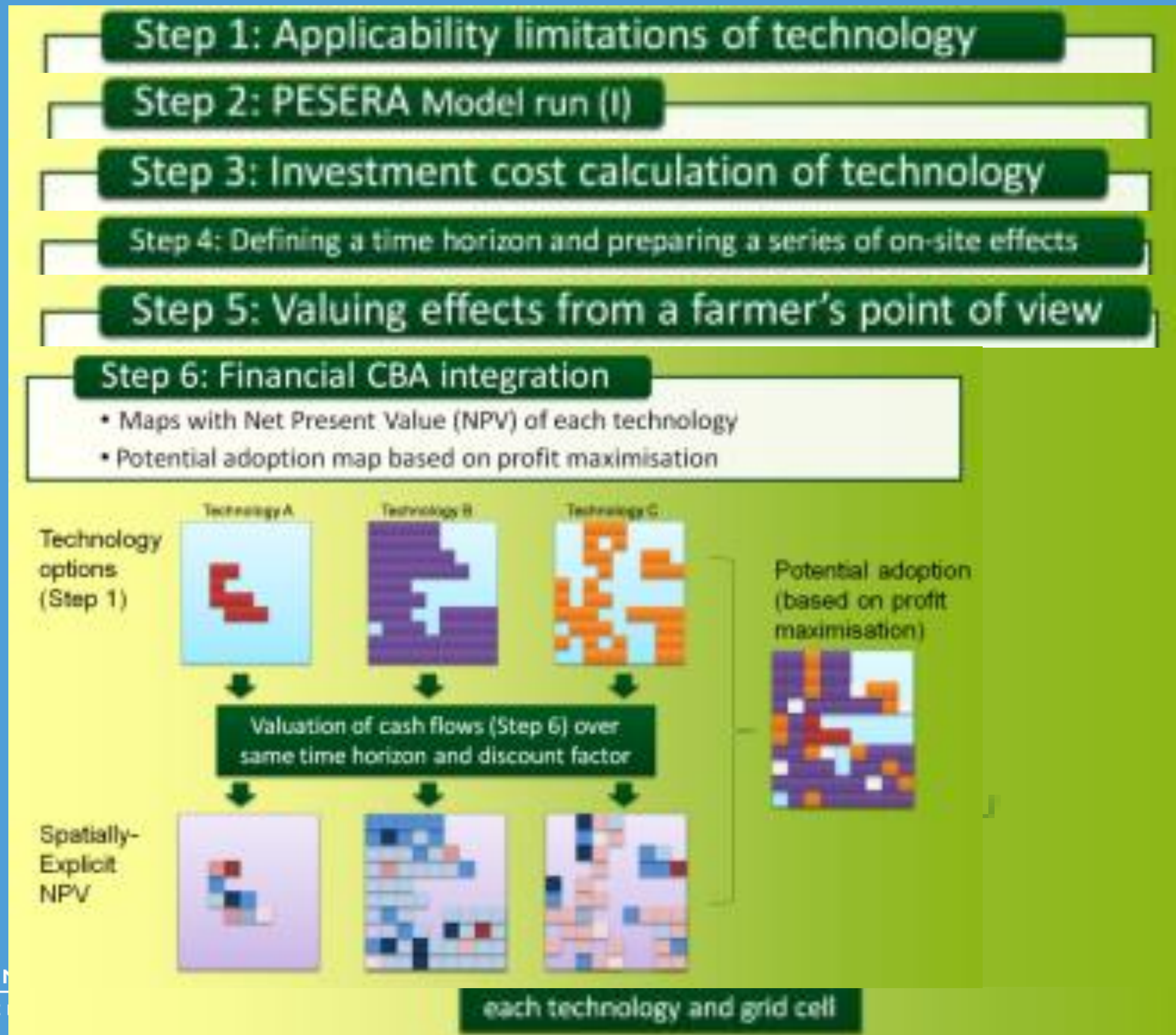
PESERA : Grid-based regional scale soil risk assessment model (grid 0.1 – 1 km), modified to take into account effect of various SLM strategies and other degradation types

DESMICE : New model scaling up SLM feasibility assessments from local to regional level using spatially-explicit financial cost-benefit analysis

Combined, these models can assess effects of policy scenarios on uptake of SLM and mitigation of land degradation

PESERA-DESMICE steps





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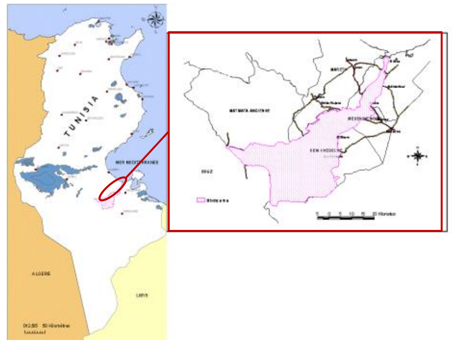
PESERA-DESMICE scenario analysis

- PESERA baseline run

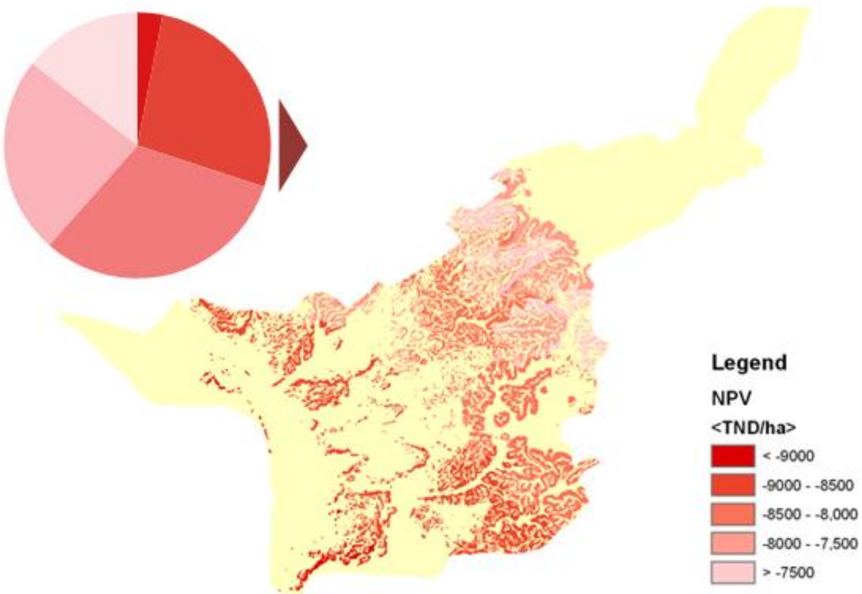
- Technology scenario
  (for each SLM option)
- Policy scenario
  (linked to one or more SLM options)
- Adoption scenario
  (estimating adoption of all simulated technologies)
- Global scenario
  (maximum food production; minimum land degradation)

PESERA-DESMICE results: Jessour, Tunisia

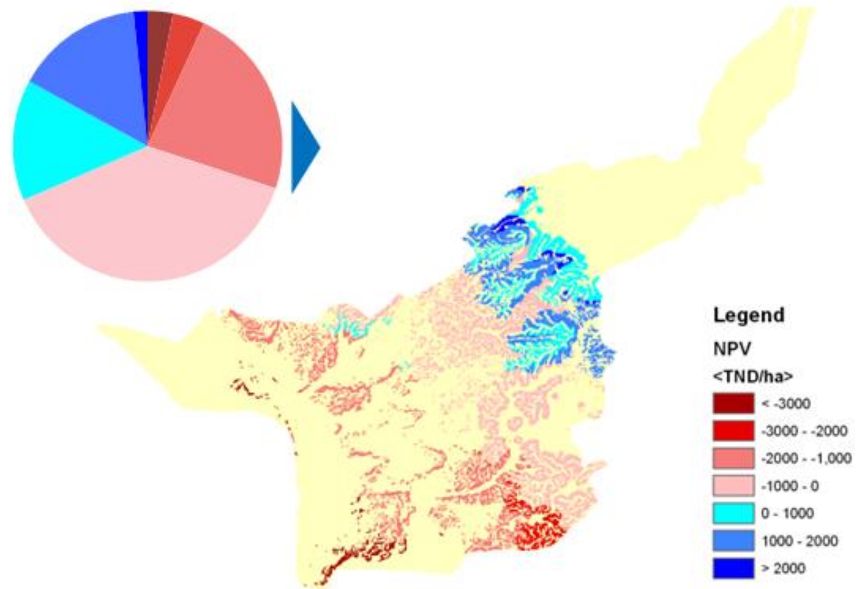


Investment cost fixed at TND 3,900 (€1945); Economic life of 20 years; Maintenance costs TND 1170 (€584); Discount rate 10%; CCR of 1:6 assumed; Extensive grazing not affected; Terrace cropped to olive; Trees productive after 6 y (25%); mature after 12 y; Olive harvest index (HI) set at 0.1; olive price TND 0.55 (€0.27) per kg; Wheat intercropped until year 12. Max. yield is 930 kg/ha; price TND 0.43 €0.21) per kg.

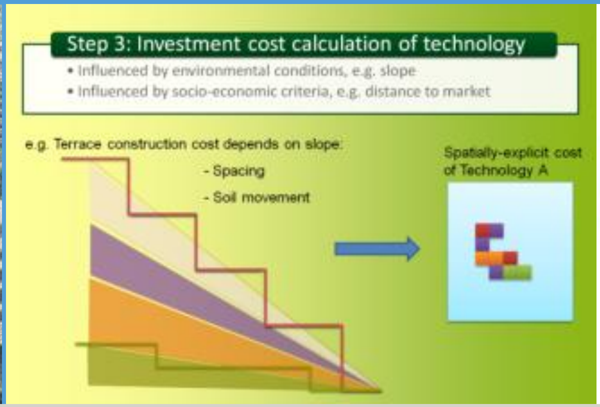
Net Present Value (20 years): olive trees newly planted

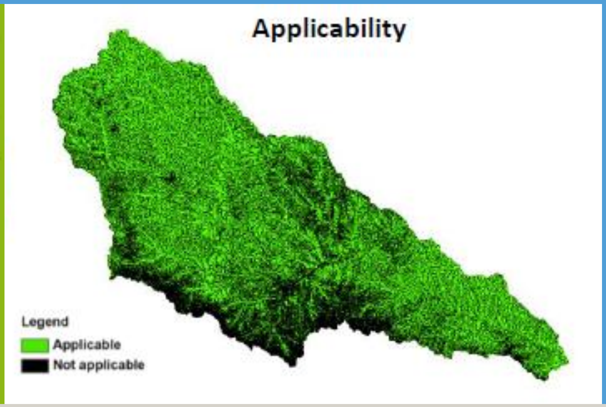


Maintenance of jessour with existing olive trees



Effect variability investment costs





$$INV_S = US\$1,823 * S/30$$

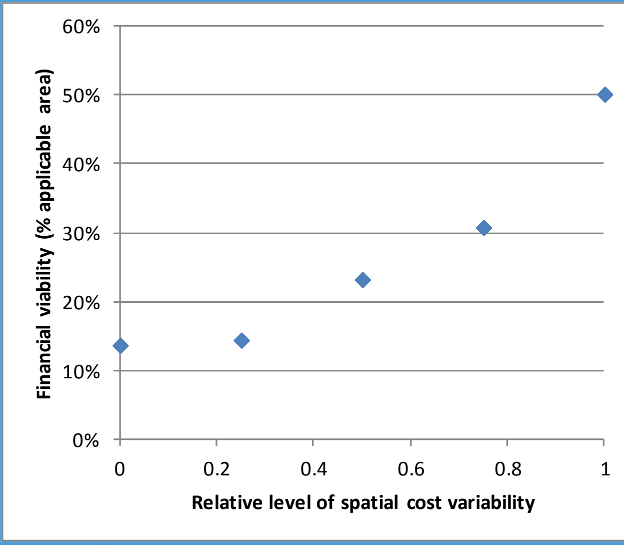
In Yanhe river basin, China bench terraces applicable in 3,732 km2

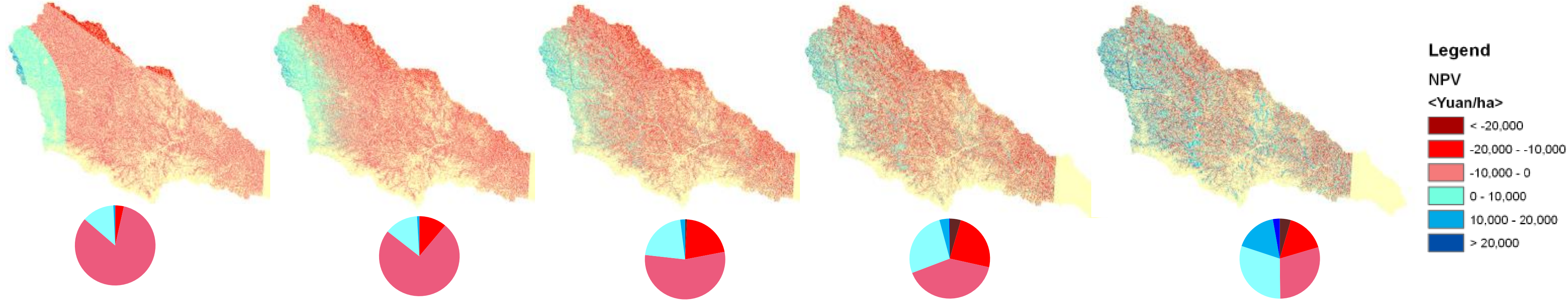
The average cost is $1,591 ± $717

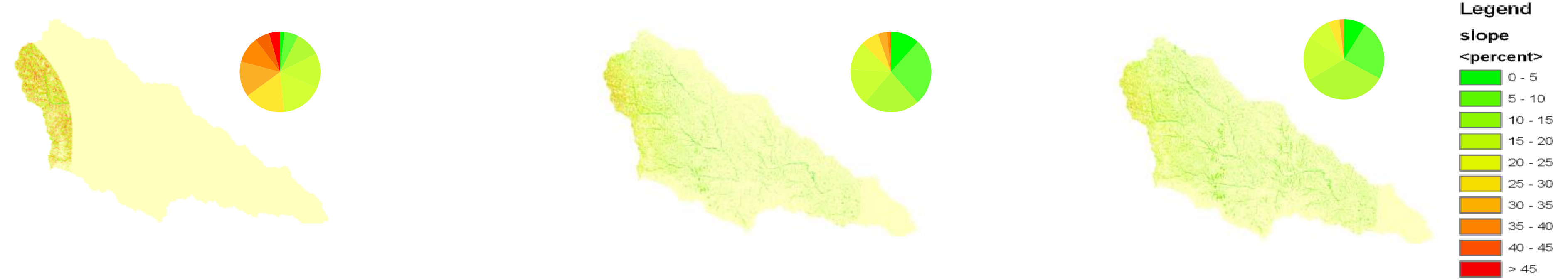
Subtracting mean from calculated cost, we can reduce spatial variability by multiplying by fractions 0.75, 0.5, 0.25 and 0.

Effect spatial variability investment cost

Investment cost (US$)	Relative level of spatial cost variability				
	0	0.25	0.50	0.75	1
Maximum	1,591	2,488	3,386	4,284	5,182
Minimum	1,591	1,196	801	406	12
St. deviation	0	179	359	538	717







Participatory evaluation of model results

- Model results can affect stakeholders' perceptions of SLM technologies: stakeholder preferences altered in light of new information or were confirmed.
- An iterative workshop approach can help to build a bridge between researchers and stakeholders, ultimately leading to greater trust in the information with which stakeholders were presented.
- Model outputs considered helpful in determining the impacts of technologies over larger areas, as well as demonstrating where technologies are not applicable or have a lower impact.
- The iterative and interactive approach helped to address some of the common critiques associated with top-down approaches to technology adoption and technology transfer, and resulted in a process with which many stakeholders were satisfied.

Stringer, Fleskens et al. (2013) Environ Manage

Ongoing DESMICE development

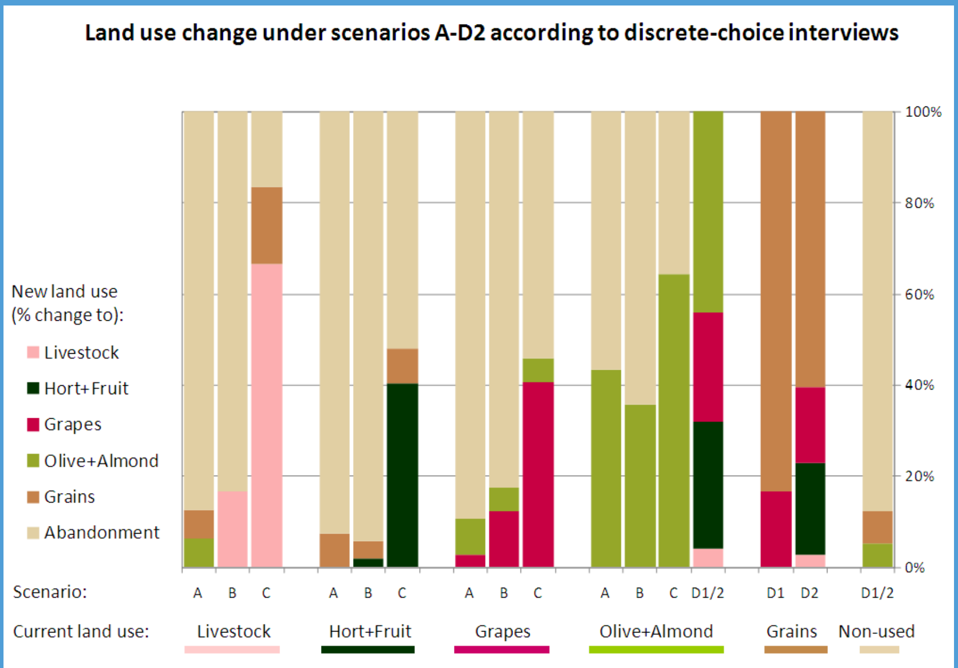
- Socio-economic data
  PhD → Cadastral information / Farm type
  Combination with farm-level optimisation
- Stated preferences
  WAHARA → Choice experiment
  CBA + Attitude to Risk + WTP limits
- Update technical coefficients CGE model
  WAHARA (PhD Mohamed) → Scenario output
  Coupling with macro-economic model to assess regional impact
- Global cost-effectiveness C-sequestration
  PBL GEO4 → Generalised global interchange of SLM options
  Coupling with GCM scenario assessment

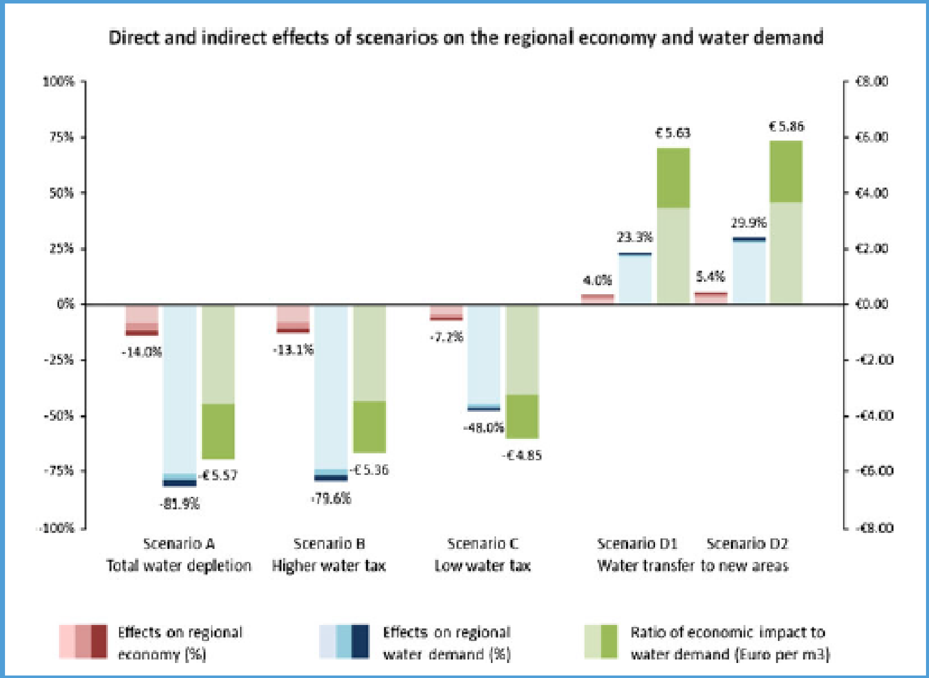
WAHARA

SEVENTH FRAMEWORK PROGRAMME

PBL Netherlands Environmental Assessment Agency

From stated preference to economic impact





Fleskens et al. (2013) Reg Environ Change

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DESIRE
A global initiative to combat desertification

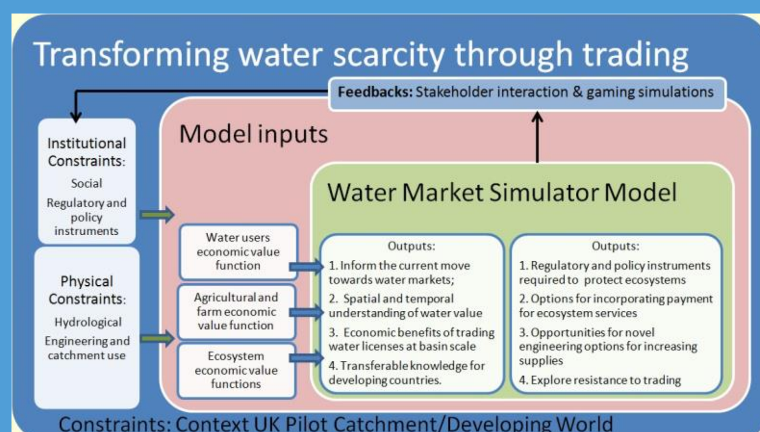
Other model developments

- Optimal timing of SLM to avoid critical transitions

CASCADE
Catastrophic shifts in drylands

SEVENTH FRAMEWORK PROGRAMME

- Dynamic value of water for water trading



EPSRC
Engineering and Physical Sciences Research Council

Transforming WATER scarcity through TRADING

Outlook

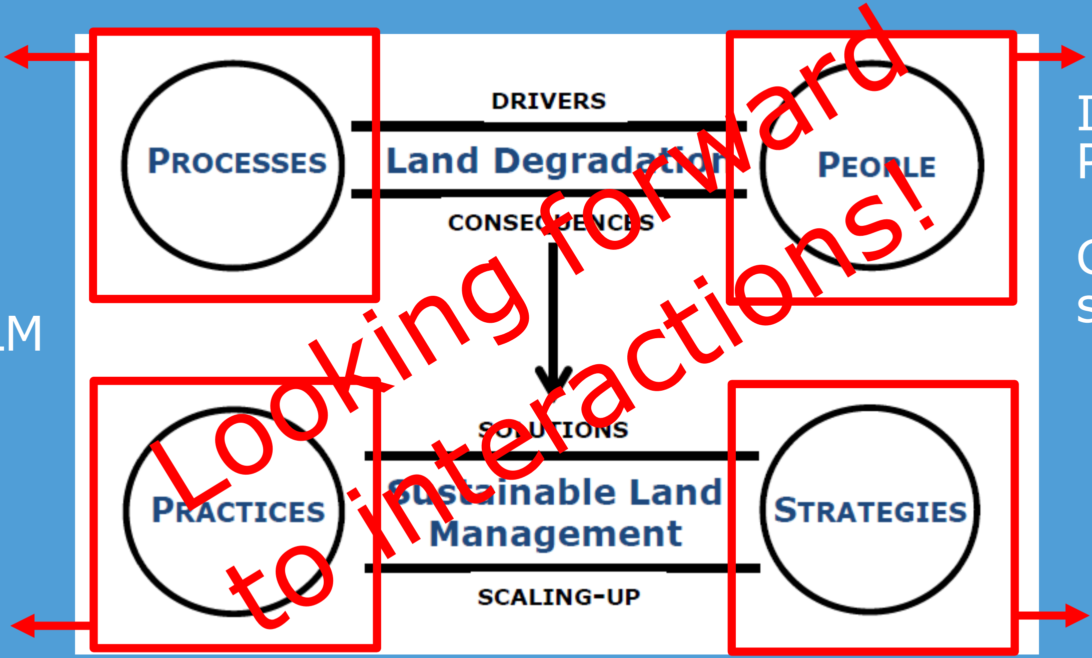
Other degradation processes

(RECARE)

Large-scale interactions SLM

Multiple ecosystem services

Scale effects



Innovation Patterns

Gaming simulations

Adaptive management

Decision-support