Rambla de Torrealvilla, Spain

Study site details

The ‘Rambla de Torrealvilla’ is a catchment within the Guadalentin basin in south-eastern Spain near the city of Lorca.

- **Coordinates:**
  Latitude: 37°47'8"N
  Longitude: 1°41'55"W
- **Size:** 266 km^2
- **Altitude:** 378 – 1499 mm
- **Precipitation:** 300 – 500 mm
- **Temperature:** 12°C - 17°C
- **Land use:** rainfed agriculture (cereals, almonds, olive), irrigated agriculture (horticulture, fruit trees, grapes), livestock.
- **Inhabitants:** na
- **Main degradation processes:** water erosion, soil salinization
- **Major drivers of degradation:** agriculture, water availability, human population, tourism, transport, climate, and land use subsidies.

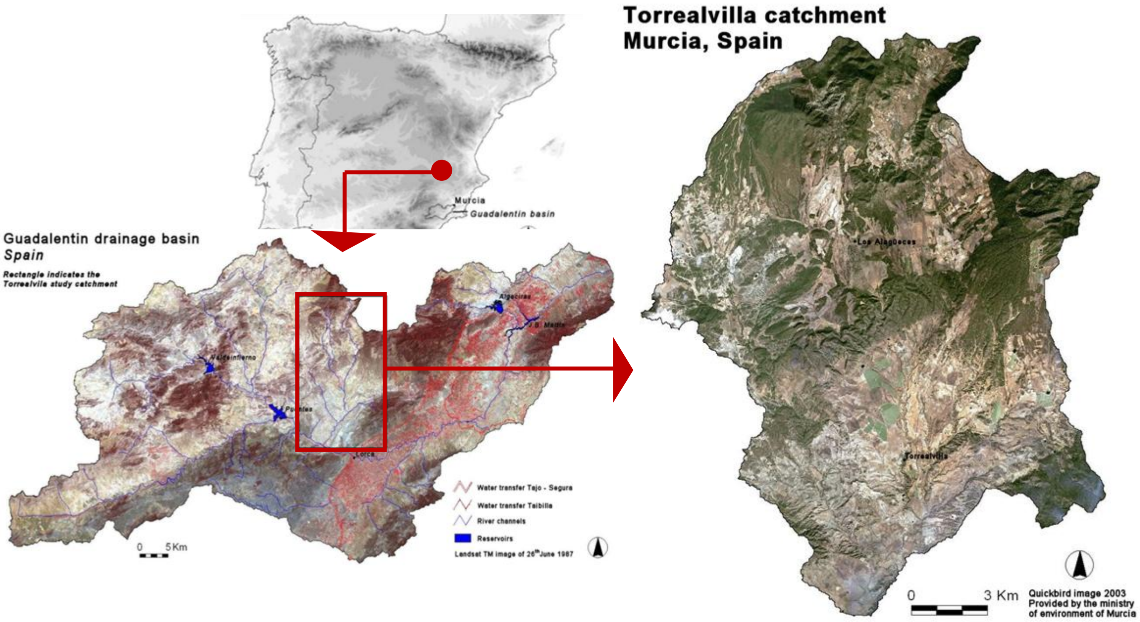

Figure 1: Study site location

Overview of scenarios

1. Baseline Scenario: PESERA baseline run
2. Technology Scenario: Reduced contour tillage in semi-arid environments (SPA01)
3. Policy Scenario: Subsidising reduced tillage (SPA01)
4. Global Scenario: Food production
5. Global Scenario: Minimizing land degradation

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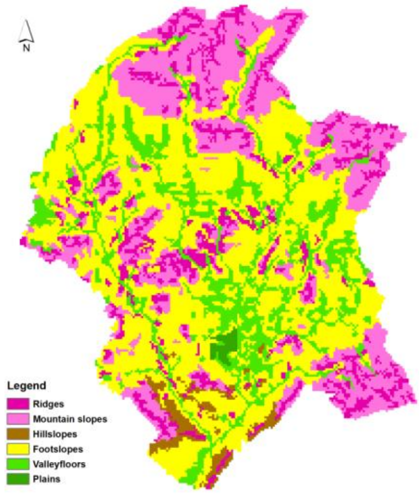
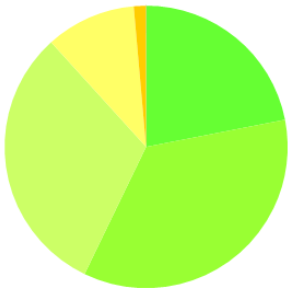
Baseline Scenario
PESERA baseline run

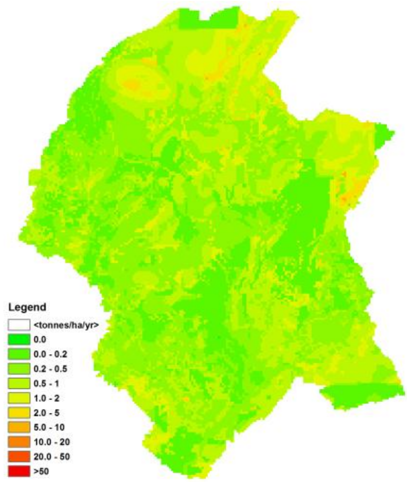
The baseline scenario shows mostly low and moderate soil erosion risk. Mountain slopes in the North-East have the highest risk. Valleyfloors display low risk. Biomass production follows the rainfall gradient towards the East, and is also influenced by land use. For example, the dry central area of the catchment with its dry land farming area shows very low biomass production (0 – 2000 kg/ha). Nevertheless, in more than half of the catchment area biomass production surpasses 10,000 kg/ha.

Landforms

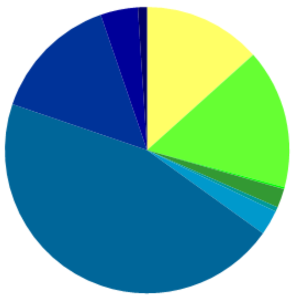


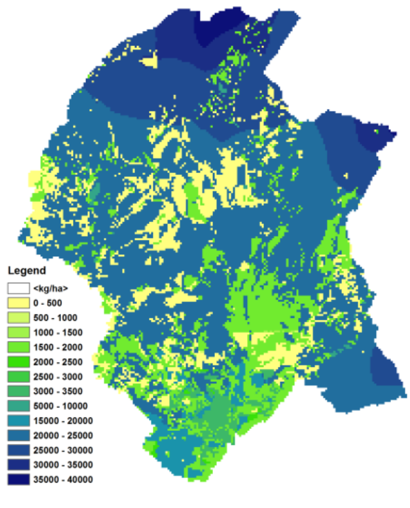
Soil erosion





Biomass production





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Technology Scenario:
Reduced contour tillage in semi-arid environments (SPA01)

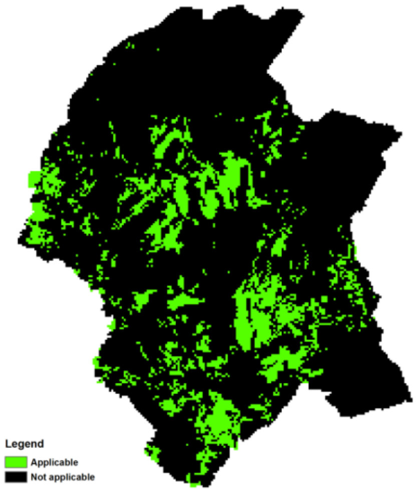
The technology could be applied to cereal plots and tree crops. Here the focus is on application on cereals.

- Total operation costs under different practices:
  - traditional tillage €75/ha
  - reduced tillage €45/ha
- The above operation costs include renting of equipment to implement each practice
- A harvest index for grains of 45% of total biomass was assumed
- The price of grains is €0.21/kg

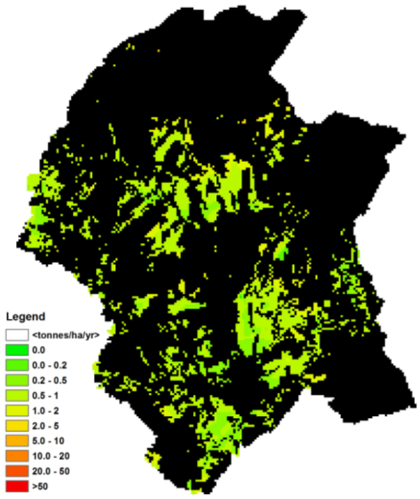
Applicability

- The technology is applicable in grain fields, with further restrictions based on slope and soil depth.

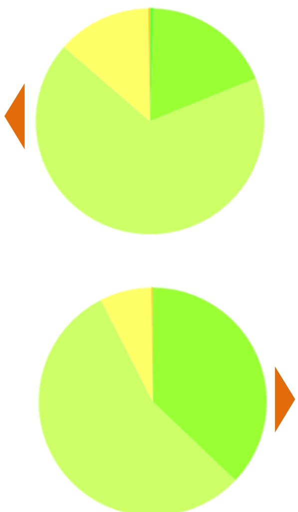
Applicability

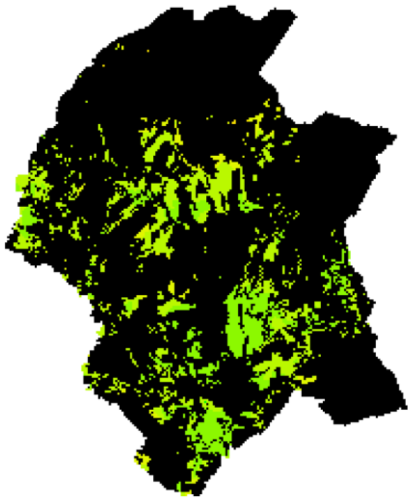


Biophysical impact: soil erosion



Under traditional tillage

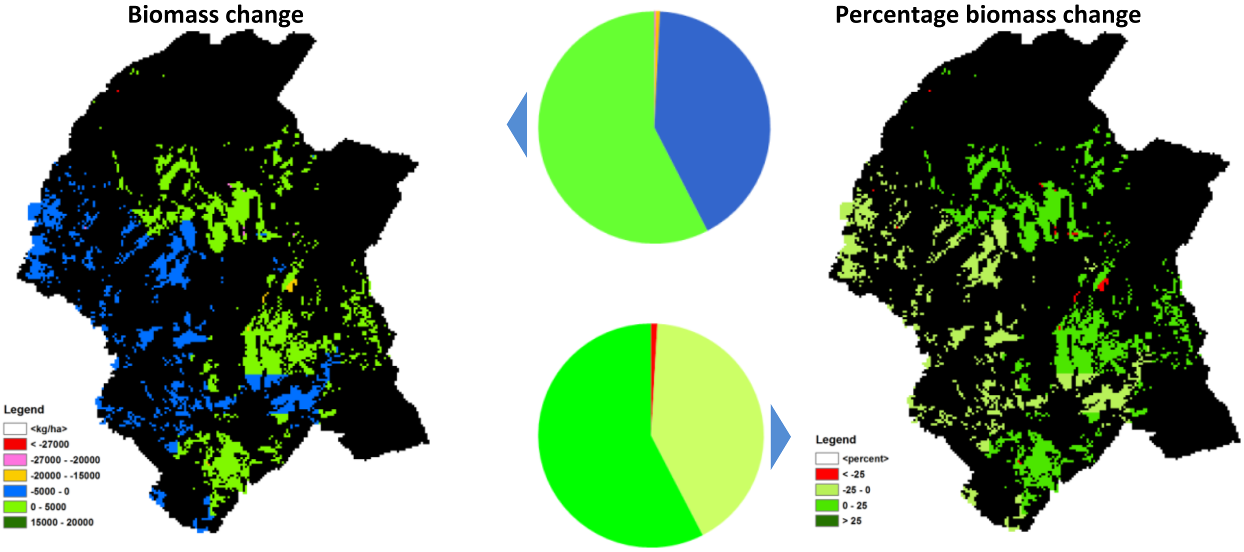




Under reduced tillage

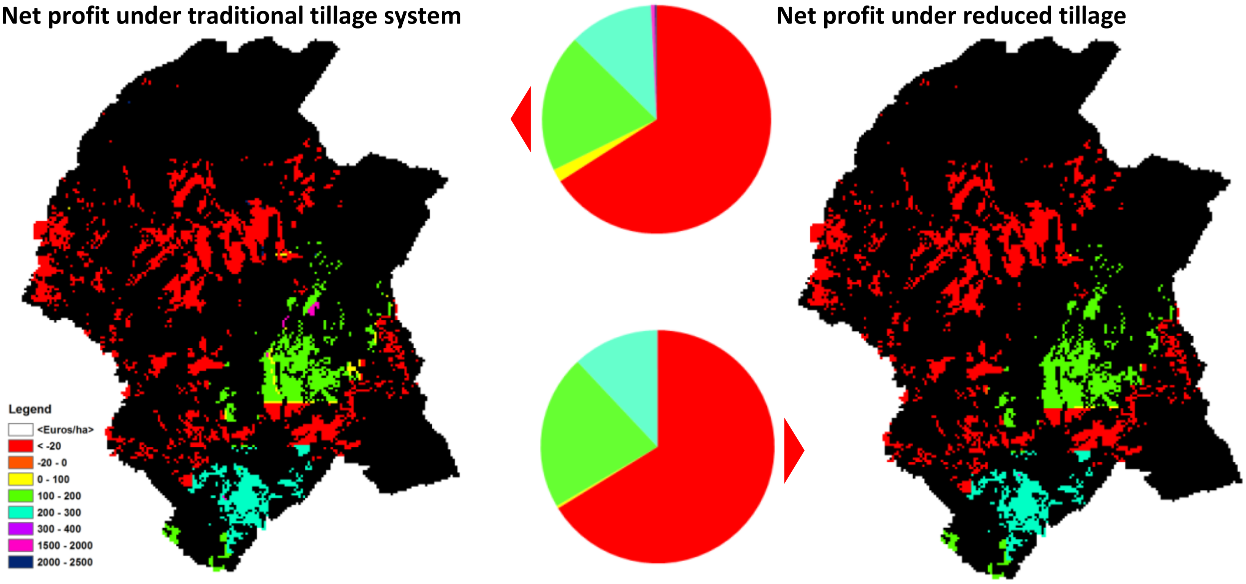
Biophysical impact: change in biomass

Biomass change / **Percentage biomass change**



Economic viability

Net profit under traditional tillage system / **Net profit under reduced tillage**



Erosion rates are typically low in the valleyfloors and footslopes where the technology is applied, even if under conventional tillage. Minimum tillage somewhat reduces the highest category soil loss, but especially leads to reduction of soil erosion in the below 1 ton/ha class. Biomass change is positive in about 60% of cases and negative in 40%. In percentages the changes almost entirely fluctuate between -25% and +25% of yields under conventional systems. Although reduced tillage is cheaper than conventional tillage, it is not enough to enable more widespread adoption. Profitability slightly improves where the technology already leads to a positive profitability - i.e. roughly in a third of the area.

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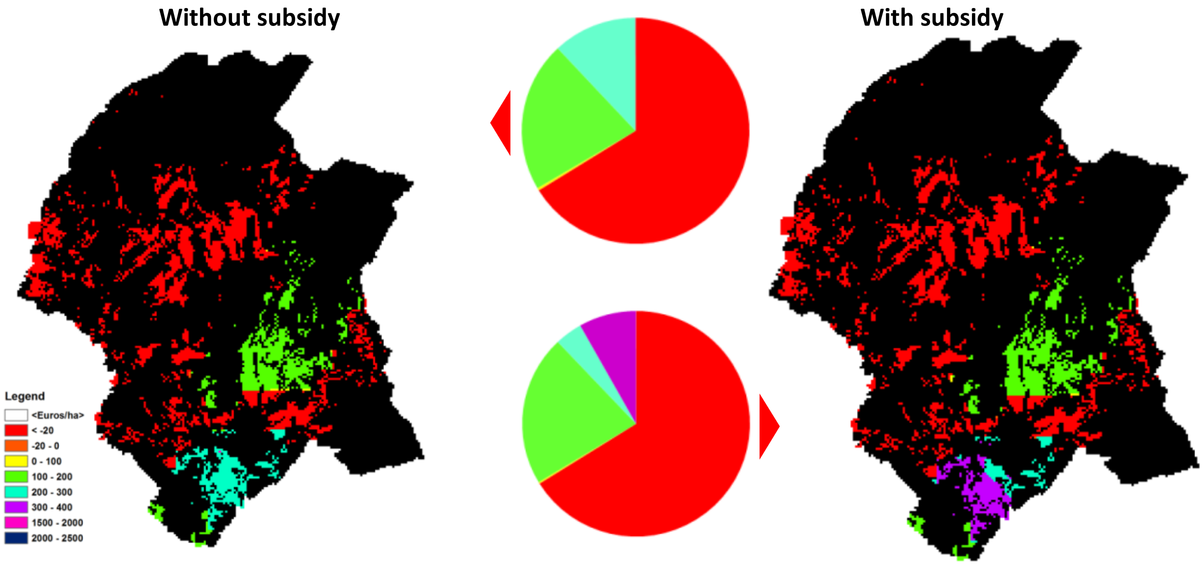
Policy Scenario:

Subsidising reduced tillage (SPA01)

Due to low productivity in many parts of the study area, without external financial incentive in all parts of the study area widespread adoption of the technology is very unlikely. In this scenario the effects of a subsidy equal to 50% of the operational costs on profitability of the technology and the potential for mitigating land degradation are explored.

50%

Profitability:



Cost-effectiveness indicators:

- The introduction of 50% subsidy does not have significant impact as the proportion of the study area with negative economic gain largely remains the same before and after the subsidy.
- No cost-effectiveness indicators can be calculated; in fact, a subsidy scheme of this nature would only raise the profitability for those already in a position to implement minimum tillage.
- The issue here is that no-tillage leads to a reduction in biomass (and yields) in part of the area. Field experiments have not confirmed such effect, and stakeholders do not perceive this as a risk either. The validity of these conclusions should be confirmed by field research.

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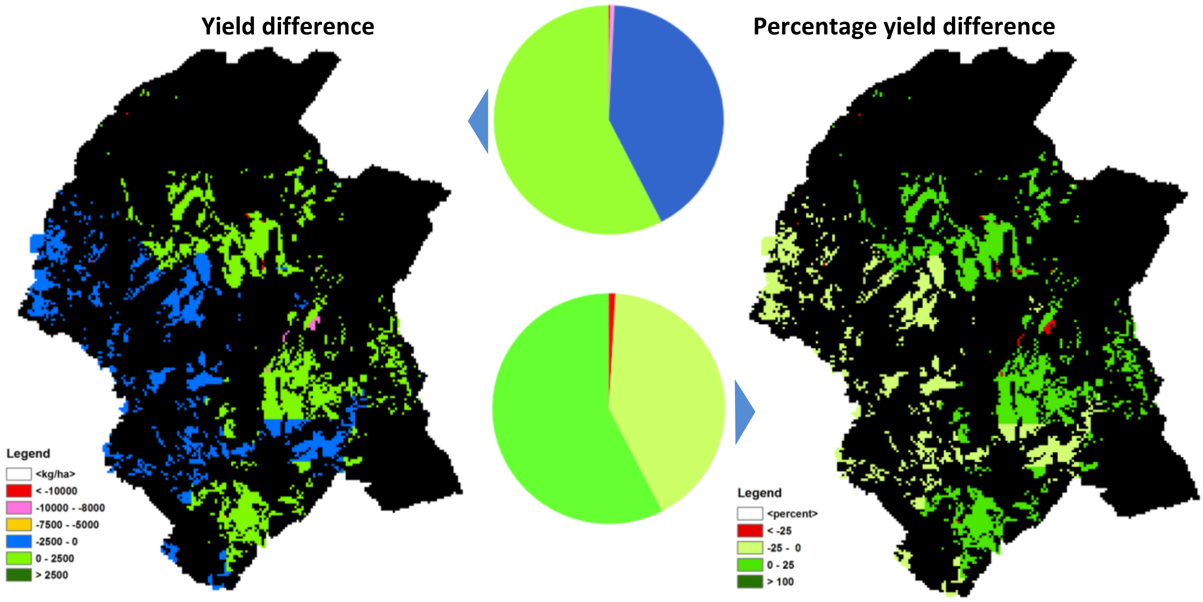
Global Scenario:
Food production

The food production scenario selects the technology with the highest agricultural productivity (biomass) for each cell where a higher productivity than in the baseline scenario is achieved. The implementation costs for the total study area are calculated and cost-productivity relations assessed. To facilitate comparison between different study sites, all costs are expressed in Euro.

+3.8 kg/ha

+? kg/inhabitant

Scope for increased production



Biophysical impact: yield difference

- The implementation of reduced tillage would see yield increase in 58 % of applicable area;
- Average absolute yield change: 3.8 kg/ha
- Average yield change: 0.4 %

Economic indicators

Average costs:

- Extra operational cost: - €30/ha/yr (saving!)
- Unitary cost: - €7,895/ton (saving!)

Aggregate indicators:

- Study site: - €75,000 (saving!)
- Augmented annual production: 9.5 ton

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Global Scenario:
Minimizing land degradation

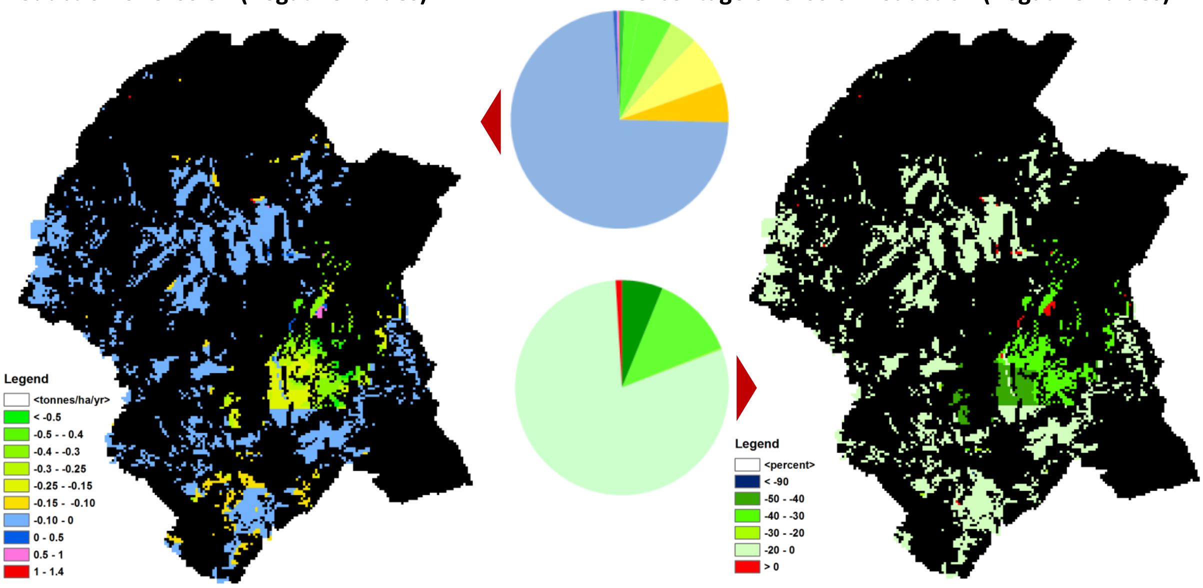
The minimizing land degradation scenario selects the technology with the highest mitigating effect on land degradation or none if the baseline situation demonstrates the lowest rate of land degradation. The implementation costs for the total study area are calculated and cost-productivity relations assessed. To facilitate comparison between different study sites, all costs are expressed in Euro.

-0.1 ton soil/ha

-€300/ton soil*

Scope for reduced erosion

Reduction of erosion (negative values) **Percentage of erosion reduction (negative values)**



Biophysical impact: erosion reduction

- Reduction of erosion in 99 % of applicable area
- Average absolute erosion reduction: 0.1 tonnes/ha/yr
- Average percent erosion reduction: 10 %

Economic indicators

Average costs:

- Extra operational cost: - €30/ha/yr* (saving)!
- Unitary cost: - €300/ton soil* (saving)!

Aggregate indicators:

- Study site: - €129,000* (saving)
- Aggregate annual erosion reduction: 443 ton

* Note: As there is on average across the applicable area a net decline of grain yields of -102 kg/ha, the actual 'benefit' is smaller (unitary cost: - €86/ton soil; study site aggregate: - €36,900).

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Concluding remarks

- Baseline simulations show comparatively low erosion rates in the Torrealvilla catchment. More than 80% of the area displays soil erosion rates below 1 ton/ha/yr. High risk areas are limited in extent. Expert mapping showed a more generic concern of soil erosion by water.
- Reduced tillage in cereals (and almonds) was the second-ranked technology selected for field testing by scientists and local stakeholders. The technology scenario shows that minimum tillage involves a reduction of operational costs. Such a saving, even in absence of a positive effect on crop yield, could make the technology profitable. The technology scenario shows a mixed picture: there are slight increases in crop yield in about 60% of the applicable area, and yield reductions in the remaining 40%. The technology is profitable in only one third of the applicable area, which seems to indicate that cereal farming is a marginal economic activity. In field experiments, the savings on operations were confirmed and no significant change in yield was observed between minimal tillage and control.
- In the workshop to evaluate monitoring and modelling results, stakeholders reiterated their views that minimum tillage in cereals is economical and that it does not lead to yield reduction risks. The technology was ranked second again. The negative effect of minimum tillage on yield simulated by PESERA contradicts this view to some degree. Margins on cereal farming are low, so that can be one factor that easily influences outcomes of model simulation. It is also possible that labour costs are not valued according to market price. Incentives for adoption of sustainable land management strategies was among the recommendations to improve adoption.
- A policy scenario reducing costs by 50% did not lead to any additional uptake of the technology. With no evidence of environmental benefits, it would be inappropriate to stimulate adoption through a subsidy. Likely, the subsidies would be applied for in areas where the technology is economically feasible without support.
- The global scenarios show that minimum tillage is beneficial through cost-saving relative to conventional tillage. It actually pays to reduce tillage operations, with environmental benefits (soil and water conservation) as side effect. Although the technology is not beneficial in the entire applicability area, the aggregate study site result is still positive. The technology will however not lead to important productivity increases: this is limited to 3.8 kg/ha on average.
- The cost-saving nature of the technology has led to it being appreciated as an easy to implement measure by local land users. Margins are small though, and dryland cereal farmers in the area may generally struggle to generate a profit. However, *relative* to conventional tillage there is little risk involved in adopting minimum tillage.