

Appendix 1. Detailed methodology descriptions

Table A1.1. Detailed summary of ecosystem services, description of variables and data handling, category values and max values

Ecosystem service	Description and data handling	Variable type	Category value					Max value
			1	2	3	4	5	
Crop production	The value representing crop production is the farmers' estimated annual crop yield for maize and beans. The largescale commercial farmers (CF) produce mostly 50% maize and 50% soya beans under a rotation scheme. The smallscale farmers (SF) produced mainly maize and dry or sugar beans and the proportions varied, both using crop rotation and intercropping. CF expressed their yield in tons/hectare. In the cases when SF expressed their yield as bags/field or other, we standardized the estimation to tons/hectares validating the data using information from previous yield studies in the field area (Kosgei et al. 2007).	Categorical	0-20% of max	21-40% of max	41-60% of max	61-80% of max	81-100% of max	The maximum yield of maize and beans mentioned by any of the farmers.
Crop variety	Crop variety is expressed as the number of different crops produced on the crop fields and in the vegetable gardens.	Categorical	0-20% of max	21-40% of max	41-60% of max	61-80% of max	81-100% of max	The maximum number of different crops mentioned by any of the farmers.
Livestock production	Livestock production is expressed as the number of cattle owned by the farmers. Although some farmers have other animals than cattle, the most important livestock in this area is cattle. The animal unit is not considered, and grazing pressure and grazing methods are not part of the analysis. The CF livestock numbers vary greatly over the seasons. Cattle are either bred, bought or leased for grazing and/or breeding in feed lots, for selling either as live animals or for meat. The SF hold cattle not primarily for food production, but as an asset and may be used for cultural purposes. Cattles are sold or slaughtered when there is a specific cultural or economic need. To simplify the comparison of livestock production between the CF and the SF, the cattle number is used as a measure of food production and/or an asset. For both farmer groups, cattle graze in the grazing lands during summer (8 months) and on the crop fields after harvest during winter (4 months). The livestock value is hence divided between the land uses grazing land and crop land according to the part of the year grazing occur.	Categorical	0-20% of max	21-40% of max	41-60% of max	61-80% of max	81-100% of max	The maximum number of cattle owned by any of the farmers at the point of the interview.
Wild foods	The value representing wild foods (wild herbs, fruits, berries, mushrooms and animals) is expressed as the proportion of their family's food intake that is being collected.	Categorical	Very little	Little	Half	Much	Very much	All
Building materials	The value representing building materials (sand, stones, clay, grass, logs, poles and sticks) is expressed as the proportion of the family's use of building material that is being collected.	Categorical	Very little	Little	Half	Much	Very much	All
Fire wood	The value representing fire wood (wood, twigs and cow dung) is expressed as the proportion of their family's energy source for cooking is that is being collected as fire wood.	Categorical	Very little	Little	Half	Much	Very much	All

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<i>Table A1.1 continued</i>		Category value						
Ecosystem service	Description and data handling	Variable type	1	2	3	4	5	Max value
Recreation	The value representing recreation is expressed as the number of different recreational activities carried out by the farmer's family in their land.	Categorical	0-20% of max	21-40% of max	41-60% of max	61-80% of max	81-100% of max	The maximum number of recreation activities mentioned by any farmer.
Traditional medicines	The value representing traditional medicine (generally a variety of plant material) is expressed as the proportion of the farmers within the farmer group who collect traditional medicine.	Binary						
Aesthetic value	The value representing aesthetic appreciation is expressed as the proportion of the farmers within the farmer group who use specific places in their land for aesthetic appreciation.	Binary						
Social relations	The value representing social relations (the use of meeting places) is expressed as the proportion of the farmers within the farmer group who use specific places in their land for social relations.	Binary						
Spiritual value	The value representing spiritual/religious meaning (the use of places for praying, worshipping, spiritual fulfilment, connections with ancestors) is expressed as the proportion of the farmers within the farmer group who use specific places in their land for spiritual/religious meaning.	Binary						
Water availability	The availability of water for crops, household use and the environment. Expert assessment based on criteria and parameters found in Table A2.	Categorical	very low	low	medium	high	very high	
Water flow regulation	The regulation of water flow, i.e. reducing high flows and floods, sustaining slow flow of water supply. Expert assessment based on criteria and parameters found in Table A2.	Categorical	very low	low	medium	high	very high	
Soil erosion regulation	The regulation of soil erosion, i.e. reducing loss of soil and nutrients. Expert assessment based on criteria and parameters found in Table A2.	Categorical	very low	low	medium	high	very high	
Nutrients retention	The retention of soil nutrients for availability to crops and vegetation. Expert assessment based on criteria and parameters found in Table A2.	Categorical	very low	low	medium	high	very high	

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Table A1.2. Detailed description of category values, variables and criteria per land use for the expert assessment of the services water availability, water flow regulation, soil erosion regulation, and nutrient retention.

Service	Definition	Land use	Category value, variables and criteria				
			very low (1)	low (2)	medium (3)	high (4)	very high (5)
Water availability	The availability of water for crops, household use and the environment.	crop	Farmers with only rainfed crop production, and very low access to household water e.g. no or little small-scale rainwater harvesting. Conventional tillage, no cover crops and very little mulching.	Farmers with only rainfed crop production, and low access to household water i.e. small-scale rainwater harvesting for vegetable gardens. No-till practices but with limited mulching and no or little cover crops, increases soil moisture slightly.	Farmers with only rainfed crop production, but with full access to household water. No-till practices, cover crop and mulching which increase soil moisture.	Farmers with a large proportions of the land irrigated and access to large dams. No-till practices, cover crop and mulching which increase soil moisture.	Farmers with all land irrigated and access to large dams. No-till practices, cover crop and mulching which increase soil moisture.
		grazing	Very low vegetation cover and very high erosion rates. Rainfall rates and frequencies.	Low vegetation cover and high erosion rates. Rainfall rates and frequencies.	Lands with medium rainfall, lower lands. Medium vegetation cover and medium erosion rates. Rainfall rates and frequencies.	Lands with higher rainfall, higher up in the mountains. High vegetation cover and low erosion rates. Rainfall rates and frequencies.	Lands with higher rainfall, higher up in the mountains. Very high vegetation cover and very low erosion rates. Rainfall rates and frequencies.
Water flow regulation	The regulation of water flow, i.e. reducing high flows and floods, sustaining slow flow of water supply.	crop	Very eroded and degraded lands. Farmers with conventional tilling, no cover crops and no or little mulching. Heavily grazed after harvest.	Lands with low infiltration rates. Farmers with no-till practices but no cover crops and limited mulching, heavily grazed after harvest.	Lands with medium infiltration rates. Farmers with no-till practices but no cover crops and limited mulching.	Lands with high infiltration rates. Farmers with no-till practices but limited cover crops and mulching.	Lands with very high infiltration rates, which leads to high soil moisture. Farmers with no-till practices, cover crops and mulching.
		grazing	Lands with very low vegetation cover and very high erosion rates.	Lands with low vegetation cover and high erosion rates.	Lands with medium vegetation cover and medium erosion rates.	Lands with high vegetation cover and low erosion rates.	Lands with very high vegetation cover and very high erosion rates.

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<i>Table A1.2 continued</i>		Category value, variables and criteria					
Service	Definition	Land use	very low (1)	low (2)	medium (3)	high (4)	very high (5)
Soil erosion regulation	The regulation of soil erosion, i.e. reducing loss of soil and nutrients.	crop	Very eroded and degraded lands. Very high soil loss rates. Sloping land. Farmers with conventional tilling, no cover crops and no or little mulching. Heavily grazed after harvest.	Eroded and degraded lands. High soil loss rates. Flat land. Farmers with no-till practices, no cover crops and limited mulching. Heavily grazed after harvest.	Lands with medium erosion regulation. Medium soil loss rates. Farmers with no-till practices, no cover crops and limited mulching. Grazing after harvest. Presence of contours which are prone to erosion.	Lands with high erosion regulation. Low soil loss rates. Farmers with no-till practices, mostly cover crops and mulching. Grazing after harvest. Presence of contours which are prone to erosion.	Lands with very high erosion regulation. Very low soil loss rates. Farmers with no-till practices, cover crops and mulching. Limited grazing after harvest. Managing contours which are prone to erosion.
		grazing	Very eroded and degraded lands. Very high soil loss rates. Farmers who are not managing grazing through rotation or fencing off dongas, cattle paths and eroded areas.	Eroded and degraded lands. High soil loss rates. Farmers who have limited managing grazing through rotation or fencing off dongas, cattle paths and eroded areas. Some rehabilitation areas present.	Lands with medium erosion levels. Medium soil loss rates. Farmers with grazing management through rotation and fencing off dongas and with limited grazing on eroded lands.	Lands with low erosion levels. Low soil loss rates. Farmers with grazing management through rotation and fencing off dongas and no grazing on eroded lands.	Lands with very low erosion levels. Very low soil loss rates. Farmers with grazing management through rotation and fencing off dongas and active rehabilitation of eroded lands.
Nutrient retention	The retention of soil nutrients for availability to crops and vegetation.	crop	Lands with very low nutrient levels and very low organic carbon levels. Farmers with conventional tillage, no cover crops, no or little mulching. High levels of soil loss.	Lands with low nutrient levels and low organic carbon levels. Farmers who practice no-till, but no cover crops and limited mulching.	Lands with medium nutrients levels and medium organic carbon levels. Farmers who practice no-till but still need external input.	Lands with high nutrients levels and high organic carbon levels. Farmers who have practiced no-till for many years but need external input.	Lands with very high nutrient levels and very high organic carbon levels.
		grazing	Lands with very low nutrient levels and very low organic carbon levels. Very low vegetation cover.	Lands with low nutrient levels and low organic carbon levels. Low vegetation cover.	Lands with medium nutrient levels and medium organic carbon levels. Medium vegetation cover.	Lands with high nutrient levels and high organic carbon levels. High vegetation cover.	Lands with very high nutrient levels and very high organic carbon levels. Very high vegetation cover.

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Table A1.3. Detailed description of factors used as criteria for the estimation of the farmers groups' capacity to maintain the supply and meet the demand of services: a) smallholder, b) commercial.

a)				
Ecosystem services	Smallholder			Factors that influence capacity to maintain the supply and meet the demand
	Supply	Demand	Capacity	
Crop production	Low	High	Low	Water and soil conditions are poor, high levels of poverty, limited capacity to implement innovations
Crop variety	High	High	Medium	Water and soil conditions are poor, high levels of poverty, diversifying of crops is relatively easy
Livestock production	Low	High	Low	Water and soil conditions are poor, high levels of poverty, communal grasslands, limited influence by individual farmers
Wild foods	Medium	High	Low	Water and soil conditions are poor, communal grasslands, limited influence by individuals, pressure on common-resources
Building material	Medium	High	Low	Water and soil conditions are poor, communal grasslands, limited influence by individuals, pressure on common-resources
Fire wood	Medium	High	Low	Water and soil conditions are poor, communal grasslands, limited influence by individuals, pressure on common-resources
Cultural heritage	Medium	Medium	Medium	Water and soil conditions are poor, limited influence by individual farmers, pressure on common-resources
Recreation	Low	Low	High	Opportunities for recreation on communal lands are present. Accessibility high.
Traditional medicine	High	High	Low	Communal lands, pressure on common-resources
Aesthetic	High	High	Medium	Soil conditions are poor, limited influence by individual farmers to manage communal lands
Spiritual/religious	High	High	High	No direct limiting factors to maintain spiritual/religious values
Social relations	High	High	High	No direct limiting factors to maintain social relation
Water availability	Low	High	Low	Soil conditions are poor, high levels of poverty, lack of infrastructure
Water flow regulation	Low	High	Low	Soil conditions are poor, high levels of poverty, limited influence by individual farmers to manage communal lands
Erosion regulation	Low	High	Low	Soil conditions are poor, high levels of poverty, limited capacity to implement innovations
Nutrient retention	Low	High	Low	Soil conditions are poor, high levels of poverty, limited capacity to implement innovations
b)				
Ecosystem services	Commercial			Factors that influence capacity to maintain the supply and meet the demand
	Supply	Demand	Capacity	
Crop production	High	High	High	Water and soil conditions ok, no poverty, infrastructure in place, private land ownership
Crop variety	Medium	Medium	High	Water and soil conditions ok, no poverty, diversifying of crops is relatively easy, market driven
Livestock production	Medium	Medium	Medium	Water and soil conditions are ok, no poverty, private grasslands, infrastructure and management practices in place
Wild foods	Low	Low	High	Water and soil conditions are ok, private lands, little pressure on resources
Building material	Low	Low	High	Water and soil conditions are ok, private lands, little pressure on resources
Fire wood	Low	Low	High	Water and soil conditions are ok, private lands, little pressure on resources
Cultural heritage	Low	Low	High	No direct limiting factors to maintain cultural heritage values
Recreation	Medium	Medium	High	Accessibility high, no poverty, private lands
Traditional medicine	Low	Low	High	No direct limiting factors to maintain traditional medicine
Aesthetic appreciation	High	High	High	Soil conditions are ok, no poverty, private lands
Spiritual/religious	Medium	Medium	High	No direct limiting factors to maintain spiritual/religious values
Social relations	Low	Low	High	No direct limiting factors to maintain social relation
Water availability	High	High	Medium	Soil conditions are ok, no poverty, infrastructure in place, still dependent on rainfall
Water flow regulation	High	High	Medium	Soil conditions are ok, no poverty, still dependent on rainfall
Erosion regulation	High	High	High	Soil conditions are ok, no poverty, private landownership, management practices in place
Nutrient retention	High	High	High	Soil conditions are ok, no poverty, private landownership, management practices in place