Land restoration in food-security programmes: synergies with climate-change mitigation. Supplementary Information

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Appendix A: Supplementary Methods

Site selection

This present study was funded by a consortium of Ethiopia's international development partners (coordinated by the World Bank) who support the food security programme in Ethiopia. The study was conducted within a project called the 'Climate Smart Initiative' (CSI), designed to strengthen the PSNP's responsiveness to climate change by testing which activities and systems of support are both sustainable and resilient to climate change, and integrating these lessons into policy and practice. In addition to the activities reported in this article, CSI also comprised a broader suite of socio-economic, policy, and disaster-risk management oriented studies that were all piloted in the same 24 selected woredas. The criteria for woreda selection were determined using an analytical hierarchy process (Saaty, 1988), conducted during the inception phase of the CSI, by a focus group of representatives from the main donors, implementing non-governmental organizations (NGOs), and stakeholders[1]. Three criteria were selected:

(1) that the selected woredas should represent all of eight livelihood zones,
(2) to ensure availability of household data, the selected woredas should be in the International Food Policy Research Institute (IFPRI)–Institute of Development Studies (IDS) database, which in turn was comprised of a stratified, randomised selection from a list of 153 chronically insecure woredas (stratified by region) (Gilligan, Hoddinott & Taffesse, 2009), and
(3) so far as practical with regard to the previous criteria, the woredas should be in geographically adjacent clusters for efficiency and cost effectiveness (with at least two clusters per regional state).

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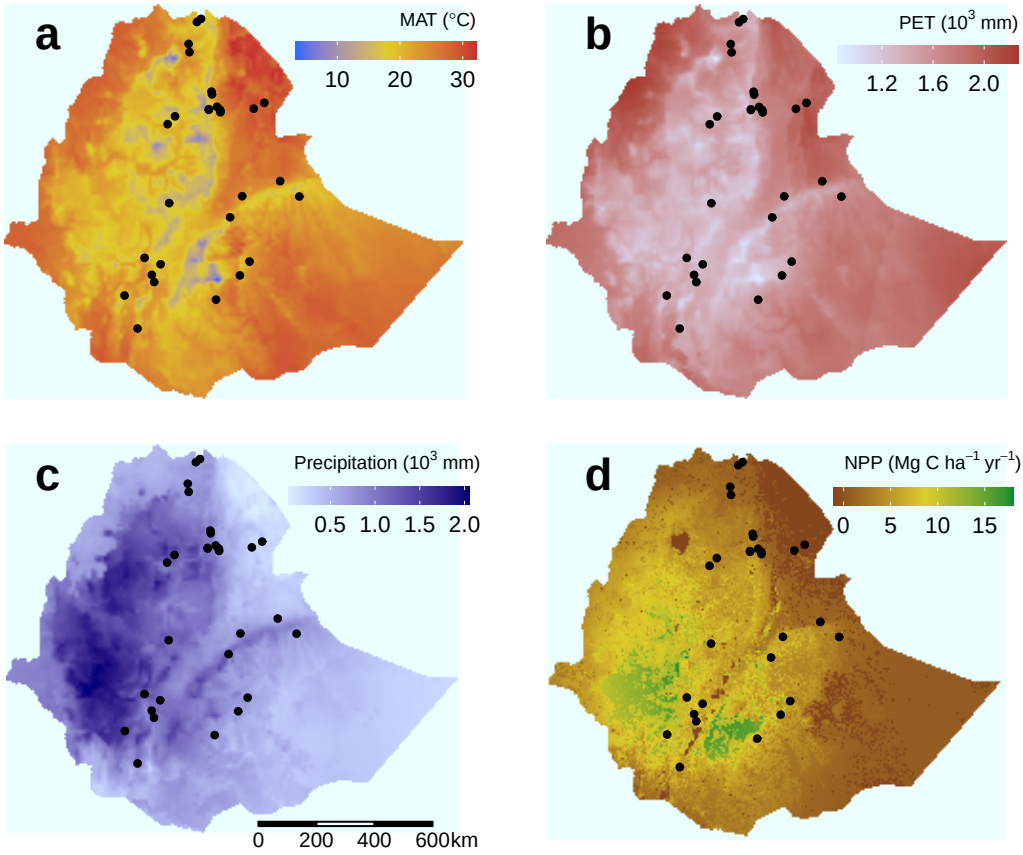

Figure 1. Locations of survey sites in relation to bio-climatic environmental parameter: a) mean annual temperature (MAT), b) potential evapotranspiration (PET), c) precipitation, and d) annual net primary production (NPP). 90 m resolution climate maps were generated by spatial interpolation of 100 climate stations located in or near Ethiopia from the agroclimatic database of the Agromet Group of the Food and Agriculture Organization of the United Nations (FAO). Interpolations was by Inverse Distance Weighted Averaging (IDWA) with linear regression for both elevation and horizontal gradients. Elevation correction used the SRTM 90m Digital Elevation Database v4.1. NPP was estimated by the MOD17 algorithm (Heinsch et al., 2003) applied to NASA MODIS satellite data averaged over 10 years (2004-13).

Survey woredas were selected by the local NGOs in each Regional State, with reference to these criteria. Climate mitigation potential and climate-mitigating activities were not considered in the site selection process. There was, thus, no known bias in the selection towards woredas with higher or lower climate mitigation potential or climate-mitigating activities. The locations of the survey sites are shown in Figure 1.

Tier 2 emission factors for modelling

Three sources of tier 2 emission factors (EFs) were used: a) Moderate-resolution Imaging Spectroradiometer (MODIS) satellite maps of net primary productivity (NPP) for site-specific biomass growth rates; b) farm level data on specific land management practices collected through interviews with farmers and key informants such as local extension agents; and c) literature values for tier 2 EFs related to crops and ecosystems found in Ethiopia that are not represented in the default IPCC tier 1 database. Two annual crops, teff (*Eragrostis tef*) and taro (*Colocasia esculenta*), and one perennial

crop, pigeon pea (*Cajanus cajan*), were commonly grown at project sites. In the case of the annual crops, crop yield and dry matter fraction of residue were found and substituted for default values and in the case of pigeon pea (a perennial crop) woody biomass C growth rate was substituted. In addition, values from the literature were used to create two forest types in the tier 2 assessment: a *Prosopis juliflora* shrubland and an *Acacia spp.* shrubland non-montane native vegetation.

Accounting period

Because the PSNP has only been operational since 2005, most of the sites were up to a few years old, and in some cases less than a year old. For the younger sites, interventions may not have been complete at the time of survey, and re-vegetation was immature. Therefore, the approach to modelling these sites was to assume that the management plan for these areas would be fully implemented over time.

Some sites, however, were relatively mature (greater than 20 years), where intervention originated before PSNP and was later adopted into the PSNP. Having more mature sites made it possible to observe the longer-term development of these sites and thus improve predictions for younger sites. In particular, the ratio of grassland to woodland on older AEs was used to estimate how this ratio would evolve in the younger sites as they approach maturity. AEs are one of the most widespread interventions in PSNP for land rehabilitation. However, AEs are not entirely unmanaged ecosystems. To ensure that enclosed lands remain a productive asset for local communities, low intensity management and resource extraction is permitted but regulated. Ubiquitously, AEs have some land allocated for cut-and-carry hay production to provide fodder for livestock. The fraction of land allocated to this purpose is determined through a participatory engagement between local communities and local government, and the best estimate of the balance between grass production and woodland regeneration that evolves over time was based on measurements of this ratio on the more mature sites using high resolution remote sensing imagery from the Pleiades satellite.

Data collection

Land use and management information was collected during site visits in 2013–2014. A standardized questionnaire was developed for collection of all input data required for the CBP model. Questionnaires were completed for each land use present at each site (forestland, grassland, cropland, trees in settlements), and for each scenario (initial, business-as-usual, and project). For areas in agroforestry, the management of trees and crops were both recorded. Questionnaires were completed by interviewing local Development Agents (DAs), farmers and agricultural officers, by field observations, and by consulting Climate Vulnerability and Capacity Analyses (CVCA) documents provided by the NGO CARE, which in turn were based on focus groups conducted with the local communities. For the BAU scenarios, a best estimate of how land would have been used and managed in the absence of the project had to be constructed. This was accomplished by considering land use under initial conditions, extracting information from the CVCA documents about drivers and trajectories of change in the locality, interviews with key informants including farmers and local extension agents, and observation of analogous land adjacent to the project sites.

Table 1. Fodder requirements and equivalent tropical livestock units (TLUs) for different types of livestock. Based on FAO conversion factors for Sub-Saharan Africa (FAO, 2003).

Livestock type	TLUs	Fodder intake (kg DM y^{-1})
Cattle	0.5	1324
Sheep	0.1	131
Goats	0.1	298
Horses	0.5	1324
Mules and Asses	0.3	794
Camels	1.1	2913

Livestock emissions and area enclosures

Area enclosures (AEs) are the most extensive intervention in the PSNP land restoration works. Most AEs were implemented on degraded lands that were grazed by livestock prior to enclosure. Therefore, the change in forage provision and its impact on GHG emissions from livestock must be accounted for. Leakage is defined as the 'unanticipated decrease or increase in GHG benefits outside of the project's accounting boundary as a result of project activities' (Watson et al., 2000). Typically, part of the land inside AEs provides cut-and-carry hay production. In such sites, defining the project boundary to be the geographic boundary of the AE would have a leakage impact, because livestock are relocated rather than eliminated, and are fed hay from within the AE. Therefore, livestock emissions from livestock fed on biomass grown inside the enclosure still have to be accounted for in the GHG balance.

To estimate and account for these leakage effects of an AE, the change in livestock numbers (ΔN) was estimated by the difference between the quantity of grass production on the project site before and after intervention, divided by average forage consumption per head of livestock (Table 1), with livestock population allocated to cattle, sheep, goats, horses, mules, asses, and camels in proportion to their local relative populations in the most recent (2013) livestock census conducted by the Central Statistics Agency of Ethiopia. According to this method, livestock emissions can increase or decrease as a result of area enclosure, depending on whether the area enclosure provides more or less forage than the same land under business as usual. In most cases, the substantial fraction of land area within an AE that is allocated to woodland regeneration resulted in a net decrease in forage production (and thus also of livestock emissions). The exception to this was hayland enclosures in agro-pastoral regions, in which the forage production inside the enclosure increased relative to the business as usual case of continued free grazing of the same land.

Supplementary References

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Appendix B: Locations and descriptive parameters of the project sites

Table A.1: Locations of the project sites.

Site ID	Region	Woreda	Elevation (m)	Latitude	Longitude
Af_Ch_Ja	Afar	Chifra	942	11.67	40.01
Af_Du_Ay	Afar	Dubti	370	11.77	41.09
Af_El_WL	Afar	Elidar	375	11.96	41.43
Af_Ew_Bo	Afar	Ewa	1125	11.83	39.89
Af_Ew_Du	Afar	Ewa	949	11.75	39.98
Am_Ha_SA	Amhara	Habru	1840	11.76	39.63
Am_Ha_WA	Amhara	Habru	1984	11.74	39.63
Am_Ko_05	Amhara	Kobo	1396	12.28	39.71
Am_Ko_Zo	Amhara	Kobo	2005	12.19	39.73
Am_Si_Aj	Amhara	Simada	2482	11.32	38.29
Am_TG_Ad	Amhara	Tach Gayint	2288	11.55	38.53
Or_DL_Od	Oromia	Daro Lebu	1705	8.62	40.34
Or_DM_ND	Oromia	Delo Mena	1125	6.24	39.90
Or_Go_Ke	Oromia	Goro	1613	6.95	40.68
Or_Me_Fa	Oromia	Meiso	1374	9.23	40.73
Or_Se_Ch	Oromia	Seweyna	1543	7.33	41.00
SN_Al_As	SNNPR	Alaba	1707	7.25	8.25
SN_DG_WB	SNNPR	Damot Gale	1390	6.95	7.95
SN_DeG_Bo	SNNPR	Demba Gofa	2195	6.35	7.35
SN_Hu_Lo	SNNPR	Humbo	1510	6.74	7.74
SN_Ko_Le	SNNPR	Konso	1484	5.40	6.40
SN_So_Sh	SNNPR	Soro	1959	7.44	8.44
So_Gu_Fa	Somali	Gursum	1457	9.24	10.24
So_Sh_Ba	Somali	Shinile	1056	8.25	9.25
Ti_Ah_Se	Tigray	Ahferom	2038	7.95	8.95
Ti_GM_SL	Tigray	Gulo Mekeda	2338	7.35	8.35
Ti_KT_DA	Tigray	Kola Tembain	1859	8.25	9.25
Ti_TA_Ge	Tigray	Tanqua Aberegele	1450	7.95	8.95

Table A.2: Main livelihood types in project areas.

Site ID	Main Crops	Main Livestock
Af_Ch_Ja	Sorghum	camels & cattle
Af_Du_Ay	Sorghum	camels & cattle
Af_El_WL	Sorghum	camels & shoats
Af_Ew_Bo	Sorghum	camels & cattle
Af_Ew_Du	Sorghum	camels & cattle
Am_Ha_SA	Sorghum, teff, fruit/veg & maize	cattle & shoats
Am_Ha_WA	Sorghum, teff, fruit/veg & maize	cattle & shoats
Am_Ko_05	Sorghum, teff, maize	cattle & shoats
Am_Ko_Zo	Sorghum, teff, fruit/veg & maize	cattle & shoats
Am_Si_Aj	Wheat & barley	cattle & shoats
Am_TG_Ad	Sorghum, teff, pulses & maize	cattle & shoats
Or_DL_Od	Sorghum, maize, coffee & chat	cattle & shoats
Or_DM_ND	Sorghum, maize & teff	cattle & camels
Or_Go_Ke	Wheat, maize, teff & sorghum	cattle & bees
Or_Me_Fa	Sorghum, maize, sesame & groundnuts	cattle & camels
Or_Se_Ch	Wheat, maize, teff & sorghum	cattle & bees
SN_Al_As	Maize, wheat, pulses & sorghum	cattle & shoats
SN_DG_WB	Maize, pulses, sweet potatoes & enset	cattle & shoats
SN_DeG_Bo	Enset, sweet potato, maize, teff_& pulses	cattle & shoats
SN_Hu_Lo	Maize, pulses, sweet potatoes & enset	cattle & shoats
SN_Ko_Le	Maize, sorghum, teff & pulses	cattle & shoats
SN_So_Sh	Maize, pulses, sweet potatoes & enset	cattle & shoats
So_Gu_Fa	Maize & sorghum	cattle & camels
So_Sh_Ba	Sorghum & maize	cattle & camels
Ti_Ah_Se	Teff, wheat, barley & millet	shoats & cattle
Ti_GM_SL	Barley, wheat & cactus fruit	shoats & cattle
Ti_KT_DA	Sorghum, maize, teff & millet	shoats & cattle
Ti_TA_Ge	Sorghum, maize, teff & millet	shoats & cattle

Table A.3: Climate at each of the project sites

Site ID	NPP (Mg C ha^{-1} y^{-1})	MAT (°C)	MAP (mm)	PET (mm)	Holdridge Zone	Bodykko Class
Af_Ch_Ja	2.0	23.2	1045	1551	Subtropical subhumid dry forest	Steppe
Af_Du_Ay	0.8	24.5	277	1807	Tropical arid thorn woodland	Desert
Af_El_WL	0.4	28.9	349	1818	Tropical arid thorn woodland	Desert
Af_Ew_Bo	2.8	22.1	952	1518	Subtropical subhumid dry forest	Steppe
Af_Ew_Du	1.8	23.1	927	1549	Tropical subhumid dry forest	Steppe
Am_Ha_SA	4.1	17.8	961	1376	Subtropical subhumid dry forest	Steppe
Am_Ha_WA	3.1	17.8	1060	1376	Subtropical subhumid dry forest	Steppe
Am_Ko_05	3.2	24.6	994	1584	Tropical subhumid dry forest	Steppe
Am_Ko_Zo	4.0	23.0	967	1542	Subtropical subhumid dry forest	Steppe
Am_Si_Aj	3.3	16.6	1512	1286	Subtropical humid moist forest	Forest
Am_TG_Ad	4.5	14.8	1685	1189	Subtropical humid moist forest	Forest
Or_DL_Od	5.7	18.7	1288	1230	Subtropical humid moist forest	Steppe
Or_DM_ND	7.9	21.1	845	1264	Subtropical subhumid dry forest	Steppe
Or_Go_Ke	5.0	24.8	489	1537	Tropical semiarid very dry forest	Desert
Or_Me_Fa	4.5	23.0	892	1514	Subtropical subhumid dry forest	Steppe

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Site ID	NPP (Mg C ha^{-1} yr^{-1})	MAT (°C)	MAP (mm)	PET (mm)	Holdridge Zone	Bodykko Class
Or_Se_Ch	4.7	25.1	581	1553	Tropical semiarid very dry forest	Steppe
SN_Al_As	6.2	19.2	1018	1305	Subtropical subhumid dry forest	Steppe
SN_DG_WB	8.0	19.2	1712	1275	Subtropical humid moist forest	Forest
SN_DeG_Bo	8.2	18.9	1350	1269	Subtropical humid moist forest	Semiarid
SN_Hu_Lo	8.9	19.5	1100	1300	Subtropical subhumid dry forest	Semiarid
SN_Ko_Le	3.2	20.8	832	1380	Subtropical subhumid dry forest	Steppe
SN_So_Sh	7.5	19.6	1295	1298	Subtropical humid moist forest	Steppe
So_Gu_Fa	2.4	20.1	671	1359	Subtropical semiarid thorn woodland	Semiarid
So_Sh_Ba	1.3	26.8	484	2090	Tropical semiarid thorn woodland	Semiarid
Ti_Ah_Se	1.4	19.5	803	1472	Subtropical subhumid dry forest	Steppe
Ti_GM_SL	0.7	19.5	804	1559	Subtropical subhumid dry forest	Steppe
Ti_KT_DA	1.6	22.4	771	1657	Subtropical semiarid very dry forest	Steppe
Ti_TA_Ge	1.3	27.4	820	1734	Tropical semiarid very dry forest	Steppe

Table A.4: Physical and biological measures implemented at each of the project sites

Site ID	Activity Area	Physical Measures	Biological Measures
Af_Ch_Ja	Improved grassland	Stone and soil bunds, deep water infiltration trenches, grassland enclosure	Leguminous tree planting and natural regeneration
Af_Du_Ay	Improved cropland	Soil bunds, terraces, micro-catchment and irrigation	Leguminous tree hedgerows, wind erosion breaks and shade trees
	Improved woodland	Soil bunds, terraces and micro-catchment	Prosopis hedgerows, wind erosion breaks and shade trees
Af_El_WL	Improved woodland	Stone and soil bunds terrace, deep water infiltration trenches, woodland enclosure	Leguminous tree planting and natural regeneration
	Improved woodland		Natural regeneration
Af_Ew_Bo	Improved woodland	Stone and soil bunds, deep water infiltration trenches and woodland enclosure	Leguminous tree planting and natural regeneration
Af_Ew_Du	Improved grassland	Stone and soil bunds, terraces, deep water infiltration trenches, farmer-managed grassland area enclosure	Farmer-managed natural regeneration
	Improved woodland	Stone and soil bunds, deep water infiltration trenches and woodland enclosure	Natural regeneration
Am_Ha_SA	Improved agroforestry	Stone and soil bunds, hillside terrace, stone check dams, eyebrow basins, deep water infiltration trenches, cropland with integrated organic and inorganic amendments	Multistory mixed agroforestry system, vegetable, fruit, coffee and leguminous and non-leguminous tree planting

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Site ID	Activity Area	Physical Measures	Biological Measures
	Improved cropland	Stone and soil bunds, hillside terrace, stone check dam, eyebrow basins, deep water infiltration trenches, cropland with integrated organic and inorganic amendments	Mixed cereal and legume cropping system, leguminous and non-leguminous tree hedgerows
	Improved woodland	Stone and soil bunds, hillside terrace, stone check dam, eyebrow basin, deep water infiltration trenches, woodland enclosure	Leguminous and non-leguminous tree planting, natural regeneration
Am_Ha_WA	Improved cropland	Stone and soil bunds, hillside terraces, stone check dams, eyebrow basins, deep water infiltration trenches, cropland with integrated organic and inorganic amendments	Mixed cereal and legume cropping system and leguminous tree planting
	Improved forestland	Stone and soil bunds, hillside terraces, stone check dams, eyebrow basins, deep water infiltration trenches, forest enclosure	Leguminous and non-leguminous tree planting and natural regeneration
	Improved grassland	Stone and soil bunds, hillside terraces, stone check dams, eyebrow basin, deep water infiltration trenches, grassland enclosure	Leguminous tree planting and natural regeneration
Am_Ko_05	Improved woodland	Stone and soil bunds, hillside terraces, stone check dams, deep water infiltration trenches, woodland enclosure	Leguminous tree planting and natural regeneration
Am_Ko_Zo	Improved cropland	Terrace-Soil bund	Mixed cereal cropping system
	Improved woodland	Stone and soil bunds, woodland permanent enclosure	Natural regeneration

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Site ID	Activity Area	Physical Measures	Biological Measures
Am_Si_Aj	Improved cropland	Stone and soil bunds, hillside terrace, stone check dams, eyebrow basin, deep water infiltration trenches	No biological measure
	Improved cropland	Stone and soil bunds, hillside terrace, stone check dam, eyebrow basin, deep water infiltration trenches, cropland with integrated organic and inorganic amendments	Mixed cereal and legume cropping system and leguminous tree planting
	Improved woodland	Terrace-Trench-Soil bund-Check dam	Leguminous and non-leguminous tree planting-Natural regeneration
Am_TG_Ad	Improved cropland	Stone and soil bunds, hillside terrace, stone check dams, eyebrow basins, deep water infiltration trenches, cropland with integrated organic and inorganic amendments	Mixed cereal and legume cropping system and leguminous tree planting
	Improved woodland	Hillside terrace, stone check dam, eyebrow basins, woodland enclosure	Leguminous and non-leguminous tree planting and natural regeneration
Or_DL_Od	Improved agroforestry	Stone and soil bunds, hillside terrace, stone check dam, eyebrow basin, deep water infiltration trenches	Multistory mixed agroforestry system, vegetable, fruit and leguminous and non-leguminous tree planting
	Improved woodland	Terrace-Soil bund-Stone bund (Gabion)-Trench (Micro catchment)-Deep Trenches	Leguminous and non-leguminous tree planting-Natural regeneration
Or_DM_ND	Improved woodland	Area enclosure of woodland	Natural regeneration
	Improved woodland	Stone and soil bunds, terrace, half-moon stone bunds, check dams, eyebrow basins, deep water infiltration trenches, area enclosure of woodland	Leguminous and non-leguminous tree planting and natural regeneration

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Site ID	Activity Area	Physical Measures	Biological Measures
Or_Go_Ke	Improved cropland	Stone and soil bunds, stone check dam, micro basins	No biological measure
	Improved woodland	Stone and soil bunds, hillside terrace, stone check dams, eyebrow basin, deep water infiltration trenches, forestland enclosure	Leguminous and non-leguminous tree planting and natural regeneration
Or_Me_Fa	Improved woodland	Area enclosure of woodland	Natural regeneration
	Improved woodland	Stone and soil bunds, terraces, half-moon stone bunds, check dams, eyebrow basins, deep water infiltration trenches, woodland enclosure	Leguminous and non-leguminous tree planting and natural regeneration
Or_Se_Ch	Improved cropland	Terraces, micro-basins	Leguminous trees left on the farm
	Improved woodland	Terraces, micro basins, woodland enclosure	Leguminous and non-leguminous tree planting, natural regeneration
SN_Al_As	Improved woodland	Stone and soil bunds, hillside terraces, stone check dams, eyebrow basins, deep water infiltration trenches, woodland enclosure	Leguminous and non-leguminous tree planting, natural regeneration
SN_DeG_Bo	Improved cropland	Soil and stone bunds, hillside terraces, micro catchments, organic and inorganic amendments	Mixed cereal and legume cropping system
	Improved woodland	Stone and soil trenches and check dams, woodland enclosure	Leguminous tree planting and natural regeneration
	Improved woodland	Terraces, infiltration trenches, microbasins	Leguminous tree planting and natural regeneration

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Site ID	Activity Area	Physical Measures	Biological Measures
SN_DG_WB	Improved agroforestry	Stone and soil bunds, hillside terrace, stone check dam, eyebrow basins, deep water infiltration trenches	Multistory mixed agroforestry system, cereal and leguminous crops, vegetable, fruit, coffee and leguminous and non-leguminous tree planting and leguminous crop and grass strips
	Improved cropland	Stone and soil bunds, hillside terraces, stone check dams, eyebrow basins, deep water infiltration trenches	Mixed cereal and legume cropping and leguminous and non-leguminous tree hedgerows and grass and legume strips between terraces
SN_Hu_Lo	Improved forestland	Stone and soil bunds, stone check dam, deep water infiltration trenches, area enclosure of forestland	Leguminous and non-leguminous tree planting, farmer-managed natural regeneration
SN_Ko_Le	Improved forestland	Stone and soil trenches and check-dams, area enclosure of woodland and eucalyptus tree planting	Leguminous and non-leguminous tree planting and natural regeneration
	Improved woodland	Stone and soil trenches and check-dams, area enclosure of woodland	Leguminous and non-leguminous tree natural regeneration
SN_So_Sh	Improved cropland	Stone and soil bunds, trenches, micro basins, half moon basins, brushwood check dams	Mixed cereal system, leguminous and non-leguminous tree left on farm
	Improved forestland	Stone and soil bunds, trenches, micro basins, check dams, enclosure of acacia-dominated woodland	Leguminous and non-leguminous tree planting and natural regeneration
	Improved forestland	Stone and soil bunds, trenches, micro basins, check dams, enclosure of acacia dominated forest	Leguminous and non-leguminous tree planting and natural regeneration

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Site ID	Activity Area	Physical Measures	Biological Measures
	Improved forestland	Stone and soil bunds, trenches, micro basins, check dams, area enclosure of Grevillea robusta dominated forest	Leguminous and non-leguminous tree planting and natural regeneration
	Improved forestland		Leguminous and non-leguminous tree planting and natural regeneration
	Improved grassland	Stone and soil bunds, stone and brushwood check dams, micro basin, enclosure of grassland	Leguminous tree planting and natural regeneration
So_Gu_Fa	Improved cropland	Soil half-moon bunds, micro basins	Leguminous tree hedgerows
So_Sh_Ba	Improved woodland	Stone and soil bunds, stone check dams, enclosure of woodland	Leguminous tree natural regeneration (very sparse)
Ti_Ah_Se	Improved cropland	Stone and soil bunds, stone check dams, terraces, irrigation,	vegetables and teff cropping with organic and inorganic fertilizers, leguminous and non-leguminous tree hedgerows and trees left in farm
	Improved cropland	Stone and soil bunds, terraces, teff cropping with inorganic fertilizers	Leguminous and non-leguminous tree hedgerows and trees left in farm
	Improved cropland	Stone and soil bunds, terraces	teff cropping with inorganic fertilizers and bare fallow, leguminous and non-leguminous tree hedgerows and trees left in farm
Ti_GM_SL	Improved woodland	Stone and soil bunds, hillside terraces, stone check dams, deep infiltration trenches, area enclosure of woodland	Leguminous and non-leguminous tree planting and natural regeneration
Ti_KT_DA	Improved cropland	Terraces, stone check dams	mixed cereal cropping system and scattered leguminous tree left in the farm

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Site ID	Activity Area	Physical Measures	Biological Measures
	Improved cropland	Terrace, stone check dams	mixed cereal cropping system and scattered leguminous tree left in the farm
	Improved grassland	Stone and soil bunds, stone check dams, area enclosure of grassland	Leguminous and non-leguminous tree natural regeneration
	Improved woodland	Stone and soil bunds, stone check dams, area enclosure of woodland	Leguminous and non-leguminous tree natural regeneration
Ti_TA_Ge	Improved cropland	Stone and soil bunds, hillside terraces, stone check dams, deep water infiltration trenches, percolation ponds and pits, check dams	Mixed cereal cropping system, scattered leguminous trees left on farms
	Improved woodland	Stone and soil bunds, hillside terrace, stone check dam, eye brow basin, deep water infiltration trenches, area enclosure of woodland on mountain side	Leguminous and non-leguminous tree natural regeneration
	Improved woodland	Stone and soil bund, hillside terrace, stone checkdam, eye brow basin, deep water infiltration trenches, woodland enclosure	Leguminous and non-leguminous tree natural regeneration