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POLICY BRIEF

Costs and Benefits of Sustainable Land Management Technologies – a new open access ECON-WOCAT dataset to support project planning and design

This new ECON-WOCAT dataset on the costs and benefits of sustainable land management (SLM) technologies is being launched at a time of heightened interest in public and private investments into land restoration, for example, by the United Nations (UN) Decade for Ecosystem Restoration. The ECON-WOCAT dataset consists of detailed information on the costs and benefits of more than 500 SLM technologies from the World Overview of Conservation Approaches and Technologies (WOCAT) database. The dataset helps fill a critical gap of scarce and often scattered information on the costs of SLM technologies across ecosystems and regions. It highlights positive economic, social, and environmental impacts of these technologies, including their significant potential for creating new jobs, and also provides numerous options for its use in planning and implementation of SLM and land restoration projects from national to global levels. For example, the information can be used to identify the funding needs for the implementation of the current land restoration commitments by countries as part of their land degradation neutrality (LDN) action plans. This policy brief presents the key characteristics of the SLM technologies in this ECON-WOCAT dataset and discusses the opportunities for the use of the dataset from global and national perspectives.

Box 1: Key message

- This new ECON-WOCAT dataset and an accompanying dashboard provide a globally unique source of mutually consistent and comparable information on the costs of SLM technologies recommended by the United Nations Convention to Combat Desertification (UNCCD), covering most regions and types of terrestrial ecosystems.
- Implementation of SLM technologies, on average, can cost from about 2,200 to 4,500 US dollars per hectare depending on the region.
- Adoption of SLM technologies offers multiple ecosystem benefits and economic returns for avoiding, reducing, and reversing land degradation, mitigating and adapting to climate change, and conserving biodiversity. This contributes to improved livelihoods, enhanced food security, and job creation.
- Estimates combining information from the ECON-WOCAT dataset and national LDN plans show that the implementation of land restoration commitments under national LDN plans could cost at least 50 billion US dollars each year until 2030 in countries which have quantified restoration commitments. However, this could also create about 8 million new jobs. Current domestic spending on related land restoration activities in these countries are estimated to be about 9 billion US dollars, with an additional 5 billion US dollars coming from outside sources – pointing to a substantial financing gap for LDN activities.
- Use of the ECON-WOCAT dataset can contribute to the successful design and implementation of national LDN action frameworks, land-based mitigation activities under the Nationally Determined Contributions (NDCs), as well as the conservation and restoration of high value habitats as part of National Biodiversity Strategies and Action Plans (NBSAPs).

Cost-benefit information is key for LDN implementation

Healthy and fertile soils are essential for our life and livelihoods, and how we use land has profound impacts on all facets of sustainable development[1,2]. SLM is a major cross-cutting entry point for attaining a wide range of Sustainable Development Goals (SDGs)[3,4], playing a particularly essential role in achieving LDN, building drought resilience, restoring degraded ecosystems, and supporting climate change mitigation and adaptation and biodiversity conservation [5–9].

More specifically, the implementation of national LDN policy frameworks relies on the adoption of SLM technologies[1] inclusive of the LDN objectives of avoiding, reducing, and reversing land degradation. The key aspect of LDN implementation is based on 'like for like' exchanges within specific land categories so that no losses are incurred in land-based natural capital as a result of land use and land cover changes[10]. Therefore, successful planning and implementation of LDN activities requires both the knowledge of economic values of land-based natural capital pertaining to each land ecosystem, as well as the implementation costs of SLM activities. The ECON-WOCAT dataset provides essential information on the costs of SLM implementation in terrestrial ecosystems from global to local scales in a consistent and comparable way. Depending on the scale of analyses, users can obtain individual or summary values of the economic costs of SLM technologies from the dataset. Some specific uses of the dataset for LDN implementation may include, *inter alia*, appraisal of investments to LDN transformative projects and programs, assessing the costs associated with alternative pathways to achieve LDN and identifying the most cost-effective courses of actions, and carrying out LDN investment gap and resource needs assessments. The information in this ECON-WOCAT dataset can be used to identify the funding needs for the implementation of the current land restoration commitments by countries as part of their LDN action plans. The data is also of direct relevance for the implementation of many other land-based activities as part of national determined contributions (NDCs) to climate change mitigation, as well as for protecting and restoring high value biodiversity habitats under the National Biodiversity Strategies and Action Plans (NBSAPs).

Costs and benefits of SLM technologies in the ECON-WOCAT dataset

Since its inception in 1992, WOCAT has compiled an extensive global database of close to 2,200 SLM practices from 133 countries across the world[12,13]. The WOCAT database is the primary recommended database by the UNCCD for the reporting on SLM best practices. **A subset of more than 500 SLM technologies with detailed costs data were selected from the WOCAT database to form the ECON-WOCAT dataset. While compiling this dataset, the information on the costs of SLM technologies was systematized to make them mutually consistent and comparable[14]** (Table 1). The SLM technologies in the dataset come from all regions of the world, with a particularly dense coverage of the developing countries in Africa and Asia. The ECON-WOCAT dataset comes along with several accompanying products (Box 3).

BOX 2: Understanding the role of SLM

SLM is the use of land resources to produce goods and provide services to meet changing human needs, while simultaneously ensuring the long-term productive potential of these land resources and their environmental functions (WOCAT Glossary)[12]. SLM is part of agricultural and forestry production activities. The use of SLM technologies helps produce more food, fodder, livestock products, timber, and other marketable goods from agriculture and forestry, while maintaining or enriching the productive potential of soils[12]. However, SLM generates many other benefits for people through a broader range of ecosystem services such as carbon sequestration, water purification, erosion control, biodiversity conservation, and others. These additional ecosystem benefits from the use of SLM technologies are often undervalued because most are not assigned market value. To provide more incentives for SLM adoption and use, non-market benefits of SLM need to be rewarded and made an integral part of our understanding of the role of SLM[12].

The application of SLM affects how we use land, labor resources, and capital assets, but it also directly interacts with many aspects of human and social capital, such as stimulating different types of collective actions, necessitating the expansion of education, extension and advisory services, and when done through inclusive participation, by effectively reducing gender and other social inequalities. This means that SLM not only contributes to achieving LDN, but also has positive synergies for the achievement of all dimensions of sustainable development[11].

Regions	Number	Share
Sub-Saharan Africa	197	38.9%
Southern Asia	62	12.2%
South-eastern Asia	55	10.8%
Central Asia	53	10.5%
Southern Europe	31	6.1%
Latin America and the Caribbean	29	5.7%
Northern Africa	24	4.7%
Western Asia	18	3.6%
Western Europe	15	3%
Eastern Asia	8	1.6%
Eastern Europe	7	1.4%
Northern Europe	5	1%
Australia and New Zealand	3	0.6%
Total	**507**	**100%**

Table 1. **Number of SLM technologies in the ECON-WOCAT dataset by region**

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[1] SLM Technology is a practice applied in the field that controls land degradation and/ or enhances productivity. It consists of one or several measures, such as agronomic, vegetative, structural, and management measures (WOCAT Glossary)

These SLM technologies were tested and successfully implemented in diverse ecosystems, with the majority of targeting croplands (45%) and mixed land uses (37%), but also rangelands (8%), forested areas (5%), and other ecosystems (5%). These technologies represent specific solution groups as improving ground cover (e.g., applying residues and mulching, intercropping), agroforestry, irrigation management, grazing land management (e.g., pasture reseeding, rotation grazing), water harvesting, and others (Figure 1).

Establishment and maintenance costs

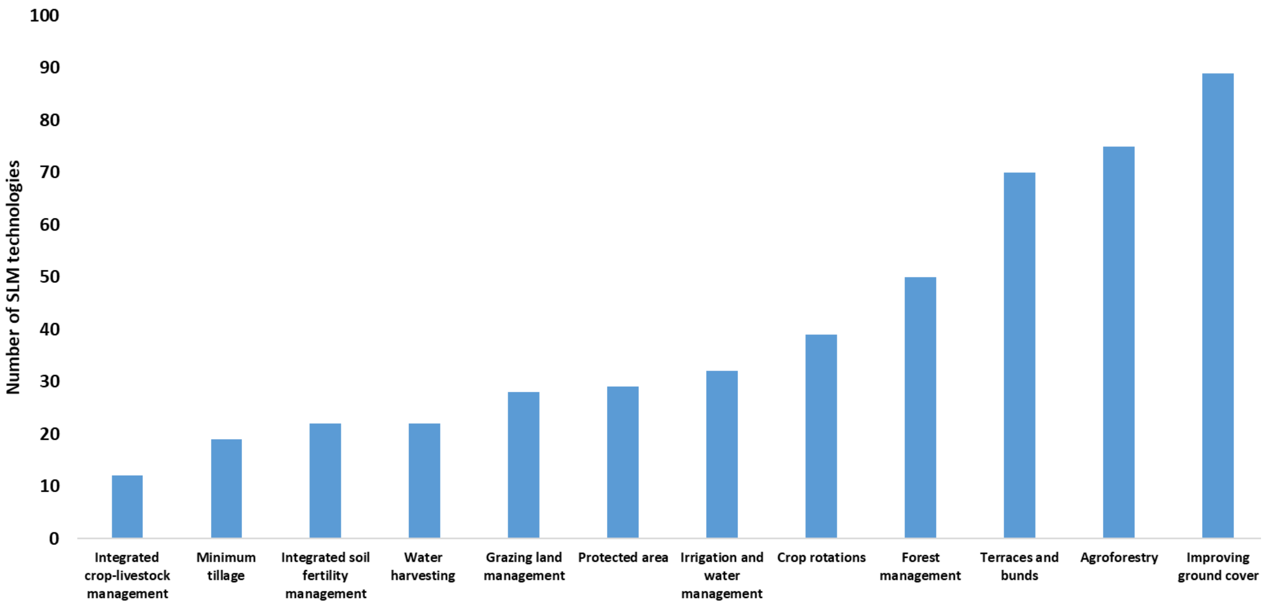
The costs associated with the adoption of SLM technologies are divided into two types: establishment and maintenance costs. Establishment costs are upfront costs needed to set up SLM technologies. For example, establishment costs of agroforestry technologies include all the one-time costs related to planting trees and shrubs, whereas maintenance costs are those incurred every year while taking care of already planted trees and shrubs. **According to the ECON-WOCAT dataset, the average establishment costs of SLM technologies across Africa, Asia, and the Americas were about 900-1200 US dollars per hectare, while establishment costs were considerably higher in Europe reaching an average value of 2,644 US dollars primarily due to higher labor costs** (Table 2). The maintenance costs of technologies also show a wide variation depending on specific SLM groups, from 129 US dollars per hectare per year in Africa to 206 US dollars per hectare per year in Europe. The SLM practices that are least expensive to maintain also vary between regions (Table 3).

BOX 3: The ECON-WOCAT dataset and accompanying products

1. **Excel dataset with SLM costs and benefits data:** contains data on the costs, benefits, and other characteristics of SLM technologies.
2. **Dashboard:** an interactive tool which shows the ways how users can work with the data and the possibilities for various questions that can be answered using the ECON-WOCAT dataset.
3. **Methodological paper:** details the steps and analytical procedures for developing this ECON-WOCAT dataset through extracting the information from the full WOCAT database.
4. **Users' guide:** explains how to use the Excel file with the data and the Dashboard.
5. This **policy brief** highlights the key characteristics of the SLM technologies in this ECON-WOCAT dataset and discuss the opportunities for the use of the dataset from the global and national perspectives.

Weblink:
https://www.wocat.net/en/projects-and-countries/projects/costs-and-benefits-slm-technologies

Figure 1. **Number of SLM technologies by SLM technology group in the ECON-WOCAT dataset**



Note: categories simplified from Critchley, Harari and Mekdaschi-Studer (2021)[12], See Annex 1 for the correspondence mapping of these SLM categories to UNCCD Science Policy Interface (SPI) SLM groups as reported in Sanz et al. (2019)[15] as well as the WOCAT SLM group categories reported by categories based on Critchley, Harari and Mekdaschi-Studer (2021)[12].

Once an SLM technology is established, continued investments into maintenance will be required for its proper upkeep and operation. Ideally, maintenance investments will be made as long as the land users are willing to continue using the technology. **In SLM project appraisals, the attainment of breakeven points, i.e., when benefits from SLM investments start exceeding costs, could be used as the minimum time horizon for continued investments into maintenance of SLM technologies.** For example, as part of the Great Green Wall initiative, it was assessed that breakeven points from land restoration investments are reached after about 10 years from the social perspective, i.e., accounting also for non-market ecosystem services, and about 20 years from the private perspective which accounts only for market-priced goods and services[6]. In some other contexts, a five-year planning horizon is used for maintenance costs[16]. Table 4 provides a perspective when the total costs per hectare of SLM technologies are calculated for a 10-year period, adding establishment costs for the initial year and the maintenance costs for the subsequent nine years.

Although there are differences in the prices of all types of costs (labor, equipment, intermediate inputs) across the regions, the key part of these differences in establishment and maintenance costs of SLM technologies between regions is the differences in labor costs and the level of labor intensiveness of SLM practices. Labor costs represent more than 90% of all costs for such SLM technology groups as water harvesting, minimum tillage, integrated soil fertility man-

SLM technology groups	**Africa**	**Americas**	**Asia**	**Europe**	**Average**
Agroforestry	1,573	1,142	1,014	1,435	**1,291**
Protected area	899	61	768	-	**576**
Terraces and bunds	221	865	640	140	**467**
Forest management	1,133	1,373	713	5,328	**2,137**
Improving ground cover	426	1,972	910	1,573	**1,220**
Integrated crop-livestock management	5,584	-	4,913	10,788	**7,095**
Integrated soil fertility management	384	163	595	1,426	**642**
Irrigation and water management	780	1,233	663	1,230	**977**
Minimum tillage	394	744	243	1,339	**680**
Grazing land management	304	-	281	243	**276**
Crop rotations	35	799	2,502	2,940	**1,569**
Water harvesting	1,142	-	1,028	-	**1,085**
Average	**1,073**	**928**	**1,189**	**206**	

Table 2. **Establishment costs of SLM technology groups by continent (average values), US dollars per ha**

Note: SLM costs which were reported across many different years were consistently brought to US dollar values in 2020 to make them comparable. See the methodology paper[14] and the accompanying dashboard for more detailed statistics on these technologies. Protected area means enclosed area.

Figure 2. **Structure of establishment costs of SLM groups (based on average values in 2020)**

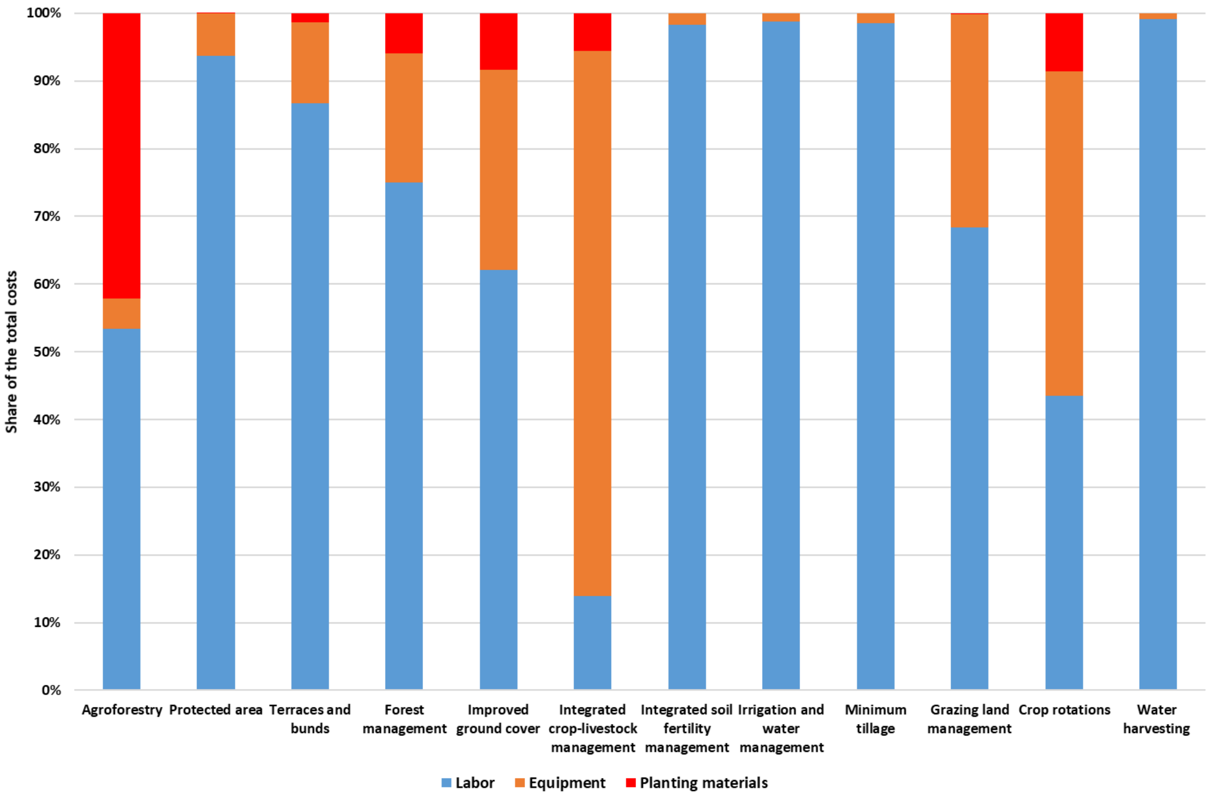
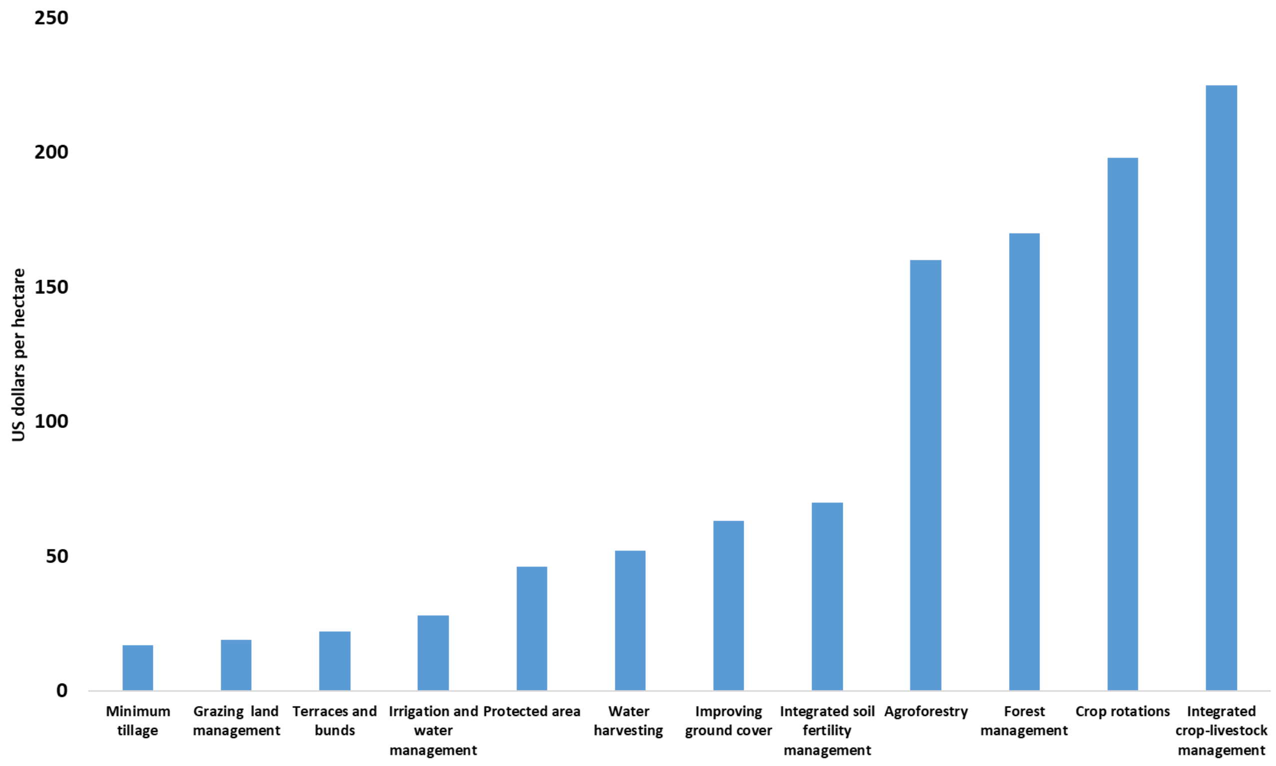


Figure 3. Annual labor costs for maintenance by SLM technologies, US dollars 2020 per ha



agement, irrigation and water management, and setting up a protected (enclosed) area (Figure 2). Whereas for SLM technology groups such as integrated crop-livestock management, crop rotations, and agroforestry, labor costs are still important but represent smaller shares of overall establishment costs because the adoption of these technologies also requires significant equipment and planting material costs (Figure 2).

Agroforestry, forest management, crop rotations, and integrated crop-livestock management require higher levels of annual spending on labor for maintaining these technologies (Figure 3). To illustrate, one hectare of agroforestry area requires about 160 US dollars of labor costs each year for maintenance. The lowest maintenance costs in terms of labor are for such SLM technology groups as minimum tillage and grazing land management, with less than 20 US dollars per hectare of labor costs needed for maintenance every year.

Economic benefits of SLM technologies

WOCAT highlights three types of benefits from the adoption of SLM practices: economic, social, and environmental. Economic benefits of SLM adoption include rural job creation, increases in agricultural and forestry production, improved water management, and higher incomes.

The adoption of SLM practices can significantly contribute to creating new jobs, especially in rural settings. The SLM technologies with the highest job creation potentials are agrofor-

SLM technology groups	Africa	Americas	Asia	Europe	Average
Agroforestry	137	432	327	906	**451**
Protected area	74	2	58	-	**45**
Terraces and bunds	28	56	28	16	**32**
Forest management	239	334	178	299	**263**
Improving ground cover	96	14	150	103	**91**
Integrated crop-livestock management	463	-	816	50	**443**
Integrated soil fertility management	140	80	108	20	**87**
Irrigation and water management	43	-	46	58	**49**
Minimum tillage	166	-	11	14	**64**
Grazing land management	34	-	22	115	**57**
Crop rotations	30	256	486	480	**313**
Water harvesting	97	-	11	-	**54**
Average	**129**	**167**	**186**	**206**	

Table 3. Annual maintenance costs of SLM technology groups by continent (average values), US dollars per ha

Note: SLM costs which were reported across many different years were consistently brought to US dollar values in 2020 to make them comparable. See the methodology paper14 and the accompanying dashboard for more detailed statistics on these technologies.

estry and forest management (Table 5). A wide scale adoption of these technologies is likely to help not only restore degraded lands and improve land management, but also have significant indirect effects in terms of improving rural livelihoods and incomes. Some initiatives such as the Great Green Wall Initiative in the Sahel are using the job creation potential of SLM practices as an important factor in their implementation[6]. Adoption of SLM technologies helps create both short-term jobs during their establishment, but also long-term jobs required for maintaining SLM practices. For example, agroforestry technology established on one hectare of land requires, on global average, 51 labor days each year for maintenance. This means that every 5 hectares of agroforestry creates one full-time labor position for its maintenance. Other SLM technologies with high long-term job creating potentials are integrated crop-livestock management, improving ground cover, and crop rotations (Table 5).

Other documented benefits of adopting SLM technologies include improvements in agricultural productivity and water use efficiency. In 88% of the cases documented in the ECON-WOCAT dataset, the impacts of SLM adoption on agricultural productivity were found to be positive. Similarly, the impacts on water availability were found to be positive in 70% of cases, while the impacts on incomes were found to be positive in 62%. These numbers confirm that positive impacts of many SLM technologies on agricultural productivity are often observed sooner than their contributions in terms of raising incomes. This is because it takes time before establishment costs of many SLM technologies are recovered and investments into SLM practices reach their financial breakeven points. For example, an analysis of land restoration returns in the Sahel shows that up to 20 years may be needed for all types of land restoration investments to reach their breakeven points from a private land user perspective[6]. This time period between initial investments and breakeven points is crucial for land users' decision making. Many low income land users need to have direct short-term benefits to incentivize their efforts for SLM adoption, but many SLM technologies start yielding their full benefits only after some time. Hence, it is essential to improve access to funding sources and credit (affordable and "patient"

SLM technology groups	Africa	Americas	Asia	Europe	Average
Agroforestry	2,806	5,030	3,957	9,589	**5,346**
Protected area	1,565	79	1,290	-	**978**
Terraces and bunds	473	1,369	892	284	**755**
Forest management	3,284	4,379	2,315	8,019	**4,499**
Improving ground cover	1,290	2,098	2,260	2,500	**2,037**
Integrated crop-livestock management	9,751	-	12,257	11,238	**11,082**
Integrated soil fertility management	1,644	883	1,567	1,606	**1,425**
Irrigation and water management	1,167	-	1,077	1,752	**1,332**
Minimum tillage	1,888	-	342	1,465	**1,232**
Grazing land management	610	-	479	1,278	**789**
Crop rotations	305	3,103	6,876	7,260	**4,386**
Water harvesting	2,015	-	1,127	-	**1,571**
Average	**2,233**	**2,420**	**2,870**	**4,499**	

Table 4. **Total SLM costs for a 10-year planning horizon by SLM technology groups and continents (average values), US dollars per ha**

Note: SLM costs which were reported across many different years were consistently brought to US dollar values in 2020 to make them comparable. Here annual maintenance costs for nine years after the initial establishment year are added up. Such addition implies that 0% of discount rate is adopted across this 10-year horizon (cf. Westerberg et al. (2022)[14] for the methodological details).

SLM technology groups	Establishment (labor days per hectare)	Annual maintenance (labor days per hectare)	The needed area(in hectares) of SLM adoption for creating one full-time job
Agroforestry	104	51	5
Protected area	101	22	13
Terraces and bunds	67	27	10
Forest management	67	23	12
Improving ground cover	53	22	13
Integrated crop-livestock management	48	12	23
Integrated soil fertility management	41	10	28
Irrigation and water management	40	32	9
Minimum tillage	28	3	93
Grazing land management	25	10	28
Crop rotations	5	2	140
Water harvesting	2	1	280

Table 5. **Number of labor days for establishment and annual maintenance of SLM practices** *(Note: A five day working week is assumed.)*

capital) to enable private land users to make investments for SLM adoption, while also assuring their immediate incomes and livelihoods (enabling agricultural policies).

Environmental dimensions of SLM technologies

An analysis of the ECON-WOCAT dataset shows that the adoption of SLM practices also has significant environmental benefits[12]. The data highlights four types of environmental benefits on soils, water, biodiversity, and climate resilience. For more than 85% of SLM technologies, it was found that they had a positive impact on all of these dimensions after adoption[14] (for more detailed information, please see the methodological paper[14]). These impressions about the positive environmental impacts of SLM technologies are in line with previous assessments regarding the environmental impacts of adopting SLM technioligies[5,8,17]. The application of SLM technologies helps increase soil moisture holding capacity, usually increases soil organic matter, and depending on specific settings, addresses land quality issues such as secondary salinity, sodicity, and others. In fact, these positive environmental effects of SLM adoptions are frequently higher when applied to marginal and degraded soils than when applied to already fertile soils[5]. The adoption of SLM technologies often provides an opportunity for proactively increasing the resilience of local communities against climate extremes.

Social dimensions of SLM technologies

For more than 90% of the SLM technologies documented in the ECON-WOCAT dataset, the adoption of these SLM technologies was reported to have had positive impacts on social dimensions of sustainability. Social sustainability is intricately related to such dimensions of social resilience as improving food security, reducing poverty, reducing gender and other inequalities. There is significant evidence highlighting the important role that adopting SLM technologies can play in terms of improving food security and nutrition, as well as reducing poverty[5,8,18]. However, adoption of SLM technologies by and in themselves does not automatically reduce inequalities. If anything, if not done through inclusive participation, SLM adoptions may exacerbate existing inequalities. For example, we know that land tenure security plays a very important role in the adoption of SLM technologies. In many settings, existing social norms lead to women land users having much less secure land tenure, lower access to extension, rural advisory services, as well as credit, than male land users, affecting differences in SLM adoptions[19]. For this reason, to increase the social sustainability impacts of SLM technologies, efforts and investments need to be made to provide women land users with more opportunities for SLM adoption.

Opportunities for global and national use of the ECON-WOCAT cost-benefit dataset

The ECON-WOCAT dataset provides numerous possibilities for its use in the planning and implementation of SLM and land restoration projects and activities from national to global levels. Depending on the scale of the analyses, users can obtain individual or summary values of economic costs of SLM technologies. This information can serve as the basis for evaluation of investments to LDN projects and programs, comparing alternative pathways to achieve LDN and identifying the most cost-effective courses of actions, carrying out LDN investment gap

BOX 4: Examples of how the ECON-WOCAT dataset can be used for achieving LDN by countries

Dust and sand dune stabilization in the desiccated bottom of the Aral Sea

The desiccated bottom of the Aral Sea in Central Asia has turned into a major source of dust storms with highly negative effects both locally and regionally across Central Asia. The ECON-WOCAT dataset contains many SLM technology solutions that could be successfully applied to green up the dried bottom of the Aral Sea and limit dust emissions. These include improving ground cover, afforestation, grazing land management, and other suitable ecosystem restoration SLM technologies in the ECON-WOCAT dataset. Responsible authorities and project implementers can improve the efficiency and targeting of afforestation activities in the dried-up Aral Sea bottom by comparing the costs of corresponding SLM technologies with benefits from dust and sand dune stabilization and ecosystem restoration in the area.

Drought-smart land management in arid and semi-arid rainfed areas

The ECON-WOCAT dataset documents many SLM technologies that improve soils' capacity to accept, retain, release, and transmit water, and increase plant water use efficiency. Thus, when applied, these SLM technologies increase the resilience of ecosystems against droughts. These technologies belong under both irrigation and water management, but also under such other SLM groups as agroforestry, creating terraces and bunds, rotational grazing, and crop diversification. Lack of knowledge on economic costs and benefits of drought resilience building measures remains a major gap and often hinders their implementation. The use of this ECON-WOCAT dataset could provide an essential input to planning proactive activities for strengthening drought resilience.

SLM for ecosystem restoration in the Sahel under the Great Green Wall program

A considerable number of SLM technologies documented in the ECON-WOCAT dataset focus not only on sustainably managing currently used lands, but also for restoring and recovering degraded and currently less productive lands. Examples of these technologies include water harvesting techniques, afforestation and reforestation, and creation of protected enclosures. The application of these technologies could substantially aid the success of ongoing land restoration activities under the Great Green Wall program in the Sahel. Several countries in the Sahel region are particularly well represented in the ECON-WOCAT dataset, which provides relevant region-specific information on these SLM technologies. Land restoration projects planned under the Great Green Wall program can use the ECON-WOCAT dataset to design and target their restoration activities in cost-efficient manner.

and resource needs assessments, and many other applications (Box 4). For example, the information in this ECON-WOCAT dataset can be used to identify the funding needs for the implementation of the current land restoration commitments by countries as part of the LDN action plans[16] (Box 5).

In combination with the information on carbon sequestration potentials of SLM technologies, the dataset can also allow for bottoms-up SLM technology-specific evaluations of carbon abatement costs. This enables more granular understanding of land-based mitigation potentials in NDCs to climate change mitigation, e.g., through the identification of cost-efficient climate-smart agricultural interventions.

The ECON-WOCAT dataset has detailed quantitative information on the costs of SLM technologies. At the same time, the benefits of SLM technologies are primarily described in qualitative terms. For this reason, it would be important to expand efforts to both gather comparable quantitative data on SLM benefits, including through innovative linkages to other relevant data sources such as the Ecosystem Services Valuation Database (ESVD) and The Economics of Ecosystem Restoration (TEER) and numerous case studies under the Economics of Land Degradation (ELD) Initiative. It would be important to capture easily quantifiable benefits – such as crop yields and other provisioning ecosystem services - that can be assessed with field data. The latter coupled with data on input costs and revenues can help more easily estimate the returns on SLM investments. This could, in turn, help mobilize more reliable and affordable finance for smallholders. Indeed, one of key constraints to greater integration of biodiversity, nature and ecosystem conservation in investment decision-making by development finance institutions and impact investors, is the ability to monitor and verify changes that are directly attributable to specific SLM investments and technologies. Another potential area for expanding the database would be inclusion of repeated observations about the evolution of SLM costs and benefits over time. This might help policymakers in deciding which technologies to deploy for medium- to long-term strategies. Moreover, increasing the geographic granularity of future versions of the ECON-WOCAT dataset could increase the value of the database for location-specific sub-national LDN activities.

Research on LDN must increasingly draw on comprehensive transdisciplinary conceptual frameworks, such as the nexus of land-climate-biodiversity. However, this will require further methodological advances in ecosystem service valuations and studies that investigate the impact of cross-sectoral measures on SLM adoption. Clearly, SLM adoption promotes the objectives of all the three Rio Conventions, and related nature-based solutions are increasingly becoming a centerpiece of both land degradation neutrality, climate action, and biodiversity conservation. Hence, effective implementation mechanisms across the Rio conventions need to be analyzed, particularly, regarding the societal and economic benefits of a joint programming for the achievement the national of LDN targets, NDCs, and NBSAPs with a special focus on targets related to the sustainable management of land resources and ecosystem restoration.

BOX 5: Financing for LDN

The SLM cost-benefit information in the ECON-WOCAT dataset can be used to identify the funding needs for the implementation of the current land restoration commitments by countries as part of their LDN action plans. Combining the information on national LDN targets and specific SLM technologies and measures planned under national LDN action plans[16] and SLM technology-specific information on establishment and maintenance costs from this ECON-WOCAT dataset, we estimate that the financial needs to achieve LDN restoration commitments in 75 countries that have quantified land restoration commitments[16] are equal 409 billion US dollars. That means that to be able to achieve LDN targets by 2030, there is a need for annual investments of at least 50 billion USD on the implementation of land restoration components of the national LDN action plans in these 75 countries. Currently, our estimates show that these 75 countries are spending in total only about 14 billion US dollars on related activities, 9 billion US dollars from domestic sources based on IMF (2020)[20], and an additional 5 billion US dollars through external funding (OECD-CRS). Using labor creating potential of SLM technologies reported in Table 5, the full implementation of the LDN land restoration targets could potentially create about eight million new jobs.

Regions	Funding needs (billions of USD)	LDN target area (millions of ha)
Africa	205	269
Latin America and Caribbean	26	40
Asia	143	133
Europe	33	5
Oceania	2	4
Total	**409**	**451**

Table B5.1. **Estimating financing needs for achieving national LDN restoration commitments in 75 countries***

Note: The estimation uses a planning horizon of five years. In case of missing observations for any specific SLM technology in a given country, the costs were extrapolated from neighboring countries by accounting for price differentials through purchasing power parities.
**Based on van der Esch et al. (2022)[16]*

Scaling up investments in land is crucial to meet LDN objectives. In order to close the financing gap, it is important to explore innovative financial instruments, non-conventional sources of financing as well as promoting enabling environments that attract additional investments in land.

Annex 1. Correspondence mapping of SLM groups to WOCAT and UNCCD SPI SLM groups

SLM Groups used in this Policy Brief	WOCAT Database SLM Groups	UNCCD-SPI SLM groups
Agroforestry	Agroforestry, windbreaks, and shelterbelts	Agroforestry, Afforestation/Reforestation
Protected area	Area closures	Reducing deforestation, Grazing pressure management
Terraces and bunds	Cross-slope barriers	Soil erosion control
Forest management	Natural and semi-natural forest management; forest plantation and management	Sustainable forest management, Forest restoration, Afforestation/Reforestation, Reducing deforestation
Improving ground cover	Improved ground and vegetation cover	Vegetation management
Integrated crop-livestock management	Integrated crop-livestock management	Agro-pastoralism, Animal waste management
Integrated soil fertility management	Integrated soil fertility management	Integrated soil fertility management, Animal waste management
Irrigation and water management	Irrigation management; surface water management; ground water management; water diversion and drainage	Water management
Minimum tillage	Minimal soil disturbance	Minimal soil disturbance
Grazing land management	Pastoralism and grazing land management	Grazing pressure management, Vegetation management
Crop rotations	Rotational systems	Vegetation management, Fire, pest, and diseases control
Water harvesting	Water harvesting	Water management

Note: Most SLM technologies have multiple functions so could be classified into several of these categories at the same time. SLM technologies are classified into specific groups based on their most important primary function.

References

1. Global Mechanism. Achieving Land Degradation Neutrality at the country level Building blocks for LDN target setting. (2016).

2. Akhtar-Schuster, M. et al. Unpacking the concept of land degradation neutrality and addressing its operation through the Rio Conventions. J. Environ. Manage. 195, 4–15 (2017).

3. Orr, B. J. & Annagylyjova, J. LAND DEGRADATION NEUTRALITY: GLOBAL VISION AND PERSPECTIVES. in Practical Geography and XXI Century Challenges 267 (2018).

4. Mirzabaev, A., Nkonya, E. & von Braun, J. Economics of sustainable land management. Curr. Opin. Environ. Sustain. 15, (2015).

5. Reichhuber, A. et al. The Land-Drought Nexus Enhancing the Role of Land-Based Interventions in Drought Mitigation and Risk Management. in United Nations Convention to Combat Desertification, Bonn (2019).

6. Mirzabaev, A., Sacande, M., Motlagh, F., Shyrokaya, A. & Martucci, A. Economic efficiency and targeting of the African Great Green Wall. Nat. Sustain. (2021). doi:10.1038/s41893-021-00801-8

7. Liniger, H. et al. Achieving land degradation neutrality: The role of SLM knowledge in evidence-based decision-making. Environ. Sci. Policy 94, 123–134 (2019).

8. Mirzabaev, A. et al. Desertification. in Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems (eds. P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. P., D.C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. P. & J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. M.) (2019).

9. Arneth, A. et al. Restoring degraded lands. Annu. Rev. Environ. Resour. 46, (2021).

10. Cowie, A. L. et al. Land in balance: The scientific conceptual framework for Land Degradation Neutrality. Environ. Sci. Policy 79, 25–35 (2018).

11. Walz, Y., Nick, F., Higuera Roa, O., Nehren, U. & Sebesvari, Z. Coherence and Alignment among Sustainable Land Management, Ecosystem-based Adaptation, Ecosystem-based Disaster Risk Reduction and Nature-based Solutions. (2021).

12. Critchley, W., Harari, N. & Mekdaschi-Studer, R. Restoring Life to the Land: The Role of Sustainable Land Management in Ecosystem Restoration. (2021).

13. WOCAT. The Global Database on Sustainable Land Management (SLM) of WOCAT (the World Overview of Conservation Approaches and Technologies. (2022). Available at: https://qcat.wocat.net/en/wocat.

14. Westerberg et al. ECON-WOCAT dataset: methodological paper. (2022).

15. Sanz, M. J. et al. . Sustainable Land Management contribution to successful land-based climate change adaptation and mitigation. A Report of the Science-Policy Interface. (2017).

16. Stefan van der Esch et al. The Global Potential For Land Restoration: Scenarios For The Global Land Outlook 2. (2022).

17. Smith, P., J. et al. nterlinkages Between Desertification, Land Degradation Food Security and Greenhouse Gas Fluxes: Synergies, Trade-offs and Integrated Response Options. in Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems (eds. [P.R. Shukla, J. Skea, E. C. B., V. Masson-Delmotte, H.- O. Portner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. H., S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. & Press, I.) (2019).

18. Olsson, L. et al. Land Degradation. in Climate Change and Land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. (2019).

19. IPCC. Climate Change and Land: An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. (2019).

20. IMF. Government Finance Statistics. (2020). Available at: https://data.imf.org/?sk=a0867067-d23c-4ebc-ad23-d3b015045405&sId=1544448386071.

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