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The Social Impacts of Sustainable Land Management in Great Green Wall Countries: An Evaluative Framework Based on the Capability Approach

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Abstract: The Great Green Wall Initiative (GGWI) is a pan-African program launched in 2007 to combat land degradation and bring about both ecological and socio-economic benefits in the Sahel. With projects in place on only one-fifth of the targeted land and uncertainty about the extent of positive impacts, there is a need for improved monitoring and evaluation of current projects to inform the design of future projects. In this paper, we focus on the evaluation of socio-economic impacts, drawing on development theory, to relate investments in sustainable land management (SLM) to outcomes in terms of human well-being. We deploy a conceptual model, which draws on both the capability approach to human development and the sustainable livelihood framework. To contextualize the framework to the Sahel, we undertook a literature review of scientific studies of the facilitative social conditions and socio-economic impacts of SLM interventions in four countries: Senegal, Burkina Faso, Niger and Ethiopia. We further refined the framework by examining project evaluation reports of Global Environmental Facility (GEF)-funded SLM projects. Our analysis of GEF projects shows that current monitoring and evaluation pays only limited attention to achieved outcomes in terms of well-being. We briefly discuss the application of the framework to SLM interventions and make recommendations for how it should be operationalized, including recommending more comprehensive measurement of the well-being impacts of these projects.

Keywords: afforestation; deforestation; sustainable development; Sahel; land degradation

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1. Introduction

Since the 1960s, the Sahel region of Africa has been reported to suffer from desertification and land degradation caused by a combination of complex interactions between social, economic and environmental systems. However, it is difficult to assess the overall patterns of land degradation across the Sahel region, i.e., whether it is "greening" or "browning" in general [1]. Satellite observations from the late 1970s and onwards have shown that rather than transformational change, the Sahel has shown the variability that is characteristic of drylands on a decadal time scale [2–4]. Land degradation is a very contextual phenomenon and cannot "be judged independently of its spatial, temporal, economic, environmental and cultural context" [5]. This makes it difficult to establish measurable indicators, remotely sensed or otherwise [6]. However, at the local scale, land degradation is real, and many local communities experience its effects, as rainfed agriculture and/or livestock production are the main livelihood activities of around 75% of the Sahelian population [7]. Poverty levels are among the highest in the world with low indicators for health, education and standard of living [8].

Significant drivers of land degradation are changes in land use, unsustainable land management practices, population growth, political instability and various economic factors [9–11]. Major forms of land use change include conversion of rangelands, forest land and wetlands for crop cultivation and urban expansion, causing loss of biodiversity, the release of greenhouse gasses and reductions in the resilience of socio-ecological systems. These problems are being compounded by ongoing climate change with an observed increase in drying, and agricultural and ecological droughts in the Sahel [9]. Land degradation and climate change act as threat multipliers for already precarious livelihoods [9]. With its high poverty level and low scores on the Human Development Index (HDI), avoiding, reducing and reversing land degradation is seen as important for achieving internationally set targets such as the Sustainable Development Goals (SDGs) in the Sahelian region, particularly the targets related to food and water security (SDGs 2 and 6), and life on land (SDG 15). It is also seen as necessary to balance losses and gains of productive land to achieve land degradation neutrality [12].

In this context, the Great Green Wall for the Sahara and the Sahel Initiative (GGWI) is a Pan-African program launched in 2007 by the African Union (AU). Its goal is to reverse land degradation and desertification, enhance food security and support local communities to adapt to climate change. Originally conceived as a green belt stretching across the Sahel between the 100 and 400 mm rain per year isohyets, the GGWI is now conceived as a mosaic of sustainable land management (SLM) practices. The objective is to restore 100 million ha of land by 2030 [13,14]. The focus is not only on trees, but on feed, medicines, food and fuel, as well as actions that can generate climate change benefits through carbon sequestration in soils and vegetation, while also supporting adaptation to climate change, improving population health and nutrition and combatting rural migration [14–17].

The short-term costs for establishing and maintaining SLM measures are generally high and constitute a barrier to adoption. The program therefore requires significant external investment, including to compensate land users for the generation of longer-term public goods [18,19]. The Economics of Land Degradation [20] evaluated the economic costs and benefits of land restoration under the GGWI program. The results show that the average annual costs of land degradation due to land use and land cover changes in the entire Sahel region during the 2001–2018 period were equal to USD 3 billion. The amount of investments needed for land restoration across the Sahel is estimated to be between USD 18 and 70 billion, which is similar to the combined GDP (2020) of Burkina Faso, Senegal, Niger and Mali (USD 73 billion). In contrast, existing investments in the 11 GGWI founding countries, from Senegal in the west to Djibouti in the east, only amount to around USD 1.9 billion according to a recent stocktaking [14]. The European Union (EU), the Global Environment Facility (GEF) and the World Bank (WB), among others, have provided funding. Some of the notable projects include the Sahel and West Africa Program in Support of the Great Green Wall Initiative (SAWAP/GGWI), and the Building Resilience through Innovation, Communication and Knowledge Services project (BRICKS). Funding has been channeled to forestry and agriculture, such as reforestation and assisted natural regeneration; water, including irrigation and watershed management; and soil, including terracing and land restoration [14].

A pledge of more than USD 14 billion was recently made by France, the World Bank and others to assist the program in achieving its goals by 2030 [21]. So far, less than one-fifth of the designated land area in the GGWI has received restoration or rehabilitation projects. Monitoring and reporting of the program is weak, especially in relation to socio-economic impacts. While there have been some reports of success, including the creation of 350,000 jobs [22], others have questioned the program's success in addressing the needs of the targeted populations [23] and brought attention to potential negative impacts on non-target groups, such as pastoralists [24].

Evaluating GGW Interventions and the GEF

There is a need to develop frameworks for the assessment of the social impacts of SLM within the GGWI on both target communities and other indirectly affected communities. This is in contrast to the current approach, where evaluation tends to focus on beneficiaries only. To contribute to this effort, in this paper, we outline an evaluative framework based on development theory, specially adapted to the context of these projects. In particular, it is designed to be used by the GEF as a major sponsor of such projects. The GEF became a key financial mechanism for the UNCCD in 2003, with a dedicated focal area for land degradation, which aims to tackle degradation and deforestation through SLM [6]. More recently, the GEF has identified the need to focus on the multiple impacts generated by its natural resource management projects, including their socio-economic impacts, and the contribution to the 2030 Agenda For Sustainable Development [25]. In this endeavor, the Scientific and Technical Advisory Panel suggests that more attention should be brought to the social dynamics and impacts of these projects by drawing on social science [26].

In its most recent and seventh phase, the GEF introduced a "Core Indicator Worksheet"[1] to monitor and track the global environmental benefits of its projects. For the Land Degradation focal area and SLM projects, the indicators include area of land restored and landscape under improved practices (excluding protected areas). The only socio-economic core indicator used is number of beneficiaries, disaggregated by gender, as a co-benefit of GEF investment. However, the GEF-7 taxonomy makes a qualitative assessment of the projects' contribution to topics such as stakeholder engagement, capacity, knowledge and research and gender equality. There is currently no standard framework for the assessment of well-being impacts. Furthermore, the implicit idea of well-being in many projects reflects a limited conception. The aim of this paper is to develop a standard framework, with guidelines for application, that allows the measurement of multi-dimensional aspects of human well-being that can be used by GEF projects. The evaluative framework in this paper is thereby intended to contribute to expanding and improving the design, monitoring and evaluation of GEF and other SLM projects.

The paper is structured as follows. In Section 2, we introduce the capability approach to sustainable development, outline a conceptual model based on this and show how it relates SLM interventions and human well-being. In Section 3, we outline the methods we used to develop the evaluative framework. These included a targeted literature review of the factors that contribute to SLM uptake and success in the Sahel and the impacts of these projects on human well-being, and an analysis of GEF SLM project evaluations. In Section 4, we present the results of our literature review. In Section 5, we present our novel evaluative framework, which takes the conceptual framework from Section 2 and contextualizes it to SLM in the Sahel by drawing on the literature review and our analysis of GEF projects. In Section 6, we describe how this framework could be applied, including a short worked example and some limitations, before we conclude the article.

2. Theory

2.1. The Capabilities Approach to Sustainable Human Development

In this paper, we develop a theoretically informed framework for the evaluation of Sustainable Land Management (SLM) projects, which can connect changes in the physical and social environment to changes in human well-being. In this context, SLM is defined as the stewardship and use of land resources, including soils, water, animals and plants, to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and the maintenance of their environmental functions [9,18].

There are already a number of theoretical approaches to the conceptualization of the social context and dynamics of SLM in the literature. For example, Nigussie et al. [27] bring attention to the institutional environment in which SLM takes place. They deployed the work of Elinor Ostrom to assess how social institutions encourage participation and commitment to sustainable water and soil management in Ethiopia. Haglund et al. [28] used the Sustainable Livelihoods Framework (SLF) to assess the uptake and impacts of

Farmer Managed Natural Regeneration (FMNR) in Niger. This approach pays attention to the assets that households possess and how these are mobilized in different livelihood strategies, which produce outcomes measured in multi-dimensional terms [28]. Resilience theory has also been applied to the problem of land degradation and SLM; for example, it has been used to outline a research agenda for SLM [13], and to understand regional systems' dynamics of de- and afforestation [29]. However, we believe the resilience approach is more appropriate in the study and design of the biophysical components of SLM projects than the evaluation of human well-being outcomes.

The framework proposed in the current study examines both the institutional environment and household assets as contributors to well-being. It examines these using a consistent theoretical underpinning based on the capability approach to human development [30–33]. This approach, with diverse inputs from economics, development theory and philosophy, has, in recent years, been applied to the challenge of sustainable development, both conceptually [30,34,35] and in relation to concrete problems [36–38]. It combines the focus on assets and resources from the SLF with detailed attention to the institutional environment, and the freedoms it creates for individuals, providing a systematic account of the relationship between assets, institutions and human well-being. In its attention to assets, opportunities and outcomes, it allows multiple entry points for the assessment of development projects, at both the individual and collective levels, and by paying attention to the constituents of well-being as well as outcomes. In this way, it allows for the conceptualization of well-being as a social process [39], which accounts for the collective and structural determinants of individual outcomes. The suitability of the capability approach for assessment has been acknowledged by proponents of the SLF [40].

The capability approach to development shifts the focus from well-being as income to well-being understood as substantive freedoms or capabilities, meaning the things people actually value—their immediate material needs such as health, nutrition and shelter but also symbolic human and social needs such as education, connection to a community, self-regard and so on. When it comes to evaluation, these freedoms must be consistently measurable, and should ideally be organized into a ranked evaluative list of priorities [31]. This ranking allows the use of multiple indicators, reflecting a wide range of priorities, but preserves the comparability of different project alternatives [41]. This is an improvement on approaches that use an unranked dashboards of indicators, where comparability is difficult to maintain [42]. It is therefore appropriate for the evaluation of real-world states of affairs as opposed to the description of ideal social arrangements [43]. It also represents an improvement on utilitarian approaches such as Cost Benefit Analysis by basing the evaluation on a broader set of criteria [36]. Nature is valued in its broad contribution to human freedom, as opposed to its contribution to income alone [44]. Furthermore, because it focuses directly on increasing human freedom, it pays special attention to the most deprived of freedom, and so questions of gender, distribution and inequality are central [45]. In order to assess such distributive effects properly, it is necessary to include all affected groups in evaluation, as opposed to targeted or beneficiary groups only.

2.2. Conceptual Framework: Assets, Opportunities and Outcomes

The conceptual framework relates (household) *Assets* and (social) *Opportunities* to (well-being) *Outcomes* (Figure 1). This is based on the capabilities approach, with input from the SLF, and adapted from Hansen et al. [38]. This was used to both organize the literature review and provide the foundation for the subsequent evaluative framework.

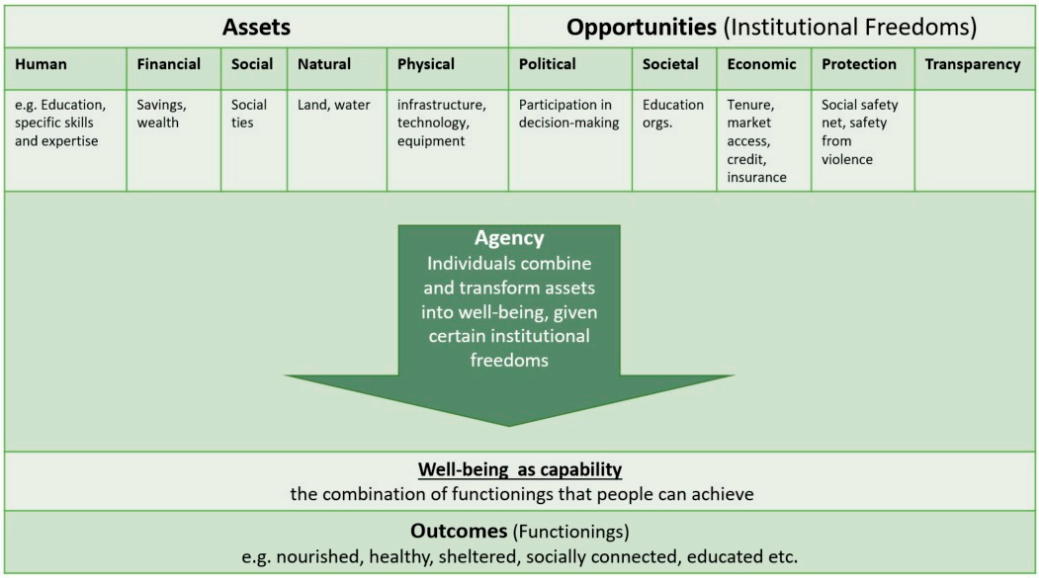

Figure 1. Representation of the process of improving an individual's well-being, understood in terms of assets, opportunities, functionings and capability (adapted from [38]).

In this scheme, assets are the individual or household-level foundations for development. They are composed of resources (elsewhere referred to as means [46]) and conversion factors [33]. Both material and symbolic resources are considered important, while conversion factors entail the abilities that individuals hold to combine and transform these resources into different functionings [47]. In this framework, the categories of the SLF—natural, physical, social, human and financial (capital)—are used to provide a comprehensive account of these assets [38]. SLM interventions influence assets, e.g., by changing people's access to material resources, such as water or forestry products, or influence individual abilities, e.g., by providing training. Institutional freedoms refer to the structural dimension of development. They describe what social, economic and political institutions must provide in order for people to be able to use their abilities and mobilize their assets in order to achieve lives they value [31]. SLM interventions create changes in institutional freedoms by, for example, setting up participatory management committees or altering market access.

The goal of development, according to the capabilities approach, is the expansion of human freedom, understood in terms of capabilities and functionings. Capabilities are the substantive opportunities that people have to lead the lives that they have reason to value. Functionings are the actual "doings and beings" that people achieve. "The valued functionings may vary from elementary ones, such as being adequately nourished and being free from avoidable disease to very complex activities or personal states, such as being able to take part in the life of the community and having self-respect" ([31] p. 75). The improvement of human well-being can be understood as a social process through which changes in assets and/or social opportunities widen the opportunity space in which agents act to improve their functionings. We hypothesize that SLM interventions cause direct changes in social institutions and assets, as in the examples above, and therefore have the potential to expand capabilities and improve functionings. Conversely, certain interventions may reduce access to certain assets or decrease institutional freedoms, causing a contraction in capabilities. Changes to assets or social institutions do not necessarily affect capabilities; the particular combination of assets and institutional freedoms in a given case will determine if an individual's capabilities will be affected and whether this will amount to expansion or contraction of their capabilities.

For the purposes of evaluation, achieved functionings are a relatively accurate and reliable means of assessing well-being, but such changes are difficult to predict prior to the intervention. On the other hand, changes to assets and institutional freedoms are easier

to predict prior to the intervention, but any subsequent impact on achieved functionings is a matter of greater speculation. Nevertheless, there is a wealth of research on the relationships between particular changes in assets, opportunities and subsequent changes in functionings, in specific contexts, which can be drawn on in order to strengthen the design of interventions and monitoring frameworks. Therefore, the final evaluative framework seeks to incorporate (i) the measurement of changes in assets and opportunities; (ii) the measurement of achieved outcomes; and, when measurement of outcomes is not possible, (iii) the evaluation of the evidence basis for targeting particular assets and opportunities.

2.3. Operationalizing the Theory for Evaluation

The capability approach has famously been operationalized for the evaluation of development internationally through the HDI [48]. However, this is a rather limited form of evaluation compared to the potential the approach has for comprehensive assessment [31]. Another attempt in this vein is the Sustainable Development Index by Hickel, which includes ecological indicators [49]. In principle, however, assessment can take account of all relevant capabilities and functionings, rather than just health and education (or a very limited set of indicators) as in the HDI. Furthermore, the approach can be context-sensitive, with the capabilities prioritized in public policy ideally selected with the full participation of all social groups affected. This is called the "total comparison" approach ([31] pp. 81–82). However, identifying and assembling data on all relevant capabilities and functionings is a highly involved process. For the purposes of developing the framework, we therefore recognize the pragmatic necessity to use "available data for practical evaluation and policy analysis" (p. 81). We use a targeted literature review to identify what capabilities, and their constituent preconditions (assets and opportunities), are most relevant for SLM interventions in the GGW program. We then further refine the framework through analysis of a number of GEF project terminal evaluation reports. The resulting framework is, nevertheless, flexible and can be adapted to the particular context and priorities of affected communities.

3. Materials and Methods

The development of the evaluative framework was undertaken in two steps. We started with a targeted review of academic literature to adapt the conceptual framework outlined above (see Figure 1) to the context of SLM in the Sahel, particularly the four target countries of Burkina Faso, Ethiopia, Niger and Senegal. The second step involved examining the project reports of GEF-sponsored SLM interventions to further sensitize the framework to the characteristics of these and similar projects.

3.1. Literature Review

The approach of the literature review was to collect sufficient information to capture the general dynamics of SLM interventions in relation to the challenge of improving human well-being. Because of the necessity that these projects be adapted to the particular contexts [50–52], the review was not intended to map every potential factor and relationship of significance described in the literature, as these will vary from case to case, but rather to identify the overarching categories of factors that seem to be relevant to SLM in the Sahel generally. These data allow the conceptual framework to be sufficiently concretized to make it operational in these contexts.

We conducted the search for literature in the Web of Science database using the following search terms:

1. "great green wall OR sustainable land management AND Sahel OR (afforestation OR reforestation) AND sahel"; and
2. "great green wall OR "sustainable land management" AND (Niger OR Ethiopia OR Burkina Faso OR Senegal)".

This search produced 373 articles. We then filtered these with a number of criteria. Articles were included if they made reference to social factors (as opposed to only biological

or climatic factors), were in the correct regional context, were written in the English language and were peer-reviewed research articles. Accounting for these exclusions left 74 articles for more detailed review.

Data Construction

From these 74 articles, information under the following categories was extracted:

1. National or regional context;
2. Type of SLM intervention;
3. The approach/theory/methodology applied in the article; and
4. Findings, in relation to:
    a. The types of factors experienced at the individual/household level that are involved and thought to affect the success of SLM interventions.
    b. The types of factors at the institutional level involved and thought to promote success.
    c. The types of social impacts resulting from SLM interventions.
    d. Any contextually specific relationships between these factors.

These findings were then grouped, largely inductively, but informed by the concepts from the conceptual framework, into sub-categories as presented in the results section. Fifty-two articles provided sufficient information to be included in this stage of the analysis. The final 52 articles are listed in Appendix A.

We should note that because the articles in this review do not use the capability approach, it was necessary to develop criteria for inclusion that would capture the relevant information. The criterion used for inclusion was that the articles refer to factors that contribute to the uptake of SLM interventions and to factors that influence human well-being. Uptake was included because it is necessary if the project is to have an influence on human well-being. Various implicit and explicit conceptualizations of human well-being existed in this literature. It is our assumption that the factors identified in these articles are likely to be important for the development of human well-being as defined by the capability approach.

The accumulated data were used to expand and refine the conceptual framework to produce a preliminary evaluative framework, which was then taken forward to be refined through comparison with the indicator frameworks of 21 GEF-funded SLM projects.

3.2. Analysis of GEF Projects

GEF projects with complete evaluations in the target countries were gathered from the GEF database [53], considering only the land degradation focal area and using search terms “Great Green Wall” and “sustainable land management” in April 2021. Terminal evaluations were gathered either from the GEF database or from the implementing agency (e.g., the World Bank, UNDP, IFAD). Including only projects that involved actual SLM interventions (as opposed to coordination or administrative projects), this search yielded 21 projects in the 4 target countries with completed evaluations (see Appendix B).

For this step of the analysis, we categorized the indicators collected from the GEF reports according to the categories that had been developed for the evaluative framework. This process was deductive–inductive, as some new sub-categories were created during the analysis to better match the content of the reports. Categorization was based primarily on the outcomes and indicators monitored in the projects. We excluded indicators relating to the reporting and monitoring of the intervention itself.

4. Results

4.1. Review of SLM Literature in Target Countries

We list here the three categories of factors and impacts extracted from the literature (summarized in Figure 2).

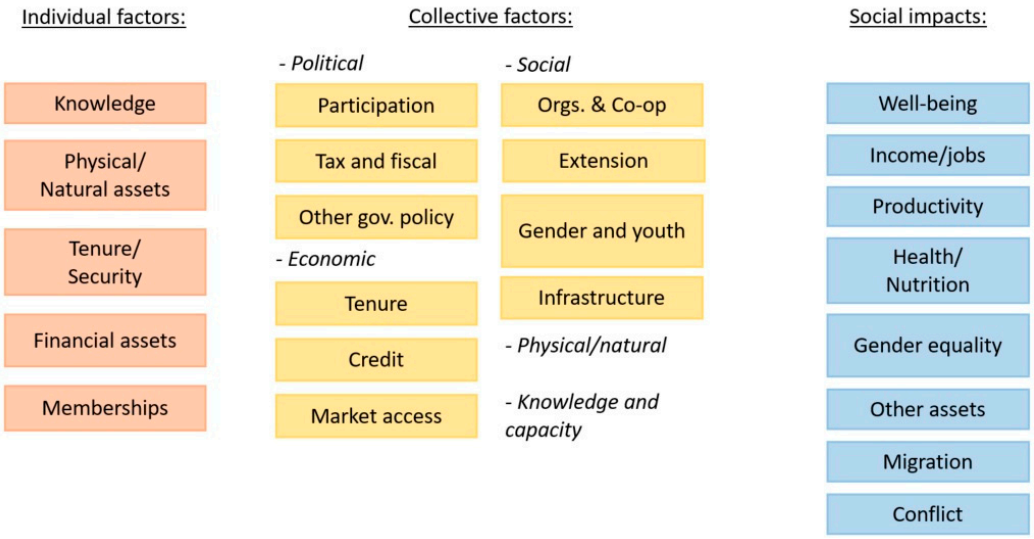

Figure 2. Overview of the factors influencing uptake of SLM and its impacts on well-being, as well as the recorded impacts of SLM, identified in the literature review.

4.1.1. Individual Factors

We identified five categories of individual factors that influence the uptake of SLM and its impacts on well-being. They are:

Knowledge and perception of risk. A number of studies found that the general education level of household heads was a key factor for the uptake of SLM practices [28,54,55]. Other authors focused on the particular type of knowledge that individuals possessed, finding that knowledge and perception of climate change [56], knowledge of the problem of deforestation [57] and the perception of forests [58] were all key for the success of projects.

Physical and natural assets. Many studies identified the characteristics of the household's land and soil [28,54,55,57,59–61] as important in influencing the uptake and success of SLM interventions. Others pointed to the amount of labor available [57,59,62], the equipment available [55,60] and household satisfaction of basic needs [16].

There were a range of other individual factors that were seen as key. These included *Tenure and security*, relating to both land tenure security [55,59,61,63] and social protections [16,62]; *Economic access*, which includes market access [28] financial incentives and constraints [54,62,64–66], and perceived economic benefit [52,67]; and *Memberships*, of both co-operatives [63] and farmers' organizations [55].

4.1.2. Collective Factors

We identified five overarching categories, three of which had a number of subcategories, as important factors at the collective level for the uptake of SLM and its impact on well-being. They are:

Political factors: *Participation*, numerous articles argued for community participation [68–72], including, specifically, in the selection of species [16], in strategizing [64], in management [73] and in monitoring and evaluation [74]. There were also a number of authors who brought attention to *Tax and fiscal policy* as important factors in the success of SLM interventions; these included reference to increased fiscal spending [68,74,75], subsidization [76], the design of social safety net programs [62] and tax regimes [77]. Finally, a range of *Other Policy* changes were suggested, including technological support and technical expertise [68,70,78,79], institutional reform and integration [15,69,74,80,81] and Public–Private Partnerships [74].

Economic factors: *Tenure*, many focus on land tenure regimes (as opposed to individual tenure) as means of ensuring incentives to undertake SLM [57,59,61,65,70,71,74,79,80,82,83]. *Credit and incentives*, others mentioned credit as a way to ensure sufficient finance for SLM [65,80], while a further group of articles focus on other policies to stimulate individual

incentives [27,68,71,80], including lifting financial constraints [84]. Finally, some articles argued for creating *Market access*, such as through general market access for products [55,80], access to the carbon market [74,81,85] and through value chains [74,78,86].

Social factors: A number of authors focused on the availability of social *Organizations* and co-operatives [55,63], *Extension services* [63,74,80] and *Infrastructure*, including roads [55,80,87], and the establishment of *Gender equality* [78,83], and paid particular attention to the landless [27].

Knowledge and Capacity: Studies advocated expanding institutional knowledge and capacity [57,62,65,69,74,76,79–81,88], conducting new research [13,82], incorporating community and local knowledge [69,74] and improving knowledge management [81,88].

Natural/Physical: A number of authors made recommendations for what physical and natural interventions should be made: to choose shrubs over trees [89], promote renewable energy and alternative energy sources [74,83], improve technology [82] and increase water availability [78]. This limited list reflects the fact that the articles selected focused on the social aspects of SLM interventions; a review of biophysically oriented papers would undoubtedly return a much more comprehensive list.

4.1.3. Social Impacts of SLM

A range of social impacts from SLM interventions were identified in the literature. They are:

In relation to general *Well-being*, authors argued that SLM can improve general quality of life [58], and the livelihood and well-being [90] of project beneficiaries. Others focused more specifically on *Income* [28,58,91,92] and *Jobs* [75,90]. Some mentioned various kinds of *Productivity* increase, including increased crop diversity [28], yields of crops [60,90], animals [58], wood and fodder [90], while some pointed out neutral [28] or negative effects [93], such as the loss of grazing lands for pastoralists [92]. Some studies focused on *Health* [91,94], food and *Nutrition* [28,75,82,90,92]; improved *Gender equality* [88,92,95]; changes in *Other assets*, including the availability of wood for fuel and construction [58,96]; changes in access to water resources, both positive [95] and negative [92,97]; reduced manure use for fuel [98]; carbon sequestration [69,81]; and bio-diversity [81]. Some studies pointed to broader social effects such as a rise in inward *Migration* [28,94] and *Conflict*, both between social groups [68,92] and with wildlife [99].

5. Developing the Evaluative Framework

Developing the evaluative framework involved refining the conceptual framework (from Figure 1), based on the information collected in the literature review, and adapting it for measurement. In general, it was possible to subsume the individual factors from the literature review under *Assets* in the conceptual framework, with a few adjustments. In some instances, it proved difficult to separate individual and collective levels; for example, "memberships" involve social institutions of which one is a member, but are also strong providers of social assets at the individual level. Similarly, "tenure" and "economic access" (as described in the literature, see Section 4.1.1) are relational concepts, where, for example, having tenure is a formal contract between the individual and the legal and economic institutions in a country. Since memberships, tenure and economic access are relational concepts, they were categorized under *Opportunities*, whereas the *Physical*, *Natural* and *Human* assets mentioned remained under *Assets*. The collective factors categorized under "physical and natural assets" were moved to *Assets*. Whereas in the literature review, these represented design recommendations for SLM projects, we determined that their main relevance in the evaluation of well-being is in their contribution to individual assets.

Only the social impacts that directly contribute to functionings were included under the *Outcomes* category. For example, "productivity" was moved to *Natural* assets, as an increase in yield is not a direct measure of a change in functionings (although under many circumstances, it is likely to give greater income) and "other assets" were moved to *Natural* and *Physical*. How gender equality was handled in the final evaluation framework is

outlined in Section 5.1.2. Migration and conflict are more complex social phenomena that may indirectly lead to a range of impacts on well-being, and so are not listed as *Outcomes* in themselves. Though income is not a functioning, it is listed alongside the other outcomes because one's ability to achieve a number of functionings is often tied to one's economic means [100]. Though it was not identified as an outcome in the literature, education was also included. This is because it is widely mentioned in the capability approach literature and is a central indicator in the HDI; because training and capacity-building (which fall under the broader category of education) are widely mentioned as important for the success of SLM; and finally, because education, both formal education and training and capacity-building, are mentioned in numerous reports from GEF projects.

The resulting framework (see Figure 3) has three major categories of *Assets*, namely, *Human*, *Natural* and *Physical*, corresponding to three of the categories of capitals in the SLF [40]. These are intended to record and evaluate the influence of interventions on people's natural assets, e.g., land use changes and water access; physical assets, e.g., equipment; and human assets, e.g., knowledge and skills. Note that the natural assets category can include indicators that capture increases in land cover and net primary productivity (NPP) that would be central to any biophysical evaluation of these projects, thus creating a point of contact between socio-economic and biophysical assessment. The *Opportunities* category, in the evaluative framework, contains four categories: *Knowledge and capacity* (at the institutional as opposed to the individual level) and *Political*, *Economic* and *Social* opportunities. The latter three correspond to three of the five institutional freedoms described in the capability approach [31]. In the framework, they are further subdivided according to data from the literature review.

Assets		Indirect Indicator	Goal	Result	Direct Indicator	Goal	Result	Suitability Index
Human		*Awareness raising campaigns (no. of campaigns)*	*5*	***4***				*Low evidence*
Natural								
Physical								
Opportunities								
Institutional Knowledge and Capacity								
Political	Participation							
	Other policy							
Economic	Tenure				*Secured tenure (no. hhlds)*	*5000*	***4000***	*Medium evidence*
	Economic Access							
	Credit and Incentives							
	Other economic							
Social	Organizations and Co-ops							
	Other social							
Outcomes								
Income								
Education								
Health								
Nutrition								
Other Functionings								

Figure 3. Framework developed for the evaluation of the socio-economic impacts of GEF-funded, and similar, SLM interventions. This includes some example indicators, goals, measured results and examples of the suitability index.

The expansion of capabilities is considered both as the means and ends of development [31]. This implies that improving people's freedom is both the goal of development as well as a means to further development; for example, increased education can also be considered a human asset, which, for example, would allow individuals better access to

economic opportunities and the possibility of improved health. This means that there is some double counting of certain *Assets* as *Outcomes*, such as *Human* assets and *Education*.

5.1. Using the Framework for Measurement

5.1.1. Assets and Opportunities

In converting the conceptual framework into an evaluative tool, it was essential to ensure that the categories in the framework are factors that are measurable consistently across projects (either quantitatively or qualitatively). We found that for the *Assets* and *Opportunities* categories, three types of indicators could be recorded. Firstly, from reviewing GEF projects, we realized that it was necessary to distinguish between (i) actions that may have an *Indirect* effect on an *Asset* or *Opportunity*, and (ii) a *Direct* measure of a change in assets or social opportunities. For example, there is a need to differentiate between recording an awareness-raising campaign undertaken, which aims at changing human assets (*Indirect*), and recording the number of people trained, which represents a quantified change in human assets (*Direct*). In relation to opportunities, the *Indirect* and *Direct* indicators allow differentiation between institutional changes, such as new plans or strategies (*Indirect*), and a quantified change in people's freedoms, such as demonstrable access to a new institution, service or organization (*Direct*). The *Knowledge and capacity* category is always *Indirect*, because although it can strengthen institutional capacity, it does not have a direct effect on individuals' opportunities.

The third indicator type in the evaluative framework is (iii) an assessment of the *Suitability* of the chosen indicator in terms of the evidence provided that it will contribute to improved functionings. In the absence of sufficient information to assess outcomes, we felt the need to include some way of assessing the suitability of the assets and opportunities targeted. Though it may not be possible to express this as a quantified value, it should be possible to assess the evidence base and reasoning behind the inclusion of particular assets and opportunities. This should be based on previous research and pre-intervention assessments of the context. For example, a change in natural assets involving the introduction of a new tree species is more likely to contribute to functioning if there is access to a market for products that can be harvested from that species. Participatory decision-making environments are more likely to deliver better results if people have the human assets to contribute meaningfully. An increase in yields is likely to lead to higher income if market opportunities remain the same, and carbon sequestration may contribute more to increased income if there is access to carbon markets, and so on.

5.1.2. Outcomes

The literature review revealed a number of functionings that we considered pertinent in general, but this list is not necessarily exhaustive for all cases. Ideally, other contextually important outcome indicators would be included, and evaluation would take account of distributive effects, including in relation to gender [31]. Outcomes should be weighted in order of priority, and they should be measured against a suitable control or baseline [101,102]. Furthermore, their identification and prioritization would be executed with the input of all social groups likely to be affected.

Appropriate indicators should be chosen based on project particulars. There are standard global options such as life expectancy, infant mortality, literacy rates and calories consumed. However, in relation to GEF projects, the effect on functionings may be more specific. Examples of potentially suitable indicators from projects reviewed include, e.g., for nutrition, the number of people with increased/decreased consumption of fruit and vegetables, or an increase/reduction in the number of households experiencing food shortages; and for education, the number of people trained in particular forms of production, or the number of people accessing school facilities. While GEF reports mention purchase of medicine, access to healthcare, reduced stunting and shorter hunger periods in project reports, there are no example indicators for health outcomes. Duboz et al. [91] assess the impact of GGW projects on the consumption of foods containing potassium, the use of

traditional medicines and self-rated health [94], which could serve as indicators depending on the context of the intervention.

One way of incorporating an evaluation of the effectiveness of projects in relation to gender and distributional effects would be to introduce coefficients that represent impacts on women or less well-off groups, similar to how the Gini coefficient is used in the calculation of the HDI [103]. Gender and distributional effects could, in principle, be recorded for any indicator, so this could be realized at the level of each outcome indicator or as an overall metric for the project.

5.2. Comparison of the Framework to GEF Project Evaluations

The primary purpose of reviewing GEF projects was to adapt the evaluative framework to the characteristics of these projects. It was also possible to make a comparison between the kinds of indicators and metrics that GEF projects already use and the ones in the proposed evaluative framework. The results of this comparison are displayed in Figure 4. It is important to note that this comparison reflects the data contained in the existing evaluation reports of GEF projects. It does not represent an assessment of the actual impacts of GEF projects on well-being. Any conclusions and recommendations can only be made in relation to the evaluation frameworks used by GEF and not the effectiveness of the projects.

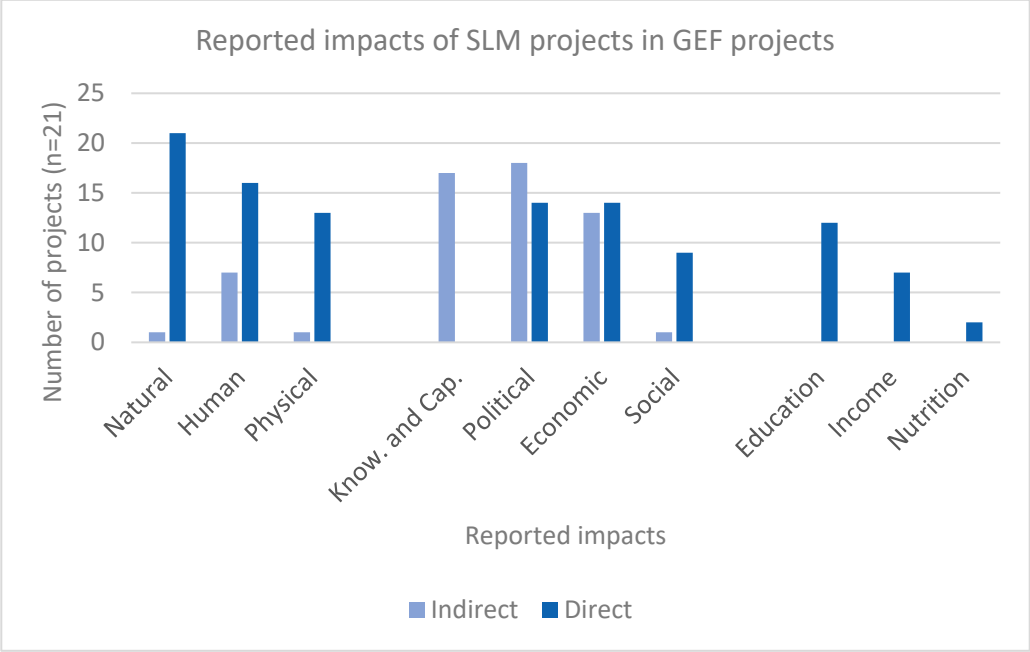

Figure 4. Impacts of GEF SLM projects in the four target countries in the Sahel region, as reported in project evaluations.

One major difference between the approach of this evaluative framework and the current approach of the GEF, as alluded to earlier, is that the former includes evaluation of impacts to all affected parties. Whereas the GEF does try to foresee negative impacts on non-target groups and anticipate indirect effects through theories of change, the current evaluation frameworks tend to focus only on the impacts to project beneficiaries. From a scientific perspective, systematic evaluation involving all affected parties is clearly superior for developing a comprehensive understanding of the socio-economic impacts of these projects.

In terms of the impacts measured, as we might expect given the traditional focus of the GGW and GEF on ecological outcomes, all projects recorded changes to natural assets, with the greatest number of indicators referring to planted area or changes in forested

area. Beyond this, many projects included indicators for human assets, especially trainings in SLM and other production practices, institutional knowledge and capacity, and other indirect and direct opportunities. Aside from education, which in most cases takes the form of specific capacity-building and training for SLM practices, very few projects recorded changes to other functionings. Thus, we found that the current evaluation frameworks only facilitate very limited insight on the well-being impacts of these projects.

6. Applying the Framework

This evaluative framework responds to the lack of standard frameworks for the assessment of the social impacts of these projects as well as the limited conception of human well-being in current practice. Therefore, the aim of this paper was to develop a standard framework for the assessment of the social impacts of GEF projects using a theoretically informed idea of well-being, which could be applied to GEF projects. In the framework, as displayed in Figure 5 and described in Section 5, we outline the specific types of indicators that should be used; in the guidelines below, we make recommendations for how these should be applied.

Group 1: Agriculturalist project beneficiaries

Assets		Indirect Indicator	Goal	Result	Direct Indicator	Goal	Result	Suitability Index
Human		*Training workshops*	*5*	***5***	*People trained in SLM techniques*	*5000*	***4000***	
Natural					*Increased area of forested land (sq. m per hhld)*	*600*	***600***	
					Increased productivity of land area (NPP – gC per m2 per day)	*+1*	***+1.2***	
Physical					*New stoves (no. hhlds)*	*1500*	***1600***	
Opportunities								
Political	Participation				*Memberships on planning council*	*250*	***250***	
Economic	Tenure				*Secured tenure (hhlds)*	*1500*	***1500***	
Outcomes								
Income					*Increase in income (USD per hhld per month)*	*+25*	***27***	
Education					*People trained in SLM techniques*	*5000*	***4000***	
Health					*Decreased exposure to indoor smoke (hhlds)*	*1500*	***1400***	
Nutrition					*Increased caloric intake (avg. calories pp)*	*+200*	***+220***	

Group 2: Agriculturalist non-beneficiaries

Outcomes		Indirect Indicator	Goal	Result	Direct Indicator	Goal	Result	Suitability Index
Income					*Increase in income (USD per hhld per month)*	*No change*	***+7.00***	
Nutrition					*Increased caloric intake*	*No change*	***+120***	

Group 3: Pastoralist non-beneficiaries

Assets		Indirect Indicator	Goal	Result	Direct Indicator	Goal	Result	Suitability Index
Natural					*Area of pasture land available (sq. km)*	*No change*	***-5.25***	
					Access to water resources (avg. litres, per person per day)	*No change*	***-1.7***	
Opportunities								
Economic	Tenure				*Customary access to land (no. hhlds)*	*No change*	***-40***	
Outcomes								
Income					*Income*	*No change*	***-7.00***	
Nutrition					*Caloric intake*	*No change*	***-100***	

Figure 5. Worked example: evaluation of a simple forestry intervention using the framework. This evaluation focuses on direct measurement of impacts, even when these impacts are second-order effects of the intervention, as is the case with the effects on non-beneficiary groups.

We recommend that there should be more focus on the direct measurement of impacts on human and physical assets, on the direct measurement of impacts on opportunities and the measurement of multiple functionings. Below, we outline recommendations for a basic and a more comprehensive application of the framework.

For a basic application:

- Apply evaluation to all impacted groups.
- Focus on *Direct* measures of *assets* and *opportunities*, wherever possible.
- Measure the impacts on a range of basic *functionings* and test in relation to a reliable and valid baseline or control.
- Use indicators appropriate to these functionings in context.

For a more comprehensive application:

- Add context-specific *functionings* with the input of affected groups.
- Develop prioritization of *functionings* with input of affected groups.
- Develop weighting which evaluates the impact on gender and distribution.
- In project design, establish relationships between factors in context to assess the *suitability indicator* for *assets* and *opportunities*.

As a rule, the more comprehensive and detailed the survey or other methods used to elicit data for the evaluation, the better the relationships between particular elements of the intervention and particular specific outcomes can be assessed. In this way, it would be possible to identify whether, for example, trainings are correlated with improved yields, and so on. This framework can be used both as an independent tool and to inform the current GEF reporting frameworks. It would also affect the design of projects, such that they focus more on the improvement of human well-being.

6.1. Worked Example

Figure 5 shows a simplified example of a basic application of the framework to a simple GGWI intervention. The intervention here is a forestation project aimed at producing new forestry products for sale by the beneficiaries, for which there is an existing market and market access. Lack of secured tenure on the land is seen as a disincentive to maintain forestry. The intervention also involves trainings in the relevant production and SLM techniques and distribution of smokeless stoves to combat indoor air pollution. A participatory planning council was established to design and monitor the intervention.

The evaluation involved identification of the affected groups and various methods of data collection appropriate for the indicators. Indicators were selected to reflect the aims of the project and to capture any trade-offs or negative effects anticipated by previous research. In this example, we are assuming that the evaluation was completed a significant period of time after the project was completed and that the recorded effects were attributable to the intervention (either through the use of controls, baselines or other reliable methods). No assessment of the *suitability* of indicators was needed, as direct assessment of the achieved functionings was possible. For the sake of simplicity, the measurements are presented here as either an increase or decrease, and the various functionings are unranked. More detailed measurements, assessment of the distribution of impacts within these groups and ranking of outcomes could be included to more comprehensively reflect the impacts on prioritized capabilities of the communities involved.

According to the capability approach, interventions should ideally aim to expand the freedom of the worst-off, but at least not reduce their freedom. Therefore, the project in the example would be considered as performing less than optimally, because while it increases the freedoms of project beneficiaries and other agriculturalists, it decreases the freedoms of nearby pastoralist communities.

6.2. Limitations

There are limits to what can be achieved by improving the monitoring and evaluation of these projects, and, for that matter, the design of interventions. There are structural

political and economic conditions within which these interventions take place but cannot change, such as the limited financial capacity of governments in the region to sustain investment, limitations in terms of costs and prices for products determined by international markets and trade policy, questions of conflict and security, etc. These structural conditions, which exist both nationally and internationally, can seriously limit the ability to achieve sustainable development. These higher-level barriers to development equally require attention from the social sciences. Here, the capabilities approach would have to be combined with social theory, which better deals with the social structural conditions and power asymmetries that create these barriers to improvement in human well-being.

7. Conclusions

The evaluative framework described in this paper is built on a conceptual framework that conceptualizes SLM interventions in terms of the changes they create in household-level assets and social opportunities. It connects these changes to outcomes measured in terms of multi-dimensional human well-being focused on the functionings that people achieve. It pays attention to impacts on all affected groups, as opposed to project beneficiaries only. The framework allows for the measurement of assets, opportunities and/or outcomes, which means that it can be deployed for both interim assessments and final evaluations. It is also suitable for either basic applications, focusing on simple measurement of changes to the most central indicators, and more comprehensive applications, which can account for public participation, differences in context, a ranking of indicators in terms of importance and questions of gender equality and distribution. We believe that this framework can be used both in the ongoing and future monitoring and evaluation of SLM projects and can inform the design of future projects so that they are more directed to equitable benefits in human well-being that are demonstrable.

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Appendix A. Articles in Literature Review

Article	Individual Factors	Collective Factors	Impacts
Abera W, Tamene L, Tibebe D, Adimassu Z, Kassa H, Hailu H, et al. Characterizing and evaluating the impacts of national land restoration initiatives on ecosystem services in Ethiopia. Land degradation Development and Change. 2020;31(1):37–52.			Productivity decrease
Adimassu Z, Kessler A. Impact of the productive safety net program on farmers' investments in sustainable land management in the Central Rift Valley of Ethiopia. Environmental Development. 2015;16:54–62.	Labor availability; social protections; financial incentives	Social safety net; institutional capacity	
Adimassu Z, Langan S, Johnston R. Understanding determinants of farmers' investments in sustainable land management practices in Ethiopia: Review and synthesis. Environment, development, sustainability. 2016;18(4):1005–23.	Financial incentives	Land tenure; credit; institutional capacity	
Alamirew B. The impact of poverty, tenure security and risk on sustainable land management strategies in north central Ethiopia: analysis across three agro-ecological zones. J Sustain Dev Africa. 2011;13:227–40.		Institutional reform; land tenure; credit; policy for economic incentives; market access; extension services; infrastructure; institutional capacity	
Alsobrook A. The social impacts of the Great Green Wall in rural, Senegalese villages. Journal of Sustainable Development in Africa. 2015;17(2):130–49.			Income; loss of pasture land; nutrition; gender equality; water access; social conflict
Amede T, Kassa H, Zeleke G, Shiferaw A, Kismu S, Teshome M. Working with communities and building local institutions for sustainable land management in the Ethiopian highlands. Mountain Research Development. 2007;27(1):15–9.		Community participation; land tenure; policy for economic incentives	
Assefa E, Bork H-R. Deforestation and forest management in Southern Ethiopia: investigations in the Chencha and Arbaminch areas. Environmental management. 2014;53(2):284–99.			Wood availability
Bazame R, Tanrıvermis H, Kapusuz YE. Land management and sustainable use of land resources in the case of Burkina Faso. Land Degradation and Development 2019;30(6):608–21.		Technological support; land tenure; institutional capacity	
Belay M, Bewket W. Farmers' livelihood assets and adoption of sustainable land management practices in north-western highlands of Ethiopia. International journal of environmental studies. 2013;70(2):284–301.	Land and/or soil characteristics; labor availability; land tenure	Land tenure	

Article	Individual Factors	Collective Factors	Impacts
Berrahmouni N, Bojang F. The Great Green Wall for the Sahara and the Sahel initiative: an opportunity to enhance gender equality in the management of Africa's natural resources. Nature and Faune. 2015;29(1):50–3.		Institutional capacity; improved knowledge management	Gender equality
Bewket W. Climate change perceptions and adaptive responses of smallholder farmers in central highlands of Ethiopia. International Journal of environmental studies. 2012;69(3):507–23.	Knowledge of climate change		
Chirwa PW, Mahamane L. Overview of restoration and management practices in the degraded landscapes of the Sahelian and dryland forests and woodlands of East and southern Africa. Southern Forests: a Journal of Forest Science. 2017;79(2):87–94.		Participatory monitoring and evaluation; fiscal spending; institutional reform; public private partnerships; land tenure; carbon market; value chains; extension services; institutional capacity; incorporating local knowledge; promote renewable energy	
Cunningham P, Abasse T. Reforesting the Sahel: farmer managed natural regeneration. Domestications des especes agroforestieres au sahel: situation actuelle et perspectives ICRAF Working Paper. 2005;5:75–80.	Perception of forests		Quality of life; income; animals; wood availability
Dallimer M, Stringer LC, Orchard SE, Osano P, Njoroge G, Wen C, et al. Who uses sustainable land management practices and what are the costs and benefits? Insights from Kenya. Land degradation development and Change. 2018;29(9):2822–35.		Subsidies; institutional capacity	
Diop S, Guisse A, Sene C, Cisse B, Diop NR, Ka SD, et al. Combating desertification and improving local livelihoods through the GGWI in the Sahel Region: The example of Senegal. Journal of Resources Ecology. 2018;9(3):257–65.		Technological support; value chains; gender equality; water availability	
Duboz P, Boëtsch G, Guissé A, Goffner D, Peiry J-L, Sarr P, et al. Reforestation and the state of health of populations in Tessekere, Senegal. Regional Environmental Change. 2019;19(6):1643–51.			Income; health
Duboz P, Boëtsch G, Guisse A, Macia E. Assessing health impacts of an environmental pan-African development project: A migration perspective. SSM-population health. 2020;11:100633.			Health; inward migration
Elagib NA, Al-Saidi M. Balancing the benefits from the water–energy–land–food nexus through agroforestry in the Sahel. Science of the Total Environment. 2020:140509.			Water access
Etsay H, Negash T, Aregay M. Factors that influence the implementation of sustainable land management practices by rural households in Tigrai region, Ethiopia. Ecological Processes. 2019;8(1):1–16.	Land and/or soil characteristics; access to equipment		Yield

Article	Individual Factors	Collective Factors	Impacts
Gadzama NM, Ayuba HK. On major environmental problem of desertification in Northern Nigeria with sustainable efforts to managing it. World Journal of Science, Technology Sustainable Development. 2016.		Land tenure; gender equality; promote renewable energy	
Gadzama NM. Attenuation of the effects of desertification through sustainable development of Great Green Wall in the Sahel of Africa. World Journal of Science, Technology and Sustainable Development. 2017.			Gender equality; water access
Gebreegziabher Z. Household fuel consumption and resource use in rural-urban Ethiopia2007.			Manure use
Gessesse B, Bewket W, Bräuning A. Determinants of farmers' tree-planting investment decisions as a degraded landscape management strategy in the central highlands of Ethiopia. Solid Earth. 2016;7(2):639–50.	Knowledge of deforestation; land and/or soil characteristics; labor availability	Land tenure; institutional capacity	
Goffner D, Sinare H, Gordon LJ. The Great Green Wall for the Sahara and the Sahel Initiative as an opportunity to enhance resilience in Sahelian landscapes and livelihoods. Regional Environmental Change. 2019;19(5):1417–28.		Research	
Haglund E, Ndjeunga J, Snook L, Pasternak D. Dry land tree management for improved household livelihoods: farmer managed natural regeneration in Niger. Journal of environmental management. 2011;92(7):1696–705.	Education level; land and/or soil characteristics; market access		Income; crop diversity; productivity decrease; nutrition; inward migration
Haregeweyn N, Tsunekawa A, Nyssen J, Poesen J, Tsubo M, Tsegaye Meshesha D, et al. Soil erosion and conservation in Ethiopia: a review. Progress in Physical Geography. 2015;39(6):750–74.		Community participation; technological support; land tenure	
Holden S, Shiferaw B, Pender J. Non-farm income, household welfare, and sustainable land management in a less-favoured area in the Ethiopian highlands. Food policy. 2004;29(4):369–92.	Financial incentives		
Kassahun D. Towards the development of differential land taxation and its implications for sustainable land management. Environmental Science and Policy. 2006;9(7–8):693–7.		Tax regime	
Kassie GW, Kim S, Fellizar FP. Determinant factors of livelihood diversification: Evidence from Ethiopia. Cogent Social Sciences. 2017;3(1):1369490.	Land tenure; co-op memberships	Co-operatives; extension services	

Article	Individual Factors	Collective Factors	Impacts
Lokonon BO, Mbaye AA, editors. Climate change and adoption of sustainable land management practices in the Niger basin of Benin. Natural Resources Forum; 2018: Wiley Online Library.	Education level; land and/or soil characteristics; access to equipment; land tenure; membership of farmer organizations	Market access; cooperatives; infrastructure	
Maisharou A, Chirwa P, Larwanou M, Babalola F, Ofoegbu C. Sustainable land management practices in the Sahel: review of practices, techniques and technologies for land restoration and strategy for up-scaling. International Forestry Review. 2015;17(3):1–19.		Community participation; fiscal spending; technological support; policy for economic incentives	Social conflict
Marques MJ, Schwilch G, Lauterburg N, Crittenden S, Tesfai M, Stolte J, et al. Multifaceted impacts of sustainable land management in drylands: a review. Sustainability. 2016;8(2):177.			Livelihood and well-being; jobs; yield; wood and fodder; nutrition
Mojo D, Rothschuh J, Alebachew M. Farmers' perceptions of the impacts of human–wildlife conflict on their livelihood and natural resource management efforts in Cheha Woreda of Guraghe Zone, Ethiopia. Human–Wildlife Interactions. 2014;8(1):7.			Conflict with wildlife
Ndoye O. The importance of sustainable land management for food security and healthy human nutrition in central Africa. Nature and FAune. 2016;30(1).		Land tenure; research; improved technology	Nutrition
Nigussie Z, Tsunekawa A, Haregeweyn N, Adgo E, Cochrane L, Floquet A, et al. Applying Ostrom's institutional analysis and development framework to soil and water conservation activities in north-western Ethiopia. Land use policy. 2018;71:1–10.		Policy for economic incentives; inclusion of landless workers	
Nigussie Z, Tsunekawa A, Haregeweyn N, Adgo E, Nohmi M, Tsubo M, et al. Factors influencing small-scale farmers' adoption of sustainable land management technologies in north-western Ethiopia. Land Use Policy. 2017;67:57–64.	Perceived economic benefit		
Nkonya E, Place F, Kato E, Mwanjololo M. Climate risk management through sustainable land management in sub-Saharan Africa. Sustainable intensification to advance food security and enhance climate resilience in Africa: Springer; 2015. p. 75–111.		Community participation; institutional reform; institutional capacity; incorporating local knowledge	Carbon sequestration
O'Connor D, Ford J. Increasing the effectiveness of the "Great Green Wall" as an adaptation to the effects of climate change and desertification in the Sahel. Sustainability. 2014;6(10):7142–54.		Promote shrubs	
Odihi J. Deforestation in afforestation priority zone in Sudano-Sahelian Nigeria. Applied Geography. 2003;23(4):227–59.		Removing financial constraints	

Article	Individual Factors	Collective Factors	Impacts
Peng Y, Fu B, Zhang L, Yu X, Fu C, Diop S, et al. Global Dryland Ecosystem Programme (G-DEP): Africa consultative meeting report. Journal of Arid Land. 2020;12:538–44.		Fiscal spending	Jobs; nutrition
Sacande M, Berrahmouni N. Africa's Great Green Wall: a transformative model for rural communities' sustainable development. Lessons learned from Action Against Desertification towards the implementation of African Forest Landscape Restoration Initiative. Nature and Faune. 2018;32(1):90–9.		Institutional reform	
Sacande M, Berrahmouni N. Community participation and ecological criteria for selecting species and restoring natural capital with native species in the Sahel. Restoration Ecology. 2016;24(4):479–88.	Basic needs satisfied; social protections	Participatory species selection	
Sacande M, Parfondry M. Non-timber forest products: from restoration to income generation: Food and Agriculture Organization of the United Nations; 2018.		Value chains	
Sacande M. Restoration programme in practice for Africa's Great Green Wall. Nature and Faune. 2016;30(2):62–5.		Participatory management	
Schmidt E, Chinowsky P, Robinson S, Strzepek K. Determinants and impact of sustainable land management (SLM) investments: A systems evaluation in the Blue Nile Basin, Ethiopia. Agricultural Economics. 2017;48(5):613–27.		Infrastructure	
Schmidt E, Zemadim B. Expanding sustainable land management in Ethiopia: Scenarios for improved agricultural water management in the Blue Nile. Agricultural Water Management. 2015;158:166–78.	Perceived economic benefit		
Syers JK, Lingard J, Pieri C, Ezcurra E, Faure G. Sustainable land management for the semiarid and sub-humid tropics. Ambio. 1996:484–91.	Financial incentives	Participatory strategy development	
Tarchiani V, Di Vecchia A, Genesio L, Sorani F. Monitoring drylands ecosystem dynamics for sustainable development policies: The Keita experience. The future of Drylands: Springer; 2008. p. 395–407.		Carbon market	
Teshome A, de Graaff J, Ritsema C, Kassie M. Farmers' perceptions about the influence of land quality, land fragmentation and tenure systems on sustainable land management in the north western Ethiopian highlands. Land degradation development and Change. 2016;27(4):884–98.	Land and/or soil characteristics; land tenure	Land tenure	
Tougiani A, Guero C, Rinaudo T. Community mobilisation for improved livelihoods through tree crop management in Niger. GeoJournal. 2009;74(5):377.		Community participation	

Article	Individual Factors	Collective Factors	Impacts
Woolf D, Solomon D, Lehmann J. Land restoration in food security programmes: synergies with climate change mitigation. Climate Policy. 2018;18(10):1260–70.		Institutional reform; carbon market; institutional capacity; improved knowledge management	Carbon sequestration; bio-diversity
Yimer M. The effect of sustainable land management (SLM) to ensure food security; local evidences from Tehuledere Woreda, ANRS, Northern Ethiopia. Scientific Journal of Crop Science. 2015;4(1):1–27.	Education level; land and/or soil characteristics; financial incentives		

Appendix B. Details of GEF Projects

ID	Title	Countries	Implement. Agencies	GEF Grant	Co-Financing	Type	GEF Period	Project Size	Start	End
1431	Fouta Djallon Highlands Integrated Natural Resources Management Project (FDH-INRM) (Tranches 1 and 2)	Gambia, Guinea, Guinea-Bissau, Mali, Mauritania, Niger, Sierra Leone, Senegal	UNEP	11,000,000	33,000,000	regional	GEF 3	Full-size Project	2008	2021
2268	SIP: Integrated Ecosystem Management in Four Representative Landscapes of Senegal, Phase 2	Senegal	UNDP	3,640,000	7,789,000	national	GEF 4	Full-size Project	2007	2013
2380	Sustainable Co-Management of the Natural Resources of the Air-Tenere Complex	Niger	UNDP	4,000,000	5,367,734	national	GEF 3	Full-size Project	2006	2016
2511	Groundnut Basin Soil Management and Regeneration	Senegal	UNDP	3,655,728	10,531,921	national	GEF 3	Full-size Project	2007	2019
2794	SIP: Country Program for Sustainable Land Management (ECPSLM)	Ethiopia	World Bank	9,000,000	28,800,000	national	GEF 4	Full-size Project	2008	2014
3367	SIP: Community-Based Integrated Natural Resources Management in Lake Tana Watershed	Ethiopia	IFAD	4,400,000	21,024,500	national	GEF 4	Full-size Project	2009	2019
3381	SIP: Oasis Micro-Basin Sand Invasion Control in the Goure and Maine Regions (PLECO)	Niger	UNDP	2,020,000	13,280,000	national	GEF 4	Full-size Project	2009	2015
3382	SIP: Community Driven SLM for Environmental and Food Security (CAP2)	Niger	World Bank	4,670,000	40,300,000	national	GEF 4	Full-size Project	2008	2013
3383	SIP: Agricultural and Rural Rehabilitation and Development Initiative (ARRDI)	Niger	IFAD	4,200,000	11,878,000	national	GEF 4	Full-size Project	2009	2017

ID	Title	Countries	Implement. Agencies	GEF Grant	Co-Financing	Type	GEF Period	Project Size	Start	End
3385	SIP: Sustainable Land Management in Senegal	Senegal	World Bank	4,800,000	46,400,000	national	GEF 4	Full-size Project	2009	2013
3386	SIP: Innovations in Micro Irrigation for Dryland Farmers	Senegal	UNDP	917,431	810,000	national	GEF 4	Medium-size Project	2009	2018
3884	CPP: National Subprogram for Coordination and Institutional Development on Sustainable Land Management	Burkina Faso	UNDP	1,000,000	8,616,088	national	GEF 4	Full-size Project	2009	2018
4301	CPP: SLM subprogram for the Centre-West Region	Burkina Faso	UNDP	2,219,594	8,141,633	national	GEF 3	Full-size Project	2010	2018
5187	GGW: Community based Rural Development Project 3rd Phase with Sustainable Land and Forestry Management (SAWAP)	Burkina Faso	World Bank	7,407,408	97,350,000	national	GEF 5	Full-size Project	2012	2019
5220	PSG: Sustainable Land Management Project 2	Ethiopia	World Bank	12,962,963	94,655,517	national	GEF 5	Full-size Project	2013	2019
5252	GGW: Third Phase of the Community Action Program (SAWAP)	Niger	World Bank	4,518,518	43,652,000	national	GEF 5	Full-size Project	2013	2017
5449	PSG: Sustainable and Inclusive Agribusiness Development Project	Senegal	World Bank	6,018,519	80,000,000	national	GEF 5	Full-size Project	2013	2021
9134	Food-IAP: Agricultural Value Chains Resilience Support Project (PARFA)	Senegal	IFAD	7,219,450	28,544,133	national	GEF 6	Full-size Project	2016	2022
9135	Food-IAP: Integrated Landscape Management to Enhance Food Security and Ecosystem Resilience	Ethiopia	UNDP	10,239,450	144,965,431	national	GEF 6	Full-size Project	2017	2022
9136	Niger: Food-IAP: Family Farming Development Programme (ProDAF)	Niger	IFAD	7,636,422	60,320,000	national	GEF 6	Full-size Project	2016	2022
9141	GEF-IAP: Participatory Natural Resource Management and Rural Development Project in the North, Centre-North and East Regions (Neer Tamba project)	Burkina Faso	IFAD	7,269,448	35,900,000	national	GEF 6	Full-size Project	2016	2022

Note

[1] This can be found at https://www.thegef.org/sites/default/files/documents/10530_core_indicator_worksheet.pdf accessed on 21 January 2022.

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