Resource-Efficient Land Use – Towards A Global Sustainable Land Use Standard
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Global Sustainable Land Use:

Concept and Examples for Systemic Indicators

GLOBALANDS Working Paper 3.3

prepared by

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All errors and omissions remain the sole responsibility of the authors.

Acronyms

BMUB	German Federal Ministry for Environment, Housing, Nature Protection and Nuclear Safety
CDE	Centre for Development and Environment
CFS	UN Commission on Food Security
EEA	European Environmental Agency
EC	European Commission
EPA	Environmental Protection Agency (USA)
ESMAP	Energy Sector Management Assistance Program
ETFRN	European Tropical Forest Research Network
EU	European Union
FLEGT	Forest Law Enforcement, Governance and Trade
FAO	Food and Agriculture Organization of the United Nations
GBEP	Global Bioenergy Partnership
GEF	Global Environmental Facility
GHG	greenhouse gas(es)
GLII	Global Land Indicators Initiative
GSLS	Global Sustainable Land Use Standard
HLPE	UN CFS High Level Panel of Experts on Food Security and Nutrition
IAASTD	International Assessment on Agricultural Science and Technology for Development
IEA	International Energy Agency
IIASA	International Institute for Applied Systems Analysis
IINAS	International Institute for Sustainability Analysis and Strategy
IPCC	Intergovernmental Panel on Climate Change
IITO	International Tropical Timber Organization
JRC	Joint Research Centre
LUC	land use change(s)
OECD	Organisation for Economic Development and Cooperation
REDD	Reducing Emissions from Deforestation and Forest Degradation
SAFA	Sustainability Assessment of Food and Agriculture Systems
SDG	Sustainable Development Goals
SFM	Sustainable Forest Management
SI	Systemic Indicator
SLM	Sustainable Land Management

UBA	German Federal Environment Agency
UN	United Nations
UNCBD	UN Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UN OWG	United Nations Open Working Group
UNEP	United Nations Environment Programme
UNEP-IRP	United Nations Environment Programme - International Resources Panel
UNFCCC	United Nations Framework Convention on Climate Change
UN-SDSN	United Nations Sustainable Development Solutions Network
VGGT	Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security
WOCAT	World Overview of Conservation Approaches and Technologies

1 Introduction

This working paper for work package 3 of the GLOBALANDS project is meant to stimulate discussion on indicators for global sustainable land use, especially in the context of future *Sustainable Development Goals* (SDGs).

The paper is based on previous work, discussions in the project team, discussions at the International Expert Workshops held in Paris in April 2014 and in October 2014, and own considerations of the authors.

Work package 3 of the GLOBALANDS project addresses

- conceptual issues of a Global Sustainable Land Use Standard (GSLS);
- the necessary framework to implement a GSLS on the UN level, as well as possible alternatives to a GSLS (governance focus);
- thoughts on implementing the proposal into the international political arena (strategy focus).

Closely linked is the outreach to international scientific contributors to allow for inclusion of views, dissemination of thoughts, and respective interaction, as with the 1st and 2nd International Expert Workshops in 2013 in Berlin, and the 3rd and 4th International Export Workshops in 2014 in Paris[1].

It should be noted that the "Global Sustainable Land Use Standard" (GSLS), based on the discussions within the project team, is now defined as a *bundle of approaches* instead of a single "standard", and that these approaches need further substantiation, and implementation within the project:

- Approach 1: Support the definition of *targets* for sustainable land use in relevant UN processes (SDG, UNCCD…)
- Approach 2: Develop a systemic approach – S*ystemic Indicators* (socially inclusive & regionally differentiated sustainable practices for land uses) to support Approaches 1 and 3
- Approach 3: *Safeguarding* sustainable land use in existing international governance systems (UN conventions and their mechanisms, World Bank Project Guidelines etc.)

This paper focuses on Approach 2, presenting, framing and discussing the so called *Systemic Indicators* (SI) and briefly discusses implications for Approaches 1 and 3.

[1] For workshop outcomes, see GLOBALANDS website: www.globalands.org

2 Global Sustainable Land Use: The Role of Indicators

Sustainable land use on the global scale is subject to agreement on adequate definition (Kaphengst 2013) and requires global goals or targets (GLOBALANDS Approach 1) as well as safeguards, especially for project financing (GLOBALANDS Approach 3).

For both, indicators are needed to express and measure sustainable land use, i.e. *metrics* for compliance and monitoring are required. As the Outcome Document on Sustainable Development Goals prepared by the United Nations Open Working Group (UN OWG) defines it:

"Sustainable Development Goals are accompanied by targets and will be further elaborated through indicators focused on measurable outcomes" (UN-OWG 2014).

A survey and compilation of land-related sustainability indicators in various sustainability policies and certification systems carried out by GLOBALANDS concluded that currently *no existing* set of indicators consistently describes sustainable land use in both the environmental and social domains (Eppler, Iriarte 2013).

Particularly as land has this integrative character giving the support for the development of any activity[2], there is the unique possibility to establish a coherent sustainable development in all its dimensions with the SDG's. As the Outcome Document of the UN-OWG clearly states:

"The goals and targets integrate economic, social and environmental aspects and recognize their interlinkages in achieving sustainable development in all its dimensions" (UN-OWG 2014).

The following subsections present a short overview on recent processes framing sustainable development with a direct linkage to land (for details on goals and indicators see Annex I). These are:

The SDG proposal from the UN OWG, the SDSN proposal for the SDGs, the CCD progress indicators on strategic objectives under the 10-year strategic plan and the CBD Aichi targets and indicators under the Strategic Plan for Biodiversity 2011-2020.

2.1 Sustainable Development Goals

The Sustainable Development Goals (SDGs) are an integrated, indivisible set of global priorities for sustainable development. They focused on measurable outcomes. So far in the process just goals and targets have been proposed.

The aim is to develop SDGs which are action oriented, global in nature and universally applicable, but as well take into account different national realities, capacities and levels of development and respect national policies and priorities. Further they should build on the foundation laid by the MDGs. Each government is setting its own national targets guided by the global level of ambition but taking into account national circumstances.

[2] Land resources – soil, water and biodiversity – are the foundation upon which our societies and economies grow and prosper (UNCCD 2014)

In the last version of the UN OWG from June 2014 there are 3 goals identified which are directly related to land (Goals 1 - Fight poverty, goal 2 – end hunger and goal 15 – Protect, restore, promote sustainable use) (Annex I) and five goals have an indirect land link related to water management, economic growth, sustainable cities, sustainable production and climate change. These goals are accompanied by aspirational global targets and will be further elaborated through indicators in the coming year 2015 and will be presented latest by September 2015.

Proposal of UN Sustainable Development Solutions Network (SDSN)

The SDSN actively contributes to the Post-2015 processes on the SDGs[3]. The Network propose 10 goals and relevant indicators where two goals are related to land: Goal 6: "*Improve Agricultural Systems and raise Rural Prosperity*" and Goal 9: "*Secure Biodiversity & Ensure good Management of Water, Oceans, Forest and Natural Resources*" (UNSDSN 2014a[4]). The related indicators capture e.g. nitrogen use, land use change, Area of forest under sustainable forest management.

2.2 UNCCD Progress Indicators

The UNCCD progress indicators (formerly known as impact indicators) are developed under the 10 year strategic plan and framework to enhance the implementation of the convention (2010 – 2018). At its eleventh session the COP adopted a refined set of six progress indicators which will be used for the first time during the second leg of the fifth reporting process in 2016 (UNCCD 2014b).

The set includes two indicators for each strategic objective. Relevant to land are the strategic objectives 2: "*To improve the condition of affected ecosystems*" and Strategic objective 3: „*To generate global benefits through effective implementation of the UNCCD*" with e.g. the Core indicator S-7: „*Areas of forest, agricultural & aquaculture ecosystems under sustainable management"* - XI Land under SLM. The progress indicators were tested through pilot exercises conducted at the national level[5].

2.3 CBD/Aichi Targets

The twenty Aichi targets under the Strategic Plan for Biodiversity 2011–2020 have five land-linked targets defined by operational indicators expressed in trends (Annex I in CBD 2014).

Most of current indicators proposed by the presented initiatives or working groups concern environmental *characteristics* of land, aiming to ensure (or restore) its potential uses, including ecosystem services. These indicators address the *impact* side through defining acceptable levels of interference, or targeted levels of improvement.

3 The SDSN Leadership Council submitted its report *An Action Agenda for Sustainable Development* to UN Secretary-General. In addition, the SDSN has issued a draft indicator report, *Indicators and a monitoring framework for Sustainable Development Goals* proposing an indicator and monitoring framework for the draft SDGs recently proposed by the OWG. Further SDSN is working with a range of partners to elaborate on the concept of the Data Revolution.

4 See: http://unsdsn.org/resources/goals-and-targets/

5 See: Results and Conclusion of the pilot testing of UNCCD Progress Indicators. A satisfactory level of successful reporting was found for Indicator XI 'SLM'. This level of reporting suggests that Parties have the potential to report against these indicators but that they could be further refined in light of the difficulties raised by some countries - http://www.unccd.int/en/programmes/Science/Monitoring-Assessment/Documents/Pilot_Conclusion-Report.pdf

For example, suggested SDG and accompanying targets by RNE (2014) and WBGU (2014) concentrate on the environmental domain. In parallel, the Global Land Indicators Initiative[6] aims to agree between major players on key indicators for land in the SDG, and has published respective reports (GLII 2014a+b).

The focus of the proposed "core 4" indicators is mainly on securing land tenure, so the GLII proposal lacks inclusion of environmental issues such as biodiversity, land degradation, soil quality etc.

The United Nations Sustainable Development Solutions Network (UN-SDSN) has compiled a comprehensive list of indicators for the SDGs which consist of 100 "core indicators", including many related to land (UN-SDSN 2014a). In the public consultation of this document, concerns were raised that 100 would be too many (UN-SDSN 2014b)[7]. With regard to the current global discussion on land within the SDGs this creates not only the problem of measuring *many* such environmental land characteristics (e.g., biodiversity status, degradation and erosion levels, soil qualities etc.)[8], each on the appropriate scale, but implies also available human capacities to do so, and available budgets to cover respective costs for equipment and staff.

Furthermore one of the greatest concerns is the low overall global coverage of the proposed indicators[9]. In many cases, sound indicators exist, but they are not collected on a systematic basis – particularly in low-income countries. As highlighted recently by UN-SDSN, major gaps exist, particularly for key social and environmental metrics (UN-SDSN 2014c).

The *possible proliferation* of indicators and the implied costs of implementing a *large number* of indicators are severe problems which could hamper (political) agreement on the UN level.

During the 2014 World Bank conference on "Land and Poverty", many sessions discussed options to make use of remote sensing data (e.g. from satellites) and crowd sourcing of data (e.g. through mobile phone applications) to reduce cost just for land demarcation, registries, and related information to secure land tenure aspects.

The socio-economic aspects of land use in combination with the environmental ones are fundamental for any sustainable land use target, and their adequate inclusion appears crucial for any progress towards negotiating SDGs.

Thus, the challenge is to develop default practice indicators for *integrative* SDGs which are:

- not too many (to avoid proliferation),

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6 See http://www.gltn.net/index.php/projects/global-land-indicator-initiative for details

7 Other commentators argued that even 100 would be not enough. It should be noted, though, that the 100 "core" indicators also include many "tier 2" sub-indicators so that the total number of indicators suggested by UN-SDSN is well above 200, with about 10 for land-related issues.

8 For example, an ad-hoc working group during the Global Soil Week 2013 aimed to substantiate wording on goals and indicators for "zero net land degradation" spend much time just to discuss how soil C is to be measured. In the context of the GBEP sustainability indicators for bioenergy it took more than 3 years to elaborate and agree upon a set of 24 indicators – derived from an original list of more than 250 (GBEP 2011).

9 "On average, data has been or is available for only 46% of the proposed indicators, presenting a significant challenge to the international statistical community." (UN-SDSN 2014c)

- reasonably implementable (to avoid excessive cost), and
- open for improvement (to avoid endless discussions about “completeness”).

In the following section, an approach to deliver on this challenge is suggested – still in early stage of development, but with possibilities for application (see Section 3), and a perspective on being implementable (see Section 5).

As with any new approach, there are still open questions and further work is required, as discussed in Section 6.

3 Systemic Indicators as a New Approach

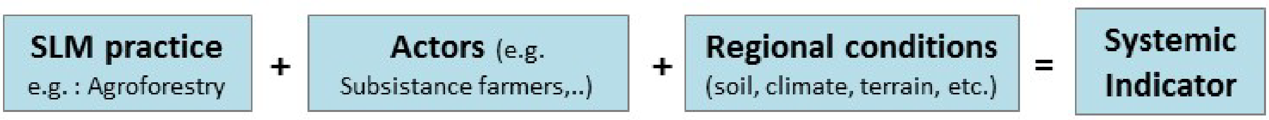
GLOBALANDS acknowledges the limitations of the current approaches and aims to provide a conceptual format of land-related sustainability metrics for which the leading thought is to focus on the management of land (land **use**).

There is a growing agreement in international policy discourses that issues relating to climate change, biodiversity, land management, etc., with their multiple social, economic, political, cultural and ecological dimensions, are complex and need to be addressed in a holistic manner (Rahmanian 2014).

The proposal for an approach to assess targets and goals in an integrative way with Systemic Indicators aims to address this complexity: instead of characterizing environmental or social aspects separately, the concept of systemic indicators focuses with an integrative view on *specific uses* of land which are sustainable not only in the environmental, but also the socioeconomic domain (*sustainable practices)*.

This approach acknowledges and integrates the particularities of specific actors in specific regions. Then, the Systemic Indicator Approach is the result of a combination between: sustainable practice, specific actors and certain regions.

Figure 1 Scheme for the Systemic Indicator Approach



Source: own elaboration by IINAS

3.1 Qualifying Sustainable Land Use Practices

The GLOBALANDS team has carried out an exhaustive literature review intensively discussed the definition on qualifying parameters to ***define sustainable practices***. Defining a sustainable land management (SLM) practice is beyond the scope of this report. GLOBALANDS refer to SLM practices as those identified and characterized in the data base established by the World Overview of Conservation Approaches and Technologies (WOCAT[10]).

WOCAT offers a unique standardized methodology and tools for documenting and evaluating sustainable land management (SLM) approaches and technologies for different regions of the world and innovative templates for dissemination of key information of best practices to field practitioners, decision-makers and policy-makers, including the UNCCD and GEF focal points. In April 2014 the UNCCD identified the WOCAT as *primary recommended database on best practice and technologies of sustainable land management (SLM)*. For that reason we refer to the WOCAT data base of *SLM practices* for further selecting, assessing and processing in the systemic indicator approach.

Exemplary a list of SLM practices was derived using qualitative screening indicators which should be seen as a preliminary proxy for the required screening. This should be done with caution to *narrow the range* of practice-actor combinations to a significant – but not too high – number to avoid the “proliferation trap” of the traditional indicator approach. The logic here is to apply a two-level (tiered) screening:

First, WOCAT data base of SLM practices is screened with regard to providing significant benefits to the environmental **and** social domains (*relevance* criterion), being well distributed amongst regions (*applicability* criterion), and being endorsed by multiple stakeholders (*acceptance* criterion).

The proxy screening is meant to illustrate how a longer list of land use practices could be filtered, and not as a definite answer to the question of sustainability of land use practices.

Table 1 Sustainability Metrics for Agricultural Land Use Practices

	Screening Criteria	**SLM Practices out of WOCAT data base**		
		Agroforestry	**Water harvesting**	**Cross-slope barriers**
Environmental	Land degradation	+++	++	++
	Biodiversity	+++	o	+
	Soil (SOC, nutrients)	+++	o	o
	Water resources	++	+++	++
	Water productivity	+++	+++	++
	Climate change	++	o	++
Socio-Economic	Food security	+++	++	o
	Rural poverty	+++	o	o
	Rural employment	o	o	o
	Land tenure and ownership	-	-	-
	Traditional knowledge	o	o	++
	Improving crop production	++	+++	++
	Improving fodder production	++	++	++
	Supporting gender equity	++	o	o

Source: own compilation based on Liniger (2011); impact levels: + = positive; o = moderate; - = low/none

[10] WOCAT was launched in 1992, more information: https://www.wocat.net/en/about-wocat.html

A particular SLM practice should have a high score in the above exemplary sustainability assessment. But to finally "qualify" a land use practice as sustainable it needs to be combined with a specific actor group within a certain region. This is the deciding factor, since a land use practice is not per se sustainable. Only this systemic **combination** safeguards against a generalized "SLM catalog" which poses the risk of accepting negative tradeoffs (e.g. no tillage in large-scale agriculture which may imply high herbicide use).

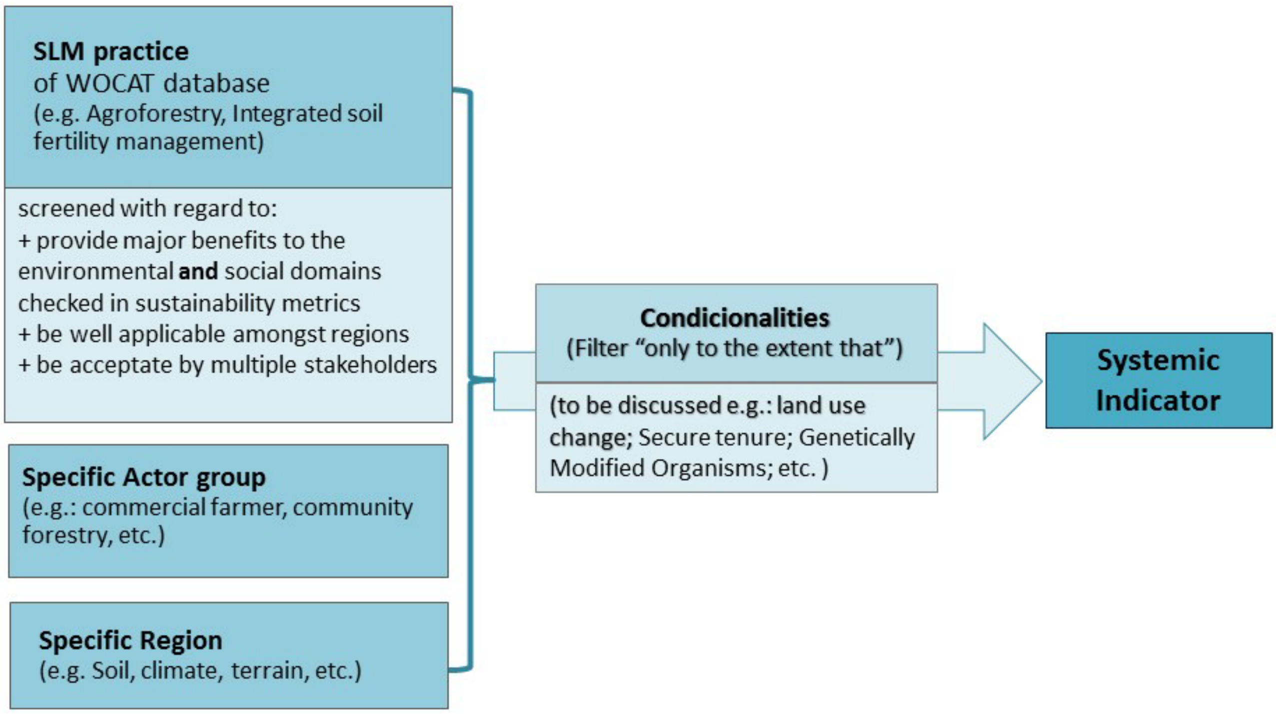
Second, the combination of land use practices and actors is checked for required *conditionalities* needed to meet normative restrictions. ***Examples*** for this are:

- Land-use changes: Generally speaking, this refers to e.g. agricultural use when previous use is forest land. An example of this safeguarding approach is the EU Renewable Energy Directive (EU 2009) which – as a part of its sustainability requirements for biofuels and bioliquids – does not allow cultivation of respective feedstocks on land which changed its status after January 1, 2008.
- Use of genetically modified organisms (transgenic plants) which may be prohibited in certain regions or countries (or subject to labeling requirements)
- Social aspects: A key issue is the provision of secure tenure for actors such as smallholders. The VGGTs are a potential safeguard for this once they are successfully implemented.

It must be ensured that sustainable land use practices do comply with these restrictions, e.g. they are sustainable only to the extent that the conditionalities are met. These conditionalities should be systematically identified in the environmental, social and economic domain as a key element of a participatory process to regionally or nationally implement e.g. the future SDGs.

This screening process is depicted schematically in the following figure.

Figure 2 Detail of the Screening of Land Use Practices in the Systemic Indicator Approach



Source: IINAS with input from GLOBALANDS team

The two screening step are *essential* in the SI concept: The first level (left boxes in Figure 2) ensures that only meaningful combinations of land use practices with actors (and regions) are considered while the second step (middle box in Figure 2) "secures" against possible negative environmental and social effects of applying certain land use practices. Thus, the screening is a necessary part of developing systemic indicators, and should be carried out in a (regionalized) participatory process with all relevant stakeholders.

Nonetheless, the following example described in Pretty (1995) shows that sustainable land use either in agriculture or in forestry needs more than new technologies and practices:

A learning group from the NGO, COSECHA, returned to areas where projects had ended three, four and I5 years previously, and used participatory methods with local communities to investigate changes (Bunch and Lopez, 1994). They found that those communities in the project areas were substantially better off economically and socially. But, surprisingly, many of the technologies known to be "successful" during the project had been completely replaced by new practices and, in all, some 80-90 innovations were documented. This has led Bunch and Lopez (personal communication, 1994) to conclude that "technologies are not sustainable: what needs to be made sustainable is the process of innovation itself'. (Pretty 1995)

3.2 Actors

As the choice on how a ***land user (actor)*** is using the land - with the most appropriate land use practice in a particular situation - is determined by and based on their socio-economic context, such as farm size, assets, capabilities (e.g. market orientation, knowledge/skills, land ownerships, etc.) and capacities.

Therefore, it is fundamental to **combine and integrate** the land user as such in this indicator approach, particularly because land users are different around the globe, within countries and regions, depending on their requirements, circumstances, goals, etc.

As for example in the agricultural sector small-scale farmers and their farming systems themselves are extremely diverse, as influenced by geographical region, national governance system and management type, but even more if compared to commercialized industrial farming.

The following simplified representation illustrates the key characteristics of two generic actor groups.

For forestry land use the actors differentiate as well in all its facets (see 4.1.2)

Table 2 Common Characteristics of Small vs. Large Scale Farming Systems

Parameter	Small-Scale farming	Industrialized Large-Scale farming
Area	0.5 - 5 ha[11]	> 50-100 ha (up to 50.000 and more)
Land characteristics	often poor, marginalized	Deep and fertile soils, for extensive grazing also marginal
Cropping systems	Diversity of crops and mixed farming	Monocultures
Input level	Low	High (fertilizers, pesticides, water...)
Production goals	Diverse, e.g., feeding the family, meeting social obligations; household's livelihood is primarily derived from farming	Only commercial
Labor	Communal responsibilities, intensive	Low due to mechanization[12]
Market access	Limited market access	Very good
Infrastructure	Poor (roads, schools, etc.)	Modern, highly efficient machinery
Subsidies	None, only aid or on project level	Many

Source: own compilation by IINAS

Thus, the actors can be aggregated into the two basic groups. This “crude” approach is meant as a first-order approximation. In reality, the groups differentiate significantly and need to be adjusted to the regional circumstances.

However, to mention one last point, smallholders often diversify their activities to complement incomes or reduce risks, participating in non-farm activities or bearing temporary migration. For these reasons:

“ *…the view of a small-scale farmer as much more than an agrarian economic actor is gaining in prominence. Rather, a small-scale farmer can be thought of as a nuclear unit for the environmental management of land and its biodiversity, an important source of cultural value and a fundamental pillar of the national development. As such, smallholders become a means and unit of organizing agriculture, forestry, fisheries, pastoral and aquaculture production systems. The family and the farm are linked, co-evolve and combine economic, environmental, reproductive, social and cultural functions.*” (FAO 2013)

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[11] Since the appropriate size threshold must be adapted to regional and national situations “small scale” farm size differs between countries e.g. in Brazil small scale farms are defined ranging from 5-110 ha (HLPE 2013, p. 25).

[12] In Brazil, 1 job is created per 8 hectares cultivated by small farmers using mixed cropping, while large-scale mechanized monocultures generate 1 job per 67 hectares. With improved working standards and rights (e.g. occupational safety and health), sustainable smallholder agriculture can represent a key driver for decent rural jobs (FAO 2012).

This systemic system calls for an integrated assessment to measure the achievement of sustainable land use.

3.3 Regions

Additionally the applicability of a land use practice is based on the local topographic, soil, climate and vegetation conditions. So, to make the SIA complete, a ***differentiation by regions*** is important because in different regions SLM practices might be different and what is sustainable in one region might not be sustainable in another.

As a starting point for a first basic classification of regions a new approach developed by Vaclavik et al. (2013) could be used. This approach describes global, archetypical patterns of land use systems. Current approaches focus on broad scale representations of dominant land cover with limited consideration of land-use intensity[13].

This study represents human–environment interactions as global archetypes of land systems, which are defined as unique combinations of land-use intensity, environmental conditions and socioeconomic factors, with patterns that appear repeatedly across the terrestrial surface of the world. It is explicitly addressing the multidimensional aspects of land-use intensity and both the drivers of land use and its impacts.

The hypothesis behind is that: (I) land systems can be clustered in consistent groups based on the similarity of available indicators of global land-use and (II) the same land system archetypes (LSAs) can be identified across the globe, while diverse patterns can be found at the sub-national scale. This implies that there are no 'one-size-fits-all' solutions to sustainable land management.

But by mapping LSAs, a broad view of the most relevant characteristics of human– environment interactions is offered while still preserving local context needed for place-specific solutions to global challenges of land use and sustainability.

Twelve archetypes of land systems were identified and mapped for the year 2005 (Vaclavik et al. 2013):

1. ***Forest systems in the tropics*** cover approximately 14% of terrestrial ecosystems. These regions occur in Latin America and the Amazon basin, Central and West Africa, and in Southeast Asia.
2. ***Degraded forest/cropland systems*** in the tropics cover only 0.35% of terrestrial ecosystems, but represent areas with the highest estimated soil erosion in the world. Occurs especially in Southeast Asia and Latin America
3. ***Boreal systems of the western world*** (14% of terrestrial ecosystems) consist of a mixture of boreal forests and tundra. This LSA occurs predominantly in Canada and Northern Europe but also in Patagonia and the higher elevations of Japan or the Alps.

[13] . Hierarchical clustering has been previously used to delineate land cover and farming systems (FAO 2011; Kruska et al. 2003; Letourneau et al. 2012; van Asselen, Verburg 2012; van de Steeg et al. 2010) but these approaches required expert rules or supervised threshold selection and used relatively few variables in order to keep the interpretation of classification trees manageable.

4. ***Boreal systems of the eastern world*** (20% of terrestrial ecosystems) closely resemble the previous archetype with the exception of several socio-economic factors. This archetype occurs predominantly in Russia and Northeast China.
5. ***High-density urban agglomerations*** (0.1% of terrestrial ecosystems).
6. ***Irrigated cropping systems with rice yield gap*** (1% of the terrestrial ecosystems). The intense land-use pressure is illustrated also by dense population which is increasing. These archetypes occur predominantly in India, Bangladesh and Southeast Asia.
7. ***Extensive cropping systems*** (11% of terrestrial ecosystems). This LSA occurs in Eastern Europe, India, China but also in South America and Sub-Saharan Africa.
8. ***Pastoral systems*** (13% of terrestrial ecosystems). Pastoral systems occur predominantly in Central Asia but also in South and North Africa, Sahel, and in portions of Mexico and South America.
9. ***Irrigated cropping systems*** cover only about 2% of terrestrial ecosystems but represent managed landscapes with the highest agricultural inputs. The LSA occur predominantly in India, China, Egypt, but also in Europe.
10. ***Intensive cropping systems*** (5% of terrestrial ecosystems) are characterized by a high density of cropland and high inputs of N fertilizer. Population density is on average. This LSA occurs mainly in Western Europe, Eastern USA and Western Australia.
11. ***Marginal lands in the developed world*** (9% of terrestrial ecosystems). The population density is only 6 people per km_2 with decreasing trend. This LSA occurs predominantly in Western USA, Australia, Argentina, but also in North and South Africa.
12. ***Barren lands in the developing world*** (11% of terrestrial ecosystems) consist of mostly barren and desert areas. Including the Middle East, Saharan Africa and also deserts of Namibia, Gobi and Atacama.

The archetypes allow to identify areas and land systems that are underrepresented in terms of knowledge and data and therefore require further case studies to investigate land use change in depth. Although remote sensing and global modelling have transformed the way of observing global land-use patterns, humane influenced systems are not directly assessable from space and need systemic local solutions.

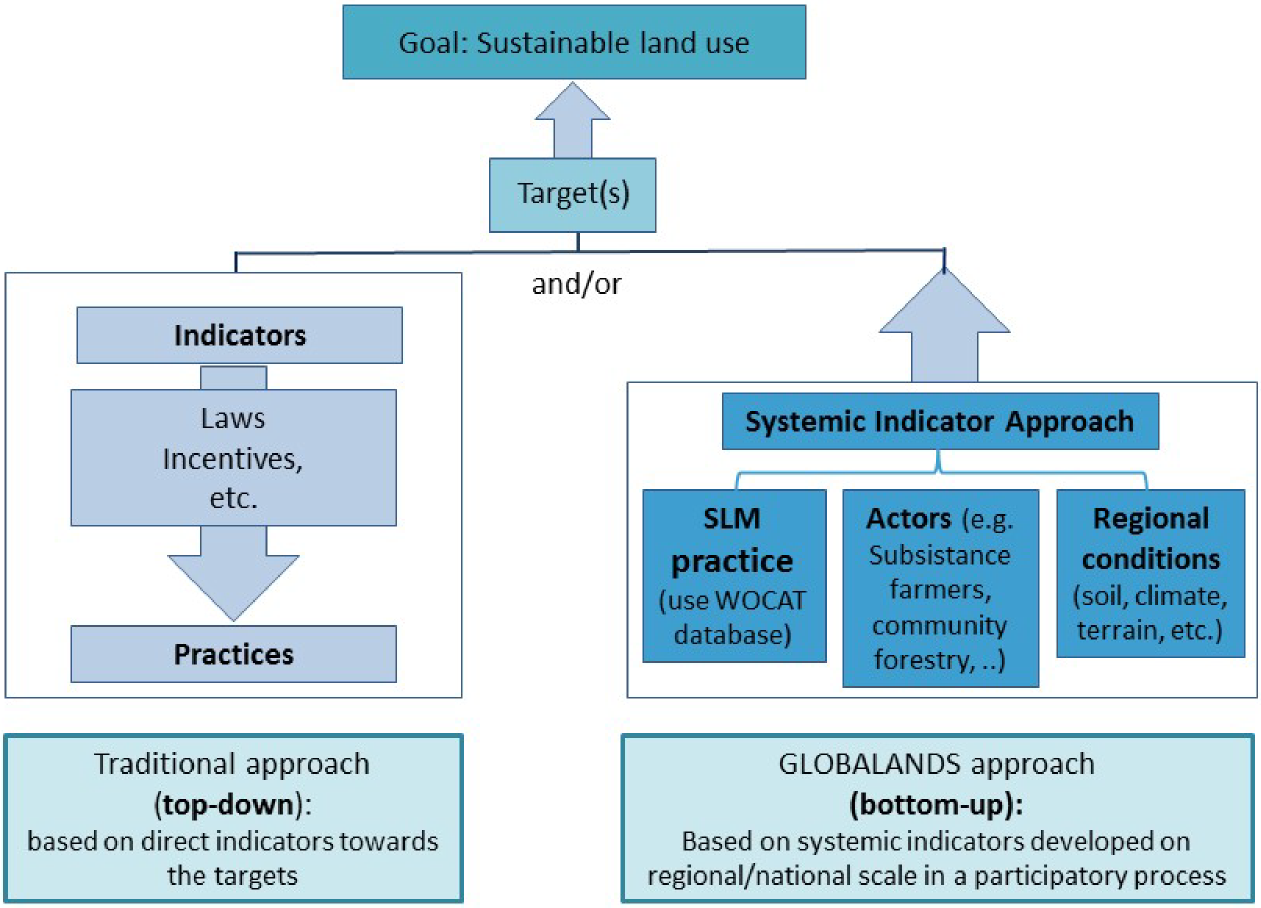
Land-use case studies at local level could be a possibility, if findings are linked and shared. Therefore the archetypes can serve as an operational framework for such efforts[14].

However, the above described classification should be seen as an example of possible land system typologies that should be improved as new data and knowledge from regional studies become available.

The essence of the systemic indicator approach (bottom up) is shown in the following figure in comparison to the "traditional" indicator approach (top-down).

[14] One existing initiatives is for example GLOBE (http://globe.umbc.edu/).

Figure 3 Overview of the Systemic Indicator Approach



Source: IINAS with input from GLOBALANDS team

The bottom-up approach is used to identify *evidence-based* sustainable land use *practices* (environmental and cultural contexts) in a *participatory consultation process* carried out by specific actors (socio-economic context) in a given region (geographical context). The governance of the decision-making depends on the (regional) application, and needs to be worked out with regard to future implementation of the SI approach (see Sections 5 and 6).

The *combination* of these elements leads to an *aggregated* expression of sustainability for land use: the qualification of land use practices applied by actors in specific regions allows for social and geographical differentiation.

The approaches of the "African Re-greening Initiative"[15] and the "Great Green Wall Initiative[16]" in the Sahel are similar to the here developed SI approach and can therefore be seen as an illustration

15 See: http://africa-regreening.blogspot.de/

16 The vision of a great green wall was originally conceived by the former President of the Federal Republic of Nigeria, Chief Olusegun Obasanjo, and was then strongly supported by the President of Senegal, Abdoulaye Wade, initially with a limited vision related to tree planting. For more information see: http://www.thegef.org/gef/great-green-wall

of the logic. Moreover, in October 2014 the European Union (EU) and the Food and Agriculture Organization of the UN (FAO) have launched the 'Action Against Desertification' program in collaboration with the African, Caribbean and Pacific Group of States (ACP).

It aims to enhance sustainable land management (SLM) and restore degraded lands will **build on the Great Green Wall for the Sahara and Sahel Initiative**, which has supported sustainable management and restoration of dryland forests and rangelands in Burkina Faso, the Gambia, Niger, Nigeria and Senegal.

The objective is to promote agro-forestry and income-generation activities, particularly in rural areas and for women and youth, and support the sustainable production, processing and marketing of agricultural products and forest goods and services.

The program will also increase South-South cooperation by building on lessons learned from Africa's Great Green Wall Initiative to help local communities **adopt improved sustainable land and forest-management practices** (FAO 2014). This action shows that the systemic approach is feasible.

3.4 The Normative Base for Systemic Indicator Approach

The SI approach does not deliver sustainable land use indicators on its own - it requires *normative* decisions by stakeholders on which practices are *deemed sustainable* if carried out by whom, and where.

For the global level, the prospective SDGs with their (explicit or implicit) goals and targets for sustainable land use may well provide this normative base once they are agreed upon.

For regional or national processes – and for the ongoing discussions around the SDG which needs input from regions and nations, as well as non-governmental stakeholders – the normative context will have to be provided through respective political discussions in the regions or countries.

To facilitate such an integrative approach a ***multi -stakeholder participation*** is essential.

The indefinable value based character of sustainability requires the full participation of all members of communities. In other words visions of a sustainable future, for all land use cannot be formulated without the involvement of its inhabitants. Stakeholders should be consulted in the indicator development process as early as possible.

The traditional top-down process at all levels of decision making needs to give way to a **bottom-up** approach, based on a binding participation of relevant stakeholders and representatives of small farmers, fishermen and indigenous people, including the most marginalized and under-represented.

It is time to re-consider small holders land user potential to combat current global challenges while recognizing the constraints of adopting site-specific ecological conservation methods – the challenge is not technical but political (FAO 2013).

There are examples of inclusive processes in the international arena with interesting results that could be followed. The endorsement of the Voluntary Guidelines on the Responsible Governance of Tenure is one example.

Still, the adoption of non-binding principles is only a starting point in terms of what is necessary. A more challenging proposition is to reform existing power asymmetries. The reform process at the

UN Committee on World Food Security (CFS) in 2009, whereby CSOs were included in the decision-making process[17] is one promising option.

In the following, the concept of Systemic Indicators is worked out exemplary for agricultural and forest land use to give an illustrative presentation.

[17] Through the Civil Society Mechanism (CSM)

4 Examples for Systemic Indicators

4.1 Systemic Indicator Approach for Agricultural Land

Concerns about sustainability in agricultural systems focus on the need to develop technologies and practices that do not have adverse effects on environmental goods and services, are accessible to and effective for farmers, and lead to improvements in food productivity (Pretty 2008). Sustainability in agricultural systems incorporates concepts of both resilience (capacity of systems to buffer shocks and stresses) and persistence (capacity of systems to continue over long periods), and addresses wider economic, social and environmental outcomes (Pretty 2008).

Over the past decades a wide range of land and water management practices evolved to address negative impacts of land degradation and to increase long-term agricultural productivity[18]. WOCAT[19] and compilations by UNCCD[20] show best practices for sustainable agricultural land use for different regions of the world.

For sustainable land use, social aspects – especially land tenure – need to be considered also. It is assumed here - *as a working hypothesis* - that the VGGT can be used as a respective safeguard especially for small-scale farmers, herders and pastoralists.

4.1.1 Sustainable Land Management in Agriculture

The following indicative compilation of practices is derived from WOCAT (Liniger et al. 2011) and meant to give illustrative examples for the Systemic Indicator approach[21].

Agroforestry: is the integration of trees within farming systems and landscapes that diversifies and sustains production with social, economic and environmental benefits. Agroforestry is therefore a practical means of implementing many forms of integrated land management, especially for small-scale producers, which builds on local traditions and practices. Agroforestry is practiced in Africa, Latin America, and Asia, as well as in parts of Europe and North America. Agroforestry is also playing a key role in dryland farming systems in India, Brazil, and other parts of the world (Critchley 2010).

Water Harvesting (WH): refers to all technologies where rainwater is collected to make it available for agricultural production or domestic purposes. WH aims to minimize effects of seasonal variations in water availability due to droughts and dry periods and to enhance the reliability of agricultural production. WH is applicable in semi-arid areas with common seasonal droughts. It is mainly used for supplementary watering of cereals, vegetables, fodder crops and trees but also to provide water for domestic and stock use, and sometimes for fish ponds. WH can be applied on highly degraded soils (Mekdaschi, Liniger 2013).

18 See e.g. IAASTD (2008); Liniger et al. (2011); Schwilch et al. (2012); FAO (2013); WRI (2013), and www.wocat.net

19 The World Overview of Conservation Approaches and Technologies (WOCAT) offers standardized methodologies and tools for documenting and evaluating SLM approaches and technologies, and templates for dissemination.

20 For over 250 SLM techniques to combat land degradation and build resilience to drought and climate change see UNCCD (2014).

21 It should be noted that e.g. certified organic farming may also represent a sustainable agricultural land use practice.

Cross-slope barriers: are measures on sloping lands in the form of earth or soil bunds, stone lines, and / or vegetative strips for reducing runoff velocity and soil loss, thereby contributing to soil, water and nutrient conservation. This is achieved by reducing steepness and/or length of slope.

While cross-slope barriers are primarily intended to reduce soil erosion, they also enable or ease cultivation between the barriers, which are usually sited along contours. Some common technologies used by smallholder farmers include contour bunds, *fanya juu* and *fanya chini* terraces, stone lines and vegetative barriers. Bench terraces can be the eventual result – though in some circumstances may be constructed through excavation and shaping (Liniger et al. 2011).

4.1.2 Agricultural Actor Groups

Actors groups in agricultural land use are complex and differ across countries. Therefore it is essential to define actors on country/regional level and classified those considering different parameters like: area, land ownership, land use rights, market orientation.

A majority of agricultural workers are poor small-scale farmers[22] in developing countries, with a high degree of dependence on subsistence systems, i.e., production by households for their own consumption, and a high degree of dependence on both the biophysical and socioeconomic systems[23].

It is difficult to categorize smallholders and family farmers according to a common typology of attributes or components. Their productive and social structures often do not follow rigid patterns.

They also differ according to land tenure – the type of contractual arrangements which can include renting or share-cropping; the control of the natural resources used; the scale of production; the share of family labor utilized (who in the family manages what and how); the extent and nature of wage labor employed; the degree of market integration; and the distance of holdings from the family residence. Furthermore, the interaction of these variables with national standards of living must also be considered (FAO 2013).

Keeping in mind the diversity described above, any definition of the characteristics of small-scale farms and family farming[24] will depend on the definitions that each region/country adopts for itself, settled in extensive and binding consultations with relevant stakeholders.

Nevertheless, scale measurements of the farm size are often used to classify producers. According to HLPE (2013), there are 2 billion men and women farmers working on farms of less than 2 ha[25].

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22 FAO (2012) proposes: "Smallholders are small-scale farmers, pastoralists, forest keepers, fishers who manage areas varying from less than one hectare to 10 hectares. Smallholders are characterized by family-focused motives such as favoring the stability of the farm household system, using mainly family labor for production and using part of the produce for family consumption."

23 Such as land area and quality, water resources, animal stocks, infrastructure and machinery and financial assets.

24 An agreed definition of what constitutes a small-scale farmer must include a territorial and socio-economic assessment that considers the level of technology and external inputs used, the production process used and its relation to the local environment, agro-biodiversity involved in the production process and type of employment existent, among other factors.

25 These smallholders manage approximately 500 million small farms and provide over 80 per cent of the food consumed in large parts of the developing world, particularly Southern Asia and sub-Saharan Africa, thus contributing to food security and poverty reduction. A previous study showed that a one-per-cent increase in agricultural per-capita Gross Domestic Product (GDP) reduced the poverty gap five times more than a one-per-cent increase in GDP in other sectors, especially amongst the poorest people. - See more at: http://www.ifad.org/media/press/2013/27.htm#sthash.zzfNUsR7.pdf

However, the 2 ha farm size is not a universal characteristic. Smallholding sizes vary across regions from an average of 0.5 to 10 ha – and even 500 ha is considered a smallholding in Australia.

A minority of agricultural workers live on larger production units and in industrialized nations, profiting from wealthy economies and a variety of subsidies to maintain their production and/or production systems (IAASTD 2008).

This industrialized large-scale farms are common in developing or transition countries. They have operational units that often exceed 10,000 ha and are hence bigger than the largest farms in comparable land abundant regions in developed countries (WB 2011).

Actor-wise barriers for SLM implementation

Changes towards SLM should build on – and be sensitive to - values and norms, allow flexibility, adaptation and innovation to improve the livelihoods of the land users (Liniger et al. 2011). Special attention needs to be given to poor and marginalized land users. The Major challenges in poor countries are:

- Labor availability is a major concern and depends on the health of people and competition with other income generating activities. Malaria, HIV-AIDS and water-borne diseases significantly affect labor productivity. Conflicts with off-farm work, including the seasonal migration of labor force (often men) can be a major constraint for SLM. Single (often female) headed rural households need practices with reduced labor inputs.
- Access to inputs and equipment such as machinery, seeds / seedlings, fertilizers, etc. is essential. Introduction of SLM is only possible if markets for inputs and products are secured.
- Access to knowledge related to SLM practices and their introduction is a prerequisite for all land users. Practices that are easy to learn, and build on existing experiences and knowledge, have the best chance of being taken up.

Apart from the costs, benefits, access to inputs, markets and knowledge, there are other elements related to improved livelihoods such as the need for practices to be:

i. socially and culturally acceptable: aesthetics (a non-linear contour may be visually unacceptable for example) and beliefs (some areas are ‘untouchable’ because of spirits) norms and values;
ii. flexible enough to allow (and even encourage) local adaptation and innovation;
iii. clearly seen to add value to the land and to the quality of life.

It should be noted that the SI approach assumes that these aspects are taken into account through *conditionalities* (safeguards, e.g. via the VGGT) defined in a *participatory approach* on the regional, national or sub-national level (see Section 5 and 6).

4.1.3 Examples for Systemic Indicators for Agricultural Land Use

The following table combines SLM practices with certain actors in specific regions to give examples of Systemic Indicators for sustainable agricultural land use.

Table 3 Overview of Systemic Indicators for Sustainable Agricultural Land Use

Land Use Practice	Actors	Region
Agroforestry	Small-scale land users; mixing of woody and non-woody species	dry and semi-arid regions, sub-humid mountains + temperate zones
Example:	Poor farmer, herders, woman	“Re-greening” of arid regions (e.g. Sahel/Niger[26])
Agroforestry	Large-scale land user; extensive and intensive	temperate and tropical zones
Example:	Tea/coffee plantations	Latin America, Asia
Example	Montado[27]	South and central Portugal
Water harvesting	Poor small-scale farmers mainly < 1ha, partly 1-2 ha/2-5 ha	Arid and semi-arid zones
Example:	Poor farmers using plant pit system/Zaï[28]	Burkina Faso[29]
Cross slope barriers	Small-scale, average level of wealth to poor land users	subhumid, semi-arid
Example	Earth-banked terraces in cereal and almond cropland covered with drought resistant shrubs	Spain, Murcia, Region Guadalentin catchment[30]
Example:	Small scale farmers using Fanya juu terrace[31]	Eastern province Kenya

Source: own compilation by IINAS

It must be noted that no *conditionalities* (see Section 3.2) were defined here, as WOCAT was used as a “proxy” to determine SLM practices.

In principle, issues such as land-use changes and land tenure would need consideration in a “real” screening process.

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26 See http://africa-regreening.blogspot.de/

27 In Portugal, the main agroforestry system is a traditional system called Montado. It is characterized by low density trees combined with agriculture or pastoral activities. http://www.agforward.eu/index.php/en/montado-in-portugal.html

28 One of the most appreciated techniques by farmers in northern Burkina Faso was the plant-pit system (demi-lunes) or “Zai” in the local language. The technique originated in Mali in the Dogon area and was adopted and improved in northern Burkina Faso by farmers after the drought of the 1980s (http://www.worldbank.org/afr/ik/iknt80.htm).

29 See: http://www.ifpri.org/sites/default/files/publications/oc64ch07.pdf

30 See: http://www.desire-project.eu/index.php?option=com_content&task=view&id=16&Itemid=35

31 A *fanya juu* terrace is made by digging a trench and throwing the soil uphill to form an embankment. The purpose of the *fanya juu* is to reduce loss of soil and water, and thereby to improve conditions for plant growth. *Fanya juu* is applicable where soils are too shallow for level bench terracing and on moderately steep slopes (e.g. < 20%), they are not suitable for stony soils.

4.2 Systemic Indicator Approach for Forest Land

Forests and forestry became a global concern some decades ago due to high deforestation rates especially in the tropics, and several international and regional initiatives - both mandatory and voluntary - have been put in place, for example: processes on criteria and indicators for sustainable forest management (SFM)[32], FLEGT and REDD+.

At global level, the main concern with respect to forest land is deforestation. Broadly speaking, the main causes of deforestation worldwide are attributable to clearing of land for agriculture (Arnold et al. 2003; ESMAP 2011). A deeper analysis results in different regional drivers that can range from corporate cattle ranging and new (e.g. pulp & paper or palm oil) plantations to the collection of woodfuel (Behrendt, Megevand, Sander 2013) mainly around urban areas (Cushion, Whiteman, Dieterle 2010) and subsistence agriculture (Hosonuma et al. 2012). Worldwide, net deforestation is still high but shows a downward trend.

Sustainable management of forest land is also a concern, especially regarding biodiversity. Assuring multifunctionality within forest management is a key goal of SFM. It is expected that both the protected areas and plantations increase in the future (Bauhus, van der Meer, Kanninen 2010).

4.2.1 Sustainable Land Management in Forestry

The following section presents examples for SLM in forestry, based on country reports to the UN Forum on Forests (UNFF)[33] and SLM technologies according to WOCAT. This compilation is not meant to be exhaustive but to illustrate the approach[34].

Voluntary forest certification schemes have been key instruments to promote SFM. Third-party certification is intended to provide credible evidence of SFM (Gustafsson et al. 2012). There are different voluntary forest certification types covering a range of actors. Thus, some of them include particular provisions for smallholders. Schemes such as FSC and PEFC were developed at international level but offer regional adaptations (country or regional level).

Retention forestry is focused on enhancing the environmental features at the stand level. Retention forestry leaves a portion of the original stand unharvested in order to maintain the continuity of structural and compositional diversity and it is inspired on mimicking natural disturbance patterns and processes. Moreover, retention forestry is "*an approach to forest management based on the long-term retention of structures and organisms, such as live and dead trees and small areas of intact forests, at the time of harvest*" (Gustafsson et al. 2012). Retention forestry reflect similarities with agroforestry, being the most prominent that *both result in a tree cover which is intermediate between treeless vegetation and continuous forest* (Roberge et al. 2013).

As stated by Lindenmayer et al. (2012), the retention approach supports the integration of environmental, economic, and cultural values and is broadly applicable to tropical, temperate and boreal

[32] The UN Forum on Forests (UNFF, http://www.un.org/esa/forests/) and particularly the Non-Legally Binding Instrument on All Types of Forests approved in 2007 (UN GA 2008) established key goals for SFM, but implementation is lacking.

[33] http://www.un.org/esa/forests/

[34] A "social-oriented" practice could be participatory forest management (see http://www.fao.org/forestry/participatory/en/)

forests, adaptable to different management objectives, and appropriate in different societal settings. Therefore, since retention forestry is based on ecological processes, the practical application of this concept to various ecosystems is different (i.e. retention forestry should be targeted in different ways to e.g. selective logging in the tropics vs. clear cuttings in boreal ecosystems).

Afforestation and reforestation might be seen as SLU in forestry and might also apply to agricultural land. These projects also contribute to strengthen the social and financial capital of communities and to climate change adaptation by increasing the resilience of communities and the local environment through enhancing the natural capital of rural communities, recovering severely degraded lands, protecting water resources, and conserving biodiversity. *Afforestation* is, according to UNFCCC (2001), the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources. *Reforestation* refers to the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land.

Forest and landscape restoration turns barren or degraded areas of land into healthy, fertile, working landscapes that local communities and ecosystems can sustainably cohabit. This practice could qualify as a SI since it could generate positive (environmental, social and economic) benefits. Many organizations published restoration guidelines, e.g. for dryland forests (FAO 2013; IUCN 2011), and for degraded and secondary tropical forests ITTO (2002).

4.2.2 Forest Actor Groups and Regional Aspects

There are several categories of forest ownership as depicted in the FAO (2010): public; private; individuals, private business entities and institutions; local communities; indigenous/tribal communities and other kinds of ownership arrangements not covered by the categories above.

A key issue related to forest actors is the secure of tenure given the uncertainties in this respect all around the world. As recognized by FAO (2010), tenure security enables or provides incentives for people to invest time and resources in forest management. As for agriculture, it is assumed here - as a hypothesis - that implementing the VGGT can be an adequate safeguard.

As regards regional aspects, forest biomes can be used as a first-order proxy.

4.2.3 Examples for Systemic Indicators for Forestry Land Use

Based on the practices, actors and regions described in the previous subsections, the following

Table 4 shows an exemplary compilation of systemic indicators for forestry land use. Potential conditionalities to qualify as SI (safeguarding) are also included.

Table 4 Overview of Systemic Indicators for Sustainable Forestry Land Use

Land Use Practice	Actor	Region
Forestry under Voluntary Certification	Potentially All (with special requirements for small-scale users)	Mainly in temperate and boreal zones
Example:	FSC and PEFC (SFI in US)	North America and Europe, some in Sub-Saharan Africa, Asia and Australia
Retention Forestry*	Corporations, public owners	Temperate and boreal zones
Example:	Various Lindenmayer et al. (2012)	Various Lindenmayer et al. (2012)
Afforestation/Reforestation*	Potentially All	Potentially All
Example:	Various (see e.g. Biocarbon Fund 2011)	Various (see e.g. Biocarbon Fund 2011)
Forest Restoration*	Potentially All	Potentially All
Example:	Small scale foresters	Danube Region (Slovakia) (see: GEF, UNDP 2010)

*Source: own compilation by IINAS; *= with conditionalities for e.g. land use changes, and land tenure, see Section 3.2*

5 Possible Implementation of Systemic Indicators

The SI approach – beyond the conceptual stage – needs consideration with regard to its implementation, and ultimately its use, i.e. the practical application. The following sections provides some first respective thoughts.

After the expected adoption of the UN-OWG proposal for the SDGs by the UN General Assembly in September 2014, the discussions around *indicators for the SDG* will continue in parallel to the discussions and negotiations on the SDGs themselves.

This opens the window to implement the SI approach as part of the *indicator framework* for the SDGs on which discussions have started[35], focusing on the ongoing debate on how to deal with sustainable land use in the SDGs.

In this context, the SI concept should be introduced to and presented at respective platforms (i.e. GLTN and GLII, UN-SDSN) and also be presented and discussed with interested countries and stakeholders participating in the SDG and post-2015 development agenda process. Conferences such as the Global Soil Week and the World Bank Land and Poverty Conference in 2015 might be appropriate opportunities to raise interest[36].

Further discussion should be sought with UNCCD, FAO and UNEP as key stakeholders in the global discussions, and further elaboration of the SI concept with these agencies could be carried out during future joint workshops in which also civil society representatives should participate.

The "real" application of the SI approach would then take place when SDGs (once agreed upon) are i*mplemented on regional and national scales*. For this, participatory processes will be required to allow for adequate screening and agreement on safeguards (see Section 3).

Other opportunities can be seen in the EU process to come up with a "land communication" by the EC, and in the ongoing discussions and procedures around national sustainability and resource efficiency plans in which land plays a major role.

Furthermore, the "safeguarding" approach for sustainable land use in existing UN schemes – especially the UNCBD, UNCCD, and UNFCCC – could make use of the SI concept, e.g. in regionalized REDD+ schemes, or the ongoing discussions about legal instruments under the UNCCD.

A final possibility may arise with the implementation of the VGGTs which requires inclusive processes on the national level and also needs monitoring[37].

All this possible activities are meant to increase credibility and "endorsement" of the SI approach. Without that, implementation will remain speculative, at best.

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[35] See e.g. UN-SDSN (2014d); UN-SDSN, UNSD (2014); UNSD (2014).

[36] Initial presentations of the SI concept were made already at the 2013 GSW and the 2014 World Bank conference.

[37] See FIAN (2012) for a brief discussion.

6 Discussion and Further Work

The concept of Systemic Indicators which defines "sustainable land use practices" of key actors in specific socio-economic and regional settings *seems possible* to be implemented, although it still lacks detailing and overall "proof" - the cases presented here are just that: examples.

Given the preliminary state of work, the following issues need further reflection:

- The various land use practices need to reflect not only the socio-economic setting, but also have to address the fundamental issue of *land tenure*. As the VGGT[38] are not (yet) operational in the real world, this promising approach cannot provide evidence of being applicable to the examples discussed here[39]. Thus, it is still a *working hypothesis* that implementing the VGGT would be an appropriate element of the sustainable land use practices.
- The examples for agriculture and forestry given in Section 4 are still rudimentary, as resources for data collection and screening were quite limited, and work on the examples was meant to substantiate that the overall approach is *feasible*. Still, more evidence could be collected through further examples in specific socio-economic and regional settings to broaden the knowledge base. This should be performed in *collaboration with partners* in the respective regions to allow for an inclusive discussion of the approach, and findings.

Furthermore, the examples for agriculture and forestry represent more than 90% of global land use, but as *future* pressures from e.g. urbanization and infrastructure development will significantly impact on agricultural and forest land uses (Fritsche, Eppler 2013), it would be worthwhile to extend the examples to the area of "sustainable cities".

[38] i.e. the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security, see CFS (2012)

[39] For the ongoing "field testing" of VGGT implementation through donor activities see http://landgov.donorplatform.org/

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Annex

A1 Overview on processes framing sustainable development with a direct linkage to land

SDGs as proposed by the UN OWG

Directly linked to land
Goal 1 End poverty in all its forms everywhere
Goal 2 End hunger, achieve food security and improved nutrition, and promote sustainable agriculture
Goal 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
Indirectly linked to land
Goal 6: Ensure availability and sustainable management of water and sanitation for all
Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 12: Ensure sustainable consumption and production pattern
Goal 13: Take urgent action to combat climate change and its impacts

SDSN

Goal 6 Improve Agricultural Systems and raise Rural Prosperity
50. Crop yield gap (actual yield as % of attainable yield) 51. Crop nitrogen use efficiency (%) 53. Global Food Loss Indicator 54. Annual change in forest area and land under cultivation (modified MDG Indicator) 55. Annual change in degraded or desertified arable land (% or ha) 56. Losses from disasters in rural areas, by climate and non-climate-related events 63. Number of agriculture extension workers per 1000 farmers [or share of farmers covered by agricultural extension programs and services]
Goal 9 Secure Biodiversity & Ensure good Management of Water, Oceans, Forest and Natural Resources
81. Red List Index (by country and major species group) 82. Protected areas overlay with biodiversity (national level) 86. Area of forest under sustainable forest management as a percentage of forest area 88. Publication of all payments made to governments under resource contracts

CCD

Strategic objective 2: To improve the condition of ecosystems –
Core indicator S-4: Reduction in the total area affected by DLDD
VI Degree of land degradation
V Capacity of soils to sustain agropastoral use
II Change in land use
Strategic objective 3: To generate global benefits through effective implementation of the CCD
Core indicator S-7: Areas of forest, agricultural & aquaculture ecosystems under sustainable management
XI Land under SLM

CBD Aichi Targets

Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.
Operational indicator: Trends in area of forest, agricultural and aquaculture ecosystems under sustainable management (B)*
Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity
Operational indicators: Trends in population of forest and agriculture dependent species in production systems (B)* Trends in production per input (B)* Trends in proportion of products derived from sustainable sources (C)*
Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.
Operational indicator: Trends in genetic diversity of cultivated plants, and farmed and domesticated animals and their wild relatives (B)* (decision VII/30 and VIII/15)
Target 14 - By 2020, ecosystems that provide essential services, including services related to water, (…), are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.
Operational indicator: Trends in proportion of total freshwater resources used (A)* (MDG indicator 7.5) Trends in proportion of the population using improved water services (A)* (MDG indicator 7.8 and 7.9)
Target 15 - By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, (…)
Headline indicator: Trends in distribution, condition and sustainability of ecosystem services for equitable human well-being

**Indicators (A) ready for use at the global level; Indicators (B) could be used at the global level but needs further development; Indicators (C) are for use at the national or other sub-global level*

A2 WOCAT Knowledge Base for Major Land Use Systems

WOCAT provides a global open-access database system on SLM Practices with direct application to knowledge of soil and water conservation. The database system consists of SLM Technologies and Approaches as well as of mapping data (see Annex for more information).

Table 5 Description of SLM Technologies and SLM Approaches

SLM Technology	SLM Approach
These are the physical practices in the field that control land degradation and enhance productivity in the field. They are: • agronomic (e.g. intercropping, contour cultivation, mulching), • vegetative (e.g. tree planting, hedge barriers, grass strips), • structural (e.g. graded banks or bunds, level bench terrace), • management measures (e.g. land use change, area closure, rotational grazing). Combinations of above measures which are complementary and thus enhance each other are part of a Technology.	The associated SLM approaches are the ways and means of support that help to introduce, implement, adapt, and promote those technologies on the ground. An SLM approach involves: • All participants (policy-makers, administrators, experts, technicians, land users, i.e. actors at all levels); • Inputs and means (financial, material, legislative, etc.); and • Know-how (technical, scientific, practical).

Source: Schwilch et al. (2012)

The WOCAT methods and tools have been used in more than 50 countries to document more than 470 SLM technologies and 235 SLM approaches[40]. This has resulted in high quality publications developed together with key UNCCD partners on SLM best practices in different regions of the world[41].

The WOCAT SLM technologies cover major land use systems (including cropland, grazing land, forest and mixed land); represent degradation types and agro-ecological zones; cover a broad variety of technologies; have potential for upscaling, in terms of both production and conservation; capture local innovation and recent developments as well as long-term project experience and strike a balance between prevention, mitigation and rehabilitation of land degradation.

Within the WOCAT database each SLM technology is defined, described (spread, principals, types, economics and applicability) and assessed by its impacts.

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[40] A SLM Approach defines ways and means used to promote and implement a SLM Technology (project/program initiated, indigenous system, local initiative/innovation) and to support it in achieving better and more widespread SLM (Liniger et al. 2011).

[41] Including Sub-Saharan Africa and the Himalayan Region, as well as in countries such as Bangladesh, China, Ethiopia, Mongolia, Nepal, Senegal, South Africa, Tajikistan and Tunisia.

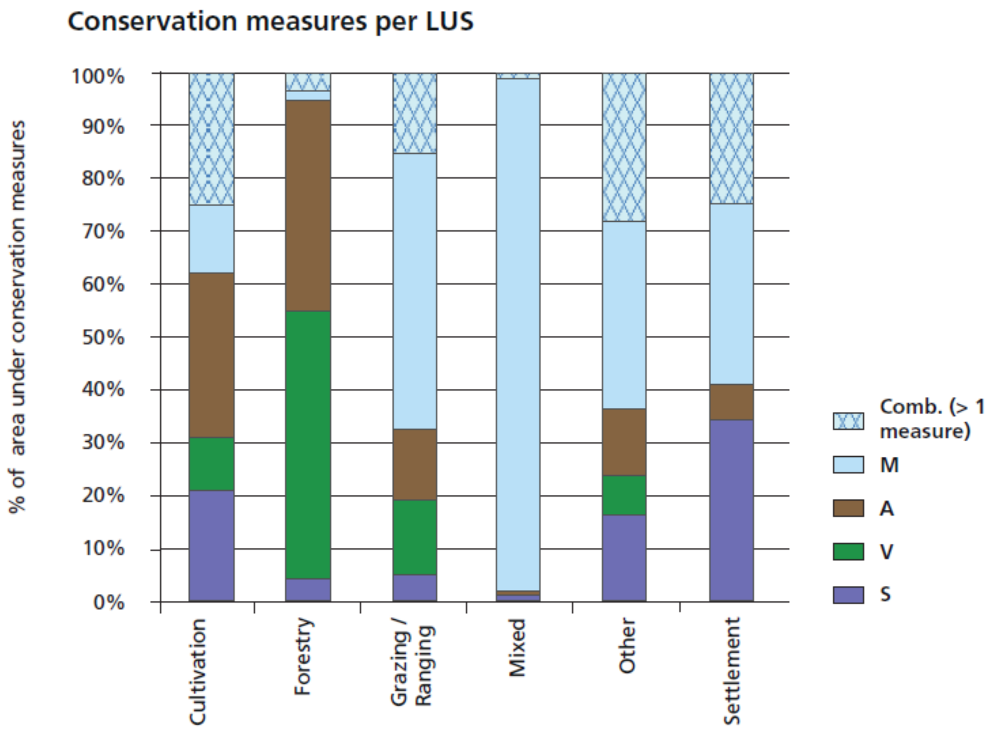
This assessment should be seen as a *preliminary proxy* for the required screening (see Section 3.1), to illustrate the concept of the SI.

A3 WOCAT SLM Technology Database

The WOCAT framework distinguishes four categories of conservation measures: I Agronomic (e.g. mulching), II Vegetative (e.g. contour grass strips), III Structural (e.g. check dams) and IV Management (e.g. resting of land).

A conservation measure is a component of an SLM technology, which may consist of a combination of several conservation measures. For instance, a terracing system is a SLM technology which typically comprises structural measures – the terrace riser, bed and a drainage ditch – often combined with other conservation measures, such as grass on the risers for stabilization and fodder (a vegetative measure), or contour ploughing (an agronomic measure). The categories of conservation measures applied vary between the major land use types (Figure 3). In cultivated land, all categories are found, but in forest, agronomic and vegetative measures dominate. Management measures are most applied in mixed land use and grazing land. Combinations of conservation measures occur in all land use types, and take up the largest absolute area in cultivated land. Structural measures are relatively most applied in settlements, since this type of measure is most suitable to control the large runoff volumes generated in built-up area.

Figure 4 Relative distribution of categories of conservation measures in major land use types (LUS)



Source: DESIRE-WOCAT (2012); M: management, A: agronomic, V: vegetative, S: structural measures

Table 6 Overview of the WOCAT SLM Technology Database

WOCAT SLM technology data base – search by:		
Country	Soil fertility	Rainfall
Conservation measures: Agronomic, vegetative, structural, management	**Market orientation:** subsistence, mixed, commercial	**Land ownership:** state, company, communal village, group, individual
Climatic regime: humid, subhumid, semi-arid, arid, and/or from: tropical, subtropical, temperate, boreal, polar/ arctic	**Land use types:** cropland, grazing land, forest/ woodland, mixed land, other land (e.g. settlements)	**Land use rights:** open access (unorganized), communal (organized), leased, individual
Slope:	**Area by households:** < 0.5; 0.5-1; 1-2; etc.	Costs

Source: IINAS compilation

Through its search facilities, the WOCAT database can be used to find strategies that could be suitable in a certain location, based on its similarity in human environmental characteristics to other locations described in the WOCAT database.

Although in many cases, any potentially suitable strategies would have to be adapted to local circumstances, this database does allow the introduction of new strategies, based on tried and tested experiences in other places.

Finally, WOCAT methods provide a way to compare information between different sites because the same standardized methods are used across all sites.