Talking about.

Annotated Glossary on Combating Desertification and Sustainable Land Management

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CCD Project
Convention Project to
Combat Desertification

BMZ
On behalf of
Federal Ministry
for Economic Cooperation
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Preface

In the past decades, debates on agriculture, land use and management of natural resources have coined a wealth of new terms. In many cases, these are in full vogue for just a period, replace older ones or are used for political reasons. Meanwhile, there are so many terms that it is difficult to keep track and distinguish them from each other.

This annotated glossary offers a unitary and coherent use of key notions from the BMZ (Federal Ministry for Economic Cooperation and Development) and implementing agencies and works towards a universal agreement on their use with partners and agents. Its aim is to distinguish terms in the field of combating desertification and sustainable land management from each other, to reveal cohesions and hierarchies between them and trace their development. The glossary in German and English language contains a selection of the most commonly used terms while raising no claim to completeness. If necessary, it can always be supplemented with further items.

For most terms, there are several definitions, often differing only slightly. The differences frequently originate in the interests and priorities of institutions and organisations. For this reason, even common definitions are adjusted to new conditions and challenges from time to time. In most cases, the authors selected more than one definition, concentrating on universally recognised definitions by leading institutions and those stressing different aspects of a term. For every definition, the source and, when possible, a hyperlink, are provided allowing citation, verification and further reading. Please bear in mind that due to occasional updating of websites, it is possible that some links will no longer be active when the glossary has been published and distributed.

1. Land Degradation

The term **[land degradation]** is often used synonymously with desertification although land degradation occurs wherever land is not used sustainably – not only in arid, semi-arid and dry sub-humid regions but also in humid and cold climates (see Figure 1). 'The interchangeable usage of "desertification" and "land degradation" may be misleading, since "land degradation" can be either perceived as "desertification", i.e. in drylands, or as a similar phenomenon or process in non-drylands.' (DSD, 2009a, p. 162)

A brief definition is given by the **International Soil Conservation Organisation (ISCO)** or the **Centre for Development and Environment (CDE)** of the University of Bern and in the **IAASTD** Glossary:

> **[Land degradation]** is the reduction in the capability of the land to produce benefits from a particular land use under a specific form of land management.
> *Source: Douglas, 1994; Hurni et al., 1996; IAASTD, 2009*

FAO's Land Degradation Assessment in Drylands (LADA) team has adopted the following definition:

> **[Land degradation]** is the reduction in the capacity of the land to perform ecosystem functions and services that support society and development.
> *Source: FAO, 2007*

The definition of the **United Nations Convention to Combat Desertification (UNCCD)** is broader and takes into account reduced biological and economic benefits:

> **[Land degradation]** means reduction of or loss in the biological or economic productivity and complexity of rain-fed cropland, irrigated cropland, range, pasture, forest, or woodlands resulting from land uses or from processes arising from human activities and habitation patterns, such as:
> – soil erosion caused by wind and/or water;
> – deterioration of the physical, chemical and biological or economic properties of soil; and
> – long-term loss of natural vegetation.
> *Source: UNCCD, 1994*

The **Global Environment Facility (GEF)** defines land degradation similarly, but adds the aspect of resilience:

> **[Land degradation]** is any form of deterioration of the natural potential of land that affects ecosystem integrity either in terms of reducing its sustainable ecological productivity or in terms of its native biological richness and maintenance of resilience.
> *Source: GEF, 1999*

A definition taking more account of the human-induced causes of land degradation is given by **Houghton and Charman:**

> **[Land degradation]** encompasses soil degradation and the deterioration of natural landscapes and vegetation. Human-induced degradation includes the adverse effects of overgrazing, excessive tillage, over-clearing, erosion and sediment deposition, extractive industries, urbanization, disposal of industrial wastes, road construction, decline of plant communities, the effects of animals and noxious plants, and pollution of the air with its effect on land.
> *Source: Houghton and Charman, 1986*

None of the definitions mention the impact of climate change on land degradation and desertification, i.e. the trend towards extreme weather situations such as frequent drought or excessive rain.

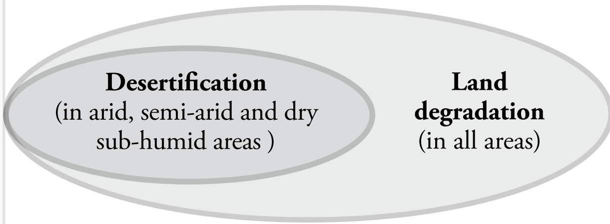

Figure 1: Systematic presentation of the relation between desertification and land degradation

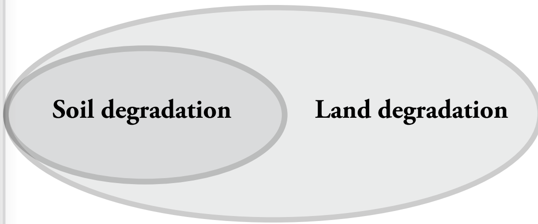

Figure 2: Systematic presentation of relations between land and soil degradation

2. Soil Degradation

Land degradation and **[soil degradation]** are often used synonymously, even though soil degradation is a more restricted term, focusing on soil quality/fertility or soil productivity (see Figure 2).

The most common definition of soil degradation is given by **FAO:**

> **[Soil degradation]** is a process which lowers the current and/or the potential capability of the soil to produce goods or services. Six specific processes contribute to soil degradation: water erosion, wind erosion, waterlogging and excess salt, chemical degradation, physical degradation, and biological degradation.
> *Source: FAO, 1979*

The FAO definition is also used by **ISCO** and **WOCAT (World Overview of Conservation Approaches and Technologies)**

> **[Soil degradation]** means a significant deterioration in the physical, chemical, and biological properties of the soil. Causes of soil degradation are bio-physical and socio-economic and frequently one problem causes the other.
> *Source: GTZ, 1996*

The **Global Assessment of Human Induced Soil Degradation (GLASOD)** identifies different types of soil degradation:

> Two categories of human-induced soil degradation processes were recognized. The first category deals with **[soil degradation]** by displacement of soil material. The two major types of soil degradation in this category are water erosion and wind erosion. […] The second category of soil degradation deals with internal soil physical and chemical deterioration. In this category only on-site effects are recognized of soil that has been abandoned or is forced into less intensive usages. […] A total of 12 soil degradation types are recognized on the map. They are grouped into four main types: water erosion (2 types); wind erosion (3 types); chemical deterioration (4 types); and physical deterioration (3 types).
> *Source: Oldeman et al., 1991*

The **European Commission** stresses in its definition the human activities leading to soil degradation through processes like compaction or salinisation:

> **[Soil degradation]**: Negative process often accelerated by human activities (improper soil use and cultivation practices, building areas) that leads to deterioration of soil properties and functions or destruction of soil as a whole, e.g. compaction, erosion, salinisation.
> *Source: European Commission – Joint Research Centre, 2011*

3. Drylands

Following the **World Atlas of Desertification**, four different categories of **[drylands]** can be defined according to the aridity index, calculated as the ratio of mean annual precipitation (P) to mean annual potential evapotranspiration (PET). The definition according to the aridity index is also used by the **Millennium Ecosystem Assessment**:

> More than 6.1 billion ha, 47.2% of the Earth's land surface, is **[dryland]**. Nearly 1 billion ha of this land are naturally hyperarid deserts, with very low biological productivity. The remaining 5.1 billion ha are made up of arid, semi-arid and dry sub-humid areas.
>
> – dry sub-humid areas (0.50 P/PET < 0.65) have highly seasonal rainfall regimes with less than 25% interannual rainfall variability and agriculture is widely practiced.
> – semi-arid areas (0.20 P/PET < 0.50) have distinctly highly seasonal rainfall regimes and mean annual values up to 800 mm in summer and 500 mm in winter regimes. Interannual variability is nonetheless high (25-50%) so despite the apparent suitability for grazing of semi-arid drylands, this and sedentary agricultural activities are susceptible to seasonal and interannual moisture deficiency.
> – arid areas (0.05 P/PET < 0.20) have mean annual precipitation values up to approximately 200 mm and interannual variability in the 50-100% range. Pastoralism is possible but without mobility or the use of groundwater resources it is highly susceptible to climatic variability.
> – hyperarid environments (P/PET < 0.5) have highly variable rainfall both interannually (up to 100%) and on a monthly basis such that there is no seasonal rainfall regime. [...] These areas are true deserts and as such offer very limited opportunities for human activities.
>
> Arid, semi-arid and dry sub-humid climatic zones are collectively referred to as the susceptible drylands. Hyperarid zones, the true deserts, are not considered to be prone to desertification because of their naturally very low biological productivity.
>
> *Source: Middleton and Thomas, 1997*

The **UNCCD** covers arid, semi-arid and dry sub-humid areas. Hyperarid drylands are not regarded by the UNCCD as at risk of being further desertified, and hence are not covered. Together, the UNCCD dryland zones cover approximately 34.9 % of the Earth's terrestrial surface (UNEP-WCMC, 2007).

> Desertification means land degradation in arid, semi-arid and dry sub-humid areas. [...] Arid, semi-arid and dry sub-humid areas means areas, other than polar and sub-polar regions, in which the ratio of annual precipitation to potential evapotranspiration falls within the range from 0.05 to 0.65;
>
> *Source: UNCCD, 1994*

The **Convention on Biological Diversity (CBD)** delineation of drylands used within its Programme of Work on Dry and Sub-humid Lands differs from the UNCCD's scope in two ways:

> 1. It also includes hyperarid zones [...]
> 2. Major vegetation types are used to define **[dryland]** areas in addition to those defined based on the bioclimatic criterion (P/PET ratio) (UNEP/CBD/SBSTTA/5/9). Hence, the CBD PoW does not only apply to the biological diversity of drylands senso stricto, but also includes Mediterranean, grassland and savannah ecosystems (Decision V/23). These ecosystem types are present in some areas with P/PET ratio ≥ 0.65, including humid and cold areas.
>
> *Source: UNEP-WCMC, 2007*

Drylands are defined by the **Millennium Ecosystem Assessment** as:

> **[Drylands]** are characterized by scarcity of water, which constrains their two major interlinked services – primary production and nutrient cycling. Over the long term, natural moisture inputs (that is, precipitation) are counterbalanced by moisture losses through evaporation from surfaces and transpiration by plants (evapotranspiration). This potential water deficit affects both natural and managed ecosystems, which constrains the production of crops, forage, and other plants and has great impacts on livestock and humans.
>
> *Source: Millennium Ecosystem Assessment, 2005b*

This definition is also used by **FAO** and its **LADA** Project (FAO, 2005).

4. Desertification

The **UNCCD** and other **UN organisations** define desertification briefly as:

[Desertification]: Land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities

Source: UNCCD, 1994

The **UN Environment Glossary** defines the causal factors more precisely:

[Desertification]: Land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations (drought) and human activities (overexploitation of drylands).

Source: United Nations Statistics Division, 2010

The UNCCD definition is also used in the **IAASTD** glossary.

Source: IAASTD, 2009

A definition with more emphasis on the causal factors can be found in the **Millennium Ecosystem Assessment**:

[Desertification] is caused by a combination of factors that change over time and vary by location. These include indirect factors such as population pressure, socioeconomic and policy factors, and international trade as well as direct factors such as land-use patterns and practices and climate-related processes. Desertification is taking place due to indirect factors driving unsustainable use of scarce natural resources by local land users. This situation may be further exacerbated by global climate change.

Source: Millennium Ecosystem Assessment, 2005a

The first working group of the **Dryland Science for Development Consortium (DSD)** on behalf of the UNCCD Committee on Science and Technology (CST), seeking to remedy the lack of clarity in the UNCCD Convention text regarding the relationship between land degradation and desertification, proposes the following definition:

[Desertification] is an end state of the process of land degradation; this process is expressed by a persistent reduction or loss of biological and economic productivity of lands that are under uses by people. The livelihood of many of these people at least partly depends on this productivity, yet the reduction or loss of productivity is driven by its use. Land degradation and desertification merit attention in all lands, with special concern directed to all dry lands namely those of climate yielding an aridity index of ≤ 0,65, whether based on 1950 – 1980 prevailing climate, and/or on recent climate data.

Source: DSD, 2009a

Furthermore, the second working group of the **DSD** gives a detailed definition of desertification which takes into account its insidious nature:

[Desertification] denotes land degradation specifically in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climatic variations and human activities (UNCCD, 2009). In the initial stages of desertification, slow variables are often responsible for the creeping nature of degradation. This explains why the process is often overlooked. Also, the key variables that define various states of equilibrium in drylands have variable thresholds for different soils and their soilscapes. This is in contrast to the concept of one maximum productivity state, which is often taken as a reference to determine the intensity of land degradation. Reynolds et al. (2007a) also pointed out that “desertification is the emergent outcome of a suite of social and biophysical causal factors, with pathways of change that are specific in time and place.”

Source: DSD, 2009b

5. Combating Desertification

The **UNCCD** defines this term as:

> **[Combating desertification]** includes activities which are part of the integrated development of land in arid, semi-arid and dry sub-humid areas for sustainable development which are aimed at:
>
> – prevention and/or reduction of land degradation;
>
> – rehabilitation of partly degraded land; and
>
> – reclamation of desertified land
>
> *Source: UNCCD, 1994, Article 1 (b)*

The first **DSD** working group gives a detailed explanation of the activities cited in Article 1 (b) of the UNCCD:

> **[Combating desertification]**, which is the most severe state of land degradation should best be avoided by preventing even the first signs of land degradation, that if it is let to initiate, would lead to desertification; if this first directive has not been followed and hence the land is already partly degraded though not yet desertified, rehabilitation efforts are in place; finally, the worst case scenario is that rehabilitation of partly degraded land has not been implemented, hence the degradation proceeded unchecked and reached the desertification state; then reclamation, which requires much greater investment than rehabilitation, is the only option.
>
> *Source: DSD, 2009a*

> **[Combating desertification]** means addressing all stages and states of land degradation, including those that precede the level of productivity loss specific to desertification, the one for which reclamation, rather than rehabilitation measures are required for restoring the persistently lost productivity of the land.
>
> *Source: DSD, 2009a*

Combating desertification requires not only technical solutions, but measures on all levels, from the field level to the national level. National governments need to create supporting framework conditions including secure land-use rights, land tenure and rural development. Consequently, the **German Federal Ministry for Economic Cooperation and Development (BMZ)** describes combating desertification as:

> Therefore, **[combating desertification]** effectively means acting to support the affected population groups in various areas of their lives. This represents a major challenge for development cooperation. It is not only a matter of promoting isolated projects that generate solutions in isolated sectors, such as resource-saving technologies. It is much more than this: development cooperation is called upon to
>
> – ensure that appropriate political consultation takes place in the affected countries to help make combating desertification a cross-sectoral objective and encourage the relevant political institutions to engage in networking to coordinate their activities;
>
> – integrate the goals and requirements of the UNCCD into broad-based development cooperation programmes, aimed for example at poverty eradication, rural development or structural policy (governance).
>
> *Source: BMZ, 2008*

The **UNCCD** places combating desertification in the context of sustainable development:

> **[Combating desertification]** is essential to ensuring the long-term productivity of inhabited drylands. Desertification can be reversed only if far-reaching changes are made in local and international behaviour. Step by step, these changes will ultimately lead to sustainable land use and food security for a growing world population. Combating desertification, then, is really just part of a much broader objective: the sustainable development of countries affected by drought and desertification.
>
> *Source: UNCCD, 1994*

6. Marginal Lands

In the literature, **[marginal land]** is generally defined as land of low productivity, not appropriate for farming. Marginal land is often used synonymously with fragile land: land that is sensitive to land degradation, as a result of inappropriate human intervention.

FAO defines marginal land as:

> **[Marginal land]**: Land having limitations which in aggregate are severe for sustained application of a given use. Increased inputs to maintain productivity or benefits will be only marginally justified. Limited options for diversification without the use of inputs. With inappropriate management, risks of irreversible degradation.
> *Source: FAO, 2011*

In another context, **FAO** stresses the efforts of bringing this land back into production:

> **[Marginal land]**: Land which is not suitable, economical or productive in most circumstances for a generalized type of land use (agriculture, forestry, intensive grazing) due to the presence of climatic, soil-associated or geographic constraints. Such land requires extensive remedial action of one or more biophysical constraints to make its general productive use possible and protect it from degradation. It is to be brought under arable farming only as a last resort.
> *Source: FAO*

The **Consultative Group on International Agricultural Research (CGIAR)** provides a detailed definition of marginal lands and marginality:

> **[Marginal agricultural lands]** are characterized by: poor soil fertility (nutrient deficiencies, acidity, salinity, poor moisture holding capacity, etc.), inaccessibility (poor communications, immobility with all its social and economic implications); fragility (low input absorptive capacity, high input-output ratios, limited capacity to withstand disturbance, vulnerable to irreversible damage); and heterogeneity (physically and culturally diverse with site-specific constraints and opportunities which restrict applicability of general technological or institutional measures to remove constraints or exploit opportunities). Aside from the above inherent characteristics, marginal low-productivity lands may also result from degradation of non-marginal lands or inappropriate development of lands formerly at low or zero use levels.
> *Source: CGIAR, 2000*

Further explanation of marginality and marginal lands, especially the focus on its economic dimension and the fact that marginality is not definite but can be reversed, is needed to understand the character of marginal lands:

> As **[Marginality]** does not just have an ecological but also an economic dimension, marginal land can be converted into productive land under certain conditions: Marginality can be the result of different combinations of constraints. For instance, biophysically good land can be marginal on account of its isolation from markets, the unavailability of inputs, or the small size of holdings. The nature, composition and interaction of the factors which determine land marginality differ widely.
>
> **[Marginal lands]** are defined in biophysical terms which establish them as: having low inherent productivity for agriculture; fragile and therefore susceptible to degradation because of slope and/or climate; and subject to high agricultural risk due to climate and disease. Marginal lands support a high proportion of the rural poor, particularly the poorest of the poor; the combination of fragility and high density of poor people who place a premium on current consumption (resulting in over-exploitation of natural resources) is leading to accelerated erosion and vegetation destruction; the consequence is a downward poverty spiral with significant negative externalities because of the large areas classified as marginal relative to those considered favoured.
>
> Land can be marginal depending on:
>
> – its use (what is marginal agricultural land may be highly productive forest land);
> – its natural biophysical characteristics (which can be altered by investment);
> – its location relative to infrastructure such as roads, railroads, harbours, and cities (a road into a region can completely alter the economic returns from land near the road);
> – the institutional and policy context which influences access of inhabitants to land, water, credit, markets, outside inputs (development of market access can completely alter the economics of land use);

– population pressure (e.g., size of land holdings; from a cattle rancher's perspective, his or her large area of land is not marginal, even though the biophysical yield per ha is low; at the same time, a farmer with only one ha. in the midst of the most favoured agricultural area may feel that he or she is on marginal land);
– technology development (Jojoba development in arid environments; acid tolerant rice in the Cerrados of Brazil);
– taking advantage of niche opportunities (spices, flowers, vegetables, special fibres).

Lands move out of and into marginal status depending on which of the above dimensions are applied in the definition. It only makes sense to define marginal land in terms of a clearly defined, specific situation.
Source: CGIAR, 2000

Marginal lands have gained a new meaning in the present debate on the production of biomass for biofuel. Some argue that the use of marginal land can help prevent competition between food production and biomass production. But land that is marginal for agriculture often hosts rich biodiversity. Using it for biomass production may threaten this biodiversity.

This aspect was discussed by an international working group meeting in a workshop following the 9th session of the Conference of the Parties (COP) to the **CBD** and the **FAO** High-Level Conference, 2008. The group stressed the economic dimensions of marginal land, using the following definition:

[Marginal land] is defined as an area where a cost-effective production is not possible, under given side conditions (e.g., soil productivity), cultivation techniques, agriculture policies as well as macro-economic and legal conditions (Schroers, 2006). Evidently, the term marginal land is an economic approach which does not factor in subsistence agriculture. Hence, marginal land might supply food, feed, medical plants, fertilizer or fuel to local people, but not through a structured, market-based approach. Further, land classified as marginal is often subject to tenure issues where disputes arise on rights of those who use these areas. Marginal land is an economic term.
Source: UNEP, 2008

The great ecological risk of the production and use of biofuels was also discussed by an international conference on biofuels. Governments should take action to prevent the use of ecologically valuable lands for the production of biomass for biofuel (GTZ, 2006).

7. Land Use and Land Use Planning

A common definition of land use adopted by **WOCAT** is:

Human activities which are directly related to the land, making use of its resources, or having an impact upon it. Technically a series of activities carried out anywhere in the world for the purpose of producing goods or benefits. A given **[land use]** may take place on one, or more than one, piece of land, and several land uses may occur on the same piece of land. (de Bie et al., 1996). It is thus based upon function, the purpose for which the land is being used.
Source: WOCAT, 2011

FAO proposes the following definition:

[Land use] is characterized by the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it.
Source: FAO, 1999

However, the LADA project and other authors criticise that land use is not clearly defined and that there is little concerted effort to come to an internationally acceptable system.

Specific **[land use]** often corresponds to a single land cover, e.g. pastoralism to unimproved grassland. However, a given land cover class may support several distinct land uses (e.g. a forest may be used simultaneously for timbering, slash-and-burn agriculture, hunting/gathering, fuelwood collection, recreation, wildlife preserve, and watershed and soil protection). The relationship between land cover1 and land use is therefore complex.
Source: George and Nachtergaele, 2002

1 Land cover is the observed (bio)physical cover on the earth's surface (general definition also used by FAO)

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uses the term **[land use]** to refer to the continuously changing human uses of and claims upon soils and land areas. Competition among different forms of use, claims and users is mounting rapidly. Several people or groups can hold different, yet not necessarily mutually exclusive, entitlements to the same piece of land (e.g. for arable farming, collection of firewood, animal feed). In reality, the land-use interests and rights of marginal groups, such as indigenous peoples or nomadic groups, are often ignored.

Source: GTZ, 2010a und b

Accordingly, **GIZ** defines land use planning as follows:

[Land use planning] […] is an iterative process based on the dialogue amongst all stakeholders aiming to define sustainable land uses in rural areas. It also implies the initiation and monitoring of measures to realise the agreed land uses.

Source: GIZ, 2011

Sustainable Land Management (SLM)

8. Sustainable Land Management (SLM)

[Sustainable land management] aims at protecting land – be it used for agriculture, as pasture or forest – from any kind of degradation including desertification. Numerous and diverse definitions of sustainable land management have been proposed. A selection of these is presented in the following.

A concise definition, widely used, is given by **ISCO** and also included in the **IAASTD** glossary:

[Sustainable land management] (SLM) is a system of technologies and/or planning that aims to integrate ecological with socio-economic and political principles in the management of land for agricultural and other purposes to achieve intra- and intergenerational equity.

Source: Hurni et al., 1996; IAASTD, 2009

WOCAT defines SLM similarly but stresses the use for production of goods and the environmental functions (ecosystem services) of land. This definition was adopted at the **UN Earth Summit** (1992).

[Sustainable land management] (SLM) is the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long term productive potential of these resources and ensuring their environmental functions.

Source: WOCAT, 2007; FAO, 2009b

Herweg et al. complement the definitions of ISCO and WOCAT with the aspect of sustainable development and poverty alleviation. They regard SLM as the foundation of sustainable agriculture. The United Nations Development Programme (UNDP) shares this view:

[Sustainable land management] (SLM) is the foundation of sustainable agriculture and a strategic component of sustainable development and poverty alleviation. […] SLM seeks to harmonise the often conflicting objectives of intensified economic and social development, while maintaining and enhancing the ecological and global life support functions of land resources. […] In fact, practising SLM principles is one of the few options for land users to generate income without destroying the quality of the land as a basis of production.

Source: Herweg et al., 1998; UNDP, 2009

The **World Bank** defines SLM very briefly as:

[Sustainable land management] (SLM) is a knowledge-based procedure that helps integrate land, water, biodiversity, and environmental management (including input and output externalities) to meet rising food and fibre demands while sustaining ecosystem services and livelihoods.

Source: The World Bank, 2006

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH uses a similar definition supplemented by major aspects of sustainable development:

> **[Sustainable land management]** means the management of land as a resource and factor of production, addressing both its economic and ecological importance. It seeks to establish forms of land use which ensure that the soil, water and vegetation continue to sufficiently underpin production systems based on use of the land, for present and future generations.

Land use planning is a key instrument of sustainable land management.

TerrAfrica has defined SLM in brief and at length in a number of papers. The short version resembles the definitions given by the World Bank and ISCO:

> **[Sustainable land management]**: The adoption of land use systems that, through appropriate management practices, enables land users to maximize the economic and social benefits from the land while maintaining or enhancing the ecological support functions of the land resources.
>
> *Source: TerrAfrica, 2005*

In another definition, **TerrAfrica** goes beyond land use as such and stresses the combination of frame conditions like policies and technologies required for a change of land uses:

> **[Sustainable land management]** combines technologies, policies, and activities aimed at integrating socio-economic principles with environmental concerns so as to simultaneously maintain or enhance production, reduce the level of production risk, protect the potential of natural resources and prevent (buffer against) soil and water degradation, be economically viable, and be socially acceptable.
>
> *Source: Smyth and Dumanski, 1993, cited in TerrAfrica, 2005*

TerrAfrica also suggests a useful list of interdisciplinary aspects that need to be understood when engaging in SLM:

> **[Sustainable land management]** encompasses or contributes to other established approaches such as sustainable agriculture and rural development, integrated natural resources management, and ecosystem management […] and involves a holistic approach to achieving productive and healthy ecosystems by integrating social, economic, physical and biological needs and values. Thus it requires an understanding of:
>
> – the natural resource characteristics of individual ecosystems and ecosystem processes (climate, soils, water, plants and animals);
>
> – the socio-economic and cultural characteristics of those who live in, and/or depend on the natural resources of, individual ecosystems (population, household composition, cultural beliefs, livelihood strategies, income, education levels etc);
>
> – the environmental functions and services provided by healthy ecosystems (watershed protection, maintenance of soil fertility, carbon sequestration, micro-climate amelioration, biodiversity preservation etc); and
>
> – the opportunities for the sustainable utilisation of an ecosystem's natural resources to meet peoples' welfare and economic needs (e.g. for food, water, fuel, shelter, medicine, income, recreation).
>
> *Source: TerrAfrica, 2008*
>
> It is added that harmonizing the conflicting objectives of production and environment is an important aspect of SLM: **[Sustainable land management]** is considered an imperative for sustainable development and plays a key role in harmonizing the complementary, yet historically conflicting goals of production and environment. Thus one of the most important aspects of sustainable land management is this critical merger of agriculture and environment through twin objectives: i) maintaining long term productivity of the ecosystem functions (land, water, biodiversity) and ii) increasing productivity (quality, quantity and diversity) of goods and services, and particularly safe and healthy food. To operationalize the sustained combination of these twin objectives, sustainable land management must also take into account issues of current and emerging risks.
>
> *Source: TerrAfrica, 2008*
>
> **[Sustainable land management]** recognizes that people (the human resources) and the natural resources on which they depend, directly or indirectly, are inextricably linked. Rather than treating each in isolation, all ecosystem elements are considered together, in order to obtain multiple ecological and socio-economic benefits.
>
> *Source: TerrAfrica, 2008*

FAO adds in its definition approaches (common principles) required for assuring SLM:

[**Sustainable land management**] (SLM) is crucial to minimizing land degradation, rehabilitating degraded areas and ensuring the optimal use of land resources for the benefit of present and future generations. SLM is based on four common principles:

– land-user-driven and participatory approaches;
– integrated use of natural resources at ecosystem and farming systems levels;
– multilevel and multi-stakeholder involvement; and
– targeted policy and institutional support, including development of incentive mechanisms for SLM adoption and income generation at the local level.

Its application requires collaboration and partnership at all levels – land users, technical experts and policymakers – to ensure that the causes of the degradation and corrective measures are properly identified, and that the policy and regulatory environment enables the adoption of the most appropriate management measures.

Source: FAO, 2009a

According to **GIZ** the definitions rarely go beyond describing the aims of [**sustainable land management**]. In a development perspective, however, it is important to also address the question of how sustainable land-use solutions can be attained, or what concept of management is implicit in SLM. One important aspect in this regard is the observation that SLM can only be practiced by the people affected in a specific location. Sustainable land management is based on continuous analyses and negotiation processes among land users. Balancing and reconciling the economic, social and ecological interests of diverse user groups is key to gaining acceptance of land-use solutions. Procedures by which to determine, register and distribute information on titles to land, values of land and uses of plots of land are generally vital for sustainable land management. Those procedures need to give special attention to the entitlements of marginalised groups such as indigenous peoples and nomadic groups.

Source: GTZ, 2000, 2009, 2010a und b

The second **DSD** working group also stresses that SLM is a constant negotiation process among land users including trade-offs:

[**Sustainable land management**](SLM) is a relative concept. SLM and land degradation can be illustrated by a spider diagram, in which the seven axes represent the normalized (on a scale 0 to 100) various sustainability aspects of a given land use system (Nachtergaele et al., 2009). Changing land use systems leads to either higher sustainability or higher degradation. Although certain group of interventions may enhance all seven axes, more often a majority of sustainability factors is enhanced while one or two of them decline. The resulting situation may or may not be the most desirable for every one of the stakeholders concerned. This conflict of interest over what kind of sustainability is desirable and its dependency on the specific and different interests of the stakeholders make sustainable land use planning often an exercise in conflict resolution. It also makes sustainable management in itself a relative rather than an absolute concept.

Source: DSD, 2009b

9. Sustainable Soil Management

In the 1990s, the concept of [**sustainable soil management**] was expanded by that of sustainable land management, which has a broader scope. The term 'sustainable soil management' is used mainly in contexts where the focus is on soil as a resource (soil function and quality).

A pithy definition is given by Hurni, **CDE**, and **ISCO**. This definition was also adopted by **GIZ**:

[**Sustainable soil management**] conserves the soil of a region for future generations as a whole to guarantee undiminished utility.

Source: Hurni, 1993

Both the (American) **Soil and Water Conservation Society** and the (German) **Federal Agricultural Research Centre (FAL)** regard sustainable management of agricultural soils as a precondition for sustainable agriculture and food security:

> Effective **[soil management]** is essential to the long-term sustainability and commercial viability of agriculture. It is also the foundation of effective environmental management of farming systems. The need for more effective and comprehensive soil management has become even more urgent as a means to both mitigate and adapt to the effects of climate change. The restoration of soil quality has become an important strategy for addressing world food security.
>
> *Source: SWCS, 2007; Bundesforschungsanstalt für Landwirtschaft (FAL), 2003a*

The **Federal Agricultural Research Centre (FAL)** emphasizes in its definition of sustainable soil management the important role of soil functions and links these with sustainable agriculture:

> **[Sustainable soil management]** is a precondition for a sustainable development of agriculture. This is borne out by the manifold soil functions as well as the productive capacity of soil:
>
> – the production function for a continuous production of biomass is the life-support base of mankind;
>
> – the living space function offers habitat for mankind, flora and fauna in genetic diversity;
>
> – the regulation function stands for manifold abiotic and biotic transformation processes as well as filter and storage functions for groundwater recharge.
>
> *Source: Bundesforschungsanstalt für Landwirtschaft (FAL), 2003b*

10. Sustainable Use of Natural Resources / Sustainable Natural Resources Management

While the term sustainable land management focuses on the use of land for agriculture and livestock production and refers mainly to soil, water and biodiversity resources, the term **[sustainable use of natural resources or sustainable natural resources management]** is much broader. It embraces all natural resources, stressing their social and cultural functions in addition to their productive and ecological ones (see Figure 3). Most definitions are general and short.

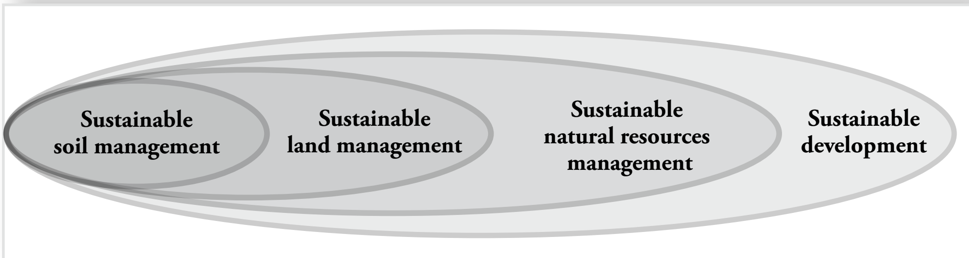

Figure 3: Systematic presentation of relations between sustainable development and different kinds of resources management

A common definition was formulated by the Swiss **CDE**, and taken up in the **IAASTD** Glossary:

> **[Natural resource use]** is **sustainable** if specific types of use in a particular ecosystem are considered reasonable in the light of both the internal and the external perspective on natural resources. Reasonable in this context means that all actors agree that resource use fulfils productive, physical, and cultural functions in ways that will meet the long-term need of the population affected.
>
> *Source: Brüschweiler et al., 2004; IAASTD, 2009*

This definition is complemented by the definition of natural resources management, with focus on the functions, including economic and social ones.

> **[Natural resources management]** includes all functions and services of nature that are directly or indirectly significant to humankind, i.e. economic functions, as well as other cultural and ecological functions or social services that are not taken into account in economic models or not entirely known.
>
> *Source: IAASTD, 2009*

A definition that takes into consideration necessary interventions by development cooperation is given by **GIZ**:

> The livelihoods of people in poor countries depends mainly on the use of natural resources: soil, water, vegetation, and biodiversity. The safeguarding of **[natural resources by means of sustainable management]** shall ensure that development potential in rural areas is maintained for the future. In this regard, it is crucial to achieve a balance between maximising the productivity of natural resources and maintaining such resources, while reconciling different user entitlements and interests.
> *Source: GTZ, 2010b*

Action is required on four levels:

- shaping the policy framework governing access to and utilisation of natural resources;
- promoting the development of institutions responsible for sustainable use of natural resources and promoting capacity building;
- facilitating dialogue and, if necessary, mediating between user groups with divergent interests;
- fostering management and research into use of natural resources.

Source: GIZ, 2011a

Soil Conservation

11. Soil Conservation

The term **[soil conservation]** is hardly used today. Soil and water are seen mostly as a unit, and therefore soil conservation has been replaced by soil and water conservation. Even the term conservation has lost acceptance, and has become replaced more and more by 'sustainable management', as the emphasis is less on protection than on productive use of soils.

A common definition, also used by **UN organisations**, is:

> **[Protection of soil]** from erosion and other types of deterioration, so as to maintain soil fertility and productivity. It generally includes watershed management and water use.
> *Source: UN-Data, 2011*

Soil and Water Conservation (SWC)

12. Soil and Water Conservation (SWC)

A common definition adopted by several organisations can be found at **ISCO** and **CDE**. Novelty and importance lie in its expansion from technical and biological aspects to include required approaches. This is a lesson learnt from many unsustainable projects implemented top-down, i.e., without participation of land users in planning and management.

> **[Soil and water conservation]** is a combination of appropriate technology and successful approach. Technologies promote the sustainable use of agricultural soils by minimising soil erosion, maintaining and/or enhancing soil properties, managing water, and controlling temperature. Approaches explain the ways and means which are used to realise SWC in a given ecological and socio-economic environment.
> *Source: Hurni et al., 1996; IAASTD, 2009*

Conservation Agriculture (CA)

13. Conservation Agriculture (CA)

The more technical terms soil conservation, conservation tillage, or direct planting were replaced internationally in the late 1990s by the term conservation agriculture propagated by **FAO**. **[Conservation agriculture]** is not just a certain technique but a concept for sustainable management of soils, or a sustainable form of agriculture.

The current **FAO** definition of conservation agriculture is:

> **[Conservation agriculture (CA)]** is a concept for resource-saving agricultural crop production that strives to achieve acceptable profits together with high and sustained production levels while concurrently conserving the environment. CA is based on enhancing natural biological processes above and below the ground. Interventions such as mechanical soil tillage are reduced to an absolute minimum, and the use of external inputs such as agrochemicals and nutrients of mineral or organic origin are applied at an optimum level and in a way and quantity that does not interfere with, or disrupt, the biological processes. CA is characterized by three principles which are linked to each other, namely:
>
> – continuous minimum mechanical soil disturbance;
>
> – permanent organic soil cover;
>
> – diversified crop rotations in the case of annual crops or plant associations in case of perennial crops.
>
> *Source: FAO, 2008*

14. Sustainable Agriculture

[Sustainable agriculture] is a broad term, including different forms of management such as conservation agriculture or organic agriculture aiming at ecological and economic sustainability and social acceptance. Sustainable Agriculture is a precondition for sustainable rural development.

FAO therefore speaks of Sustainable Agriculture and Rural Development (SARD):

> **[Sustainable agriculture]** and rural development (SARD) refers to a process which is ecologically sound, environmentally sustainable, economically viable, socially just, culturally appropriate, humane, based on a holistic scientific approach and productive over the long term
>
> *Source: FAO and SARD, 2007*

A more detailed definition is provided in the **Agenda 21**:

> The major objective of **[SARD]** is to increase food production in a sustainable way and enhance food security. This will involve education initiatives, utilization of economic incentives and the development of appropriate and new technologies, thus ensuring stable supplies of nutritionally adequate food, access to those supplies by vulnerable groups, and production for markets; employment and income generation to alleviate poverty; and natural resource management and environmental protection.
>
> *Source: United Nations Department of Economic and Social Affairs, 1992*

FAO, the **International Labour Organisation (ILO)** and the **International Union of Food, Agricultural, Hotel, Restaurant, Catering, Tobacco and Allied Workers' Associations (IUF)** define sustainable agriculture briefly but to the point:

> (Sustainable agriculture and rural development are integral and necessary components of sustainable development.) **[Sustainable agriculture]** involves all three pillars of development – economic, social and environmental. It cannot be viewed merely or even primarily as farming systems that are technically able to maintain or increase yields while conserving their natural resource base.
>
> *Source: FAO, ILO, IUF, 2005*

The **US-American Ministry of Agriculture (USDA)** specifies this by defining sustainable agriculture as:

> The term **[sustainable agriculture]** means an integrated system of plant and animal production practices having a site-specific application that will, over the long term:
>
> – satisfy human food and fibre needs;
>
> – enhance environmental quality and the natural resource base upon which the agricultural economy depends;
>
> – make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;
>
> – sustain the economic viability of farm operations;
>
> – enhance the quality of life for farmers and society as a whole.
>
> *Source: USDA, 2009*

A good definition of sustainable agriculture which is appropriate for international development cooperation is given by **Sustainet**, a supraregional project of German development cooperation. It follows the **FAO** definition, but adds the ecological, economic and social perspectives. The institutional and political perspective (dimension) are still lacking:

> **[Sustainable agriculture]** must be economically viable and socially responsible. It must be geared towards conserving land, water and genetic resources for future generations. [...]
>
> – From an ecological perspective, sustainable agriculture must contribute to conserving and improving soil fertility and water quality, restoring biodiversity and making economical use of energy.
>
> – In economic terms, sustainable agriculture must improve incomes and offer farmers a secure income. It must deliver long-term improvements in nutritional status and ensure access to foods. (Income security from agriculture should be able to compete with other income-earning options.)
>
> – From the social point of view, sustainable agriculture must involve disadvantaged farmers in development, and take account of social customs, traditions and norms, including taboos. It should utilise local knowledge and distribute work and income equitably between the members of a household, and between the genders and generations. This supports equitable access to land, water, capital and innovations and gives farmers the opportunity of extending their skills and knowledge.
>
> *Source: Sustainet, 2011*

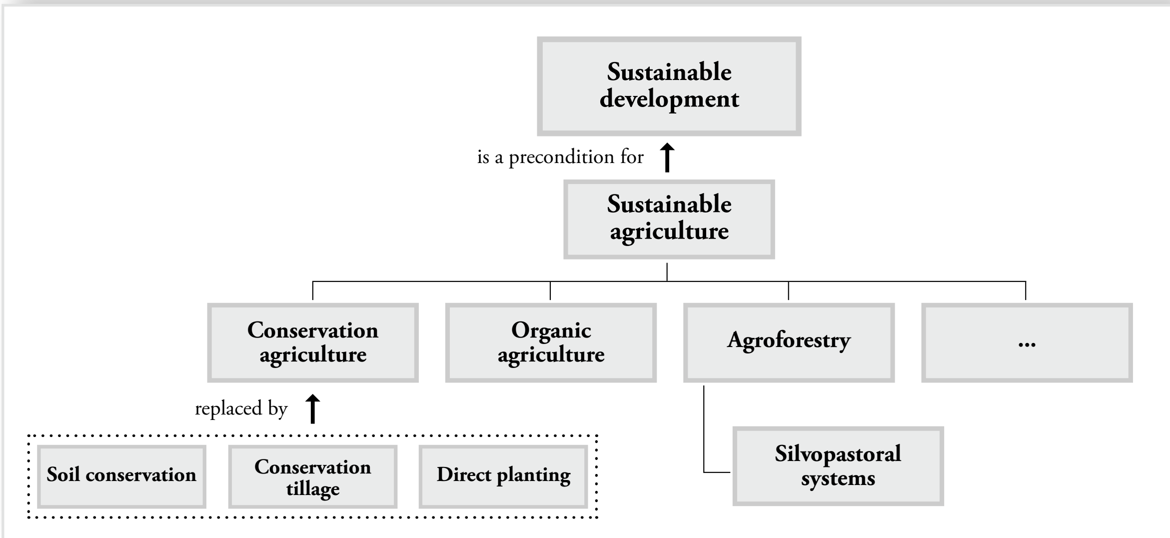

Figure 4: Schematic presentation of relations between different forms of sustainable agriculture contributing to sustainable development

15. Organic Agriculture

[**Organic agriculture**] is a form of sustainable agriculture (see Figure 4).

Organic Agriculture is defined by the **International Federation of Organic Agriculture Movements (IFOAM)** as:

> [**Organic agriculture**] is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.
>
> *Source: IFOAM, 2008*

FAO and **WHO** in the Codex Alimentarius define Organic Agriculture similarly as:

> [**Organic agriculture**] is a holistic production management system which promotes and enhances agroecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, cultural, biological and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system. An organic production system is designed to:
>
> – enhance biological diversity within the whole system;
> – increase soil biological activity;
> – maintain long-term soil fertility;
> – recycle wastes of plant and animal origin in order to return nutrients to the land, thus minimizing the use of non-renewable resources;
> – rely on renewable resources in locally organized agricultural systems;
> – promote the healthy use of soil, water and air as well as minimize all forms of pollution thereto that may result from agricultural practices;
> – handle agricultural products with emphasis on careful processing methods in order to maintain the organic integrity and vital qualities of the product at all stages;
> – become established on any existing farm through a period of conversion, the appropriate length of which is determined by site-specific factors such as the history of the land, and type of crops and livestock to be produced.
>
> *Source: FAO, WHO, 2007*

16. Agroforestry

[**Agroforestry**] is a special form of sustainable agriculture (see Figure 4), integrating perennials, trees and shrubs into the production system.

A succinct definition is given by the **United Nations**:

> [**Agroforestry**] is the collective term used for land- use systems and technologies in which woody perennials (trees, shrubs, palms, bamboo's and so forth) are deliberately used on the same land management unit as agricultural crops and/or animals, in some form of either spatial arrangement or temporal sequence.
>
> *Source: United Nations, 1997*

A more detailed definition is found in the **IAASTD** Glossary:

> [**Agroforestry**]: A dynamic, ecologically based, natural resources management system that through the integration of trees in farms and in the landscape diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels. Agroforestry focuses on the wide range of work with trees grown on farms and in rural landscapes. Among these are fertilizer trees for land regeneration, soil health and food security; fruit trees for nutrition; fodder trees that improve smallholder livestock production; timber and fuelwood trees for shelter and energy; medicinal trees to combat disease; and trees that produce gums, resins or latex products. Many of these trees are multipurpose, providing a range of social, economic and environmental benefits.
>
> *Source: IAASTD, 2009*

Silvopastoral Systems

17. Silvopastoral Systems

[**Silvopastoral systems**] can be regarded as a special form of agroforestry. The Farm Woodland Forum therefore talks of silvopastoral agroforestry.

A detailed definition is provided by **FAO**:

> Tree-grass-animal systems, also known as [**silvopastoral systems**], combine trees with fodder and forage production for livestock. Trees are managed for high-value sawlogs but at the same time they provide shade and shelter for livestock. In this system, managed grazing provides added products and income. The selected livestock are generally browsing animals such as sheep or goats that are more likely to eat trees or large grazing animals such as cattle which step on young trees. Integrating trees, forage and livestock creates a land management system that can produce marketable products while maintaining long-term productivity. Silvopasture systems can also improve wildlife diversity, water quality, soil fertility and physical properties by protecting the soil from water and wind erosion.
> *Source: FAO, 2003*

In a paper presented at a symposium on silvopastoral systems, **Harvey** stresses the potential of silvopastoral systems to conserve biodiversity.

> [**Silvopastoral systems**] tend to have a high genetic diversity and incorporate a wide variety of tree, shrub and grass species that are deliberately planted or retained by the farmer (planned biodiversity). The tree, shrub and grass components, in turn, provide physical structures, resources and habitats that support additional plant and animal species (associated biodiversity). Rich communities of lianas, mosses, lichens and epiphytic plants often occur on tree branches and trunks, while many forest plant species may establish under the shade of the tree canopies. A wide variety of animals (insects, birds, bats and other mammals) may use the silvopastoral system for food, shelter or protection from predators or adverse weather conditions.
> In addition to providing habitats and resources for both plants and animals, silvopastoral systems may also help conserve biodiversity by creating microclimatic and soil conditions that are more favourable to forest species, by acting as stepping stones or corridors that facilitate animal movement across the agricultural habitats, and by acting as buffer zones around protected or natural areas. Perhaps equally important, silvopastoral systems provide alternative sources of timber, firewood and other wood products, thereby reducing the pressure on the remaining natural forest habitats and their biodiversity.
> *Source: Harvey, 2002*

GIZ and the **Global Mechanism** of the UNCCD bring in a new perspective, arguing that silvopastoral systems play a role in adaptation to climate change:

> An intensive, diversified [**silvopastoral systems**] can help communities adapt to climate change. Selecting tree varieties and other wood species that are suited to drought conditions will help improve the resilience of livestock systems. The resulting improved shade factor increases the amount and quality of available fruit and forage, reduces heat stress for animals and increases their productivity. Good silvopastoral systems can also prevent overgrazing and land degradation, and improve nutrient cycling and erosion control.
> *Source: GTZ and The Global Mechanism, 2009*

Agro-ecosystem

18. Agro-ecosystem

FAO defines [**Agro-ecosystems**] briefly and to the point:

> [**Agro-ecosystems**]: A dynamic association of crops, pastures, livestock, other flora and fauna, atmosphere, soils, and water. Agro-ecosystems are contained within larger landscapes that include uncultivated land, drainage networks, rural communities, and wildlife.
> *Source: FAO, 2011*

The definition in the **IAASTD** Glossary considers the aspect of the functions in relation to biodiversity:

> **[Agro-ecosystems]**: A biological and biophysical natural resource system managed by humans for the primary purpose of producing food as well as other socially valuable non-food goods and environmental services. Agroecosystem function can be enhanced by increasing the planned biodiversity (mixed species and mosaics), which creates niches for unplanned biodiversity.
> *Source: IAASTD, 2009*

19. Agrobiodiversity

The definition in the **IAASTD** Glossary stresses the key function of **[agrobiodiversity]** in agro-ecosystems:

> **[Agricultural biodiversity]** encompasses the variety and variability of animals, plants and microorganisms necessary to sustain key functions of the agro-ecosystem, its structure and processes for, and in support of, food production and food security.
> *Source: IAASTD, 2009*

A detailed definition of agrobiodiversity, rather more of a description, is formulated by **GIZ**:

> Agricultural biological diversity – or **[agrobiodiversity]** for short – embraces all components of biodiversity of relevance to food and agriculture. This includes all organisms that contribute to sustaining the key functions of agro-ecosystems. Agrobiodiversity has three levels:
>
> – all cultivated and domesticated animal and plant species and their wild relatives components that contribute to maintaining the key functions of agriculture;
>
> – ecosystems (agro-ecosystems), such as bees for pollination or beneficial insects (predators, natural enemies of pests);
>
> – managed stocks of wild animals and plants.
>
> Agrobiodiversity is the outcome of thousands of years of effort by farmers. Selection and breeding created species, breeds and varieties that are adapted optimally to the conditions in their regions of origin and best match the needs of their breeders.
> Plant and animal genetic resources are the source material for further development, by breeders and farmers, of cultivated crop varieties and domesticated animal breeds. The variety of these resources harbours a rich gene pool, which breeders can use to cope with new challenges such as adaptation to climate change.
> *Source: GIZ, 2011b*

20. Water Productivity

In view of the enormous water requirements for food production (90 % of human annual use, the rest being industrial and domestic) and the increasing competition for water between agriculture and rapidly expanding urban centres, the efficient use of water – or **[water productivity]** – is gaining importance internationally.

FAO defines water productivity as:

> **[Water productivity]** is an efficiency term quantified as a ratio of product output (goods and services) over water input. The output could be biological goods or products such as crop (grain fodder) or livestock (meat, egg, fish) and can be expressed in term of yields, nutritional value or economic return. The output could also be an environment service or function. Water productivity can be at different scales and for a mixture of goods and services.
> Three major expressions of water productivity (WP) can be identified:
>
> – the amount of carbon gain per unit of water transpired by the leaf or by the canopy (photosynthetic WP);
>
> – the amount of biomass obtained per unit amount of water transpired by the crop (biomass WP); or
>
> – the yield obtained per unit amount of water transpired by the crop (yield WP).
>
> *Source: Kassam, A. and Smith, M., 2001; Steduto, P. et al., 2001*

IAASTD adopts the first part of the FAO definition and adds definitions of three forms of water productivity: Agricultural water productivity, Physical water productivity, and Economic water productivity (physical water productivity in this definition corresponds to the water productivity in the FAO definition):

> Agricultural **[water productivity]** relates net benefits gained through the use of water in crop, forestry, fishery, livestock and mixed agricultural systems. It reflects the objectives of producing more food, income, livelihood and ecological benefits at less social and environmental cost per unit of water in agriculture.
>
> Physical **[water productivity]** relates agricultural production to water use – more crop per drop. Water use is expressed either in terms of delivery to a use, or depletion by a use through evapotranspiration, pollution, or directing water to a sink where it cannot be reused. Improving physical water productivity is important to reduce future water needs in agriculture.
>
> Economic **[water productivity]** relates the value of agricultural production to agricultural water use.
>
> *Source: IAASTD, 2009*

Watershed Management

21. Watershed Management

A watershed (or catchment area) is a geographically defined area in which precipitation and the resulting runoff is discharged by a certain riverine system. As internally coherent physiographic units, they provide an important frame of reference for the management planning of larger geographic systems (GTZ, 2000).

Only very general definitions of **[watershed management]** are found in the literature.

International Union of Soil Sciences (IUSS, until 2002 International Society of Soil Science – ISSS):

> **[Watershed management]**: Use, regulation and treatment of water and land resources of a watershed to accomplish stated objectives.
>
> *Source: Bergsma et al., 1996.*

The best and most detailed definition of watershed management is given by the **California Watershed Program**:

> **[Watershed management]** is the process of creating and implementing plans, programs, and projects to sustain and enhance watershed functions that provide the goods, services and values desired by the community affected by conditions within a watershed boundary. The objective of watershed management is to increase and sustain a watershed's ability to provide for the diverse needs of the communities that depend on it, from local to regional to state and federal stakeholders. Resource management using watersheds as an organizing unit has proven to be an effective scale for natural resource management. It presents a common reference point for the many different activities and actors that affect the system, and promotes greater integration and collaboration among those actions.
>
> *Source: State of California, Department of Conservation, 2011*

GIZ defines watershed management from a development perspective:

> **[Watershed management]** comprises all processes and institutions contributing to the compliance of manifold activities and development measures in a watershed with the objective of a socially, economically and ecologically sustainable management of water resources. Activities and development measures which are of special importance for a watershed and therefore need to be checked whether they comply with the above objective are generally a part of:
>
> – regional rural development (e.g. land-use planning);
>
> – agricultural production, multifunctional forestry;
>
> – water resources management, water supply and sanitation;
>
> – disaster risk management.
>
> *Source: GIZ, 2011c*

22. Integrated Water Resources Management (IWRM)

While watershed management considers mainly actions within a regional catchment area, the term IWRM considers entire water basins, i.e. the watershed of river systems often covering more than one country. The term **[integrated water resources management]** is more and more replacing the term watershed management; they are often used synonymously.

According to **UN-Water** the most widely accepted definition of IWRM is that given by the **Global Water Partnership (GWP)**:

> **[IWRM]** is defined as a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.
> *Source: UN-Water, 2008, GWP 2000*

The **GWP** together with the **International Network of Basin Organizations (INBO)** further defines the integrated water resources management approach:

> The **[integrated water resources management]** approach helps to manage and develop water resources in a sustainable and balanced way, taking account of social, economic and environmental interests. It recognises the many different and competing interest groups, the sectors that use and abuse water, and the needs of the environment. The integrated approach co-ordinates water resources management across sectors and interest groups, and at different scales, from local to international. It emphasises involvement in national policy and law making processes, establishing good governance and creating effective institutional and regulatory arrangements as routes to more equitable and sustainable decisions. A range of tools, such as social and environmental assessments, economic instruments, and information and monitoring systems, support this process.
> *Source: GWP and INBO, 2009*

GIZ defines IWRM from a development perspective:

> **[IWRM]** is a management approach, in which the resource water is considered in the context of the entire ecosystem. Planning and management will involve all sectors that influence the complex fabric of the eco-system. Action in the water sector must focus on the sustainable use and protection of resources. Management and planning units are based on water catchment areas – independent of political borders – since problems of use and pollution do not stop at borders. All groups can participate – those exerting influence and those affected by it, and all economic and social interests will be considered. IWRM encompasses a wide range of issues, such as:
> – urban Water Management and Decentralised Water Supply (rural areas);
> – ecological sanitation;
> – the Water for Food concept, water productivity in agriculture;
> – management of water basins, agricultural policy and trade policy, virtual water;
> – transboundary water management, establishment and development of river basin organisations.
> *Source: GIZ, 2011d*

23. Ecoagriculture

[Ecoagriculture] is a relatively new approach, in the early 21st century, which aims at managing landscapes to meet three goals: to conserve biodiversity and ecosystem services, provide agricultural products sustainably and support viable livelihoods for local people. The term ecoagriculture can be seen as a

Altieri in a working paper of the **International Union for Conservation of Nature (IUCN)** defines Ecoagriculture as follows:

> **[Ecoagriculture]** is defined as sustainable agriculture and associated natural resource management that embrace and simultaneously enhance productivity, rural livelihoods, ecosystem services and (especially wild) biodiversity.
> *Source: Altieri, 2004*

A brief definition plus a more detailed one is given by **Ecoagriculture Partners**, an initiative established under the auspices of the IUCN and the Future Harvest Foundation during the 2002 World Summit for Sustainable Development in Johannesburg, South Africa:

> **[Ecoagriculture]**: Land-use systems designed to produce both human food and ecosystem services, including habitat for wild biodiversity.
> *Source: Ecoagriculture Partners, 2011*

> **[Ecoagriculture]** is defined as sustainable agriculture and associated natural resources management systems that simultaneously enhance productivity, rural livelihoods, ecosystem services and biodiversity. Ecoagriculture includes a wide range of systems and practices that integrate productivity goals (for crops, livestock, fish, trees and forests) with provision of ecosystem services (including biodiversity and watershed services) at a landscape scale. Ecoagriculture systems make more space for wildlife by designating protected areas and corridors that also enhance local production and incomes, and improve the habitat value of productive areas by reducing pollution, improving resource management, or creating crop mixtures that mimic natural habitat conditions – while still maintaining or increasing productivity.
> *Source: Scherr, 2002 in FAO, 2004*

The **Ecoagriculture Working Group** at **Cornell University** defines ecoagriculture similarly:

> **[Ecoagriculture]** is a landscape approach to natural resource management that seeks to sustain agricultural production, conserve biodiversity and ecosystem services, and support local livelihoods.
> *Source: Ecoagriculture Working Group, 2009*

24. Landscape Approach

Only a few and very general definitions exist of this not entirely new, but only recently revived term. Most definitions refer to a paper by R.F. Noss, published 1983 in the scientific journal BioScience. Unlike the term ecoagriculture, the **[landscape approach]** does not expressly embrace production aspects, but focuses on nature conservation, including conservation of biodiversity.

This definition is also used/proposed by the **Global Environment Facility (GEF)**:

> Almost all ecosystems are open and exchange energy, mineral nutrients, and species. Particularly in highly heterogeneous regions, the landscape mosaic may be a more appropriate unit of study and management than single sites or ecosystems. Landscape is a kilometre-wide area where a cluster of interacting stands or ecosystems is repeated in similar form. A landscape is therefore an ecological unit with distinct structure. The importance of the **[landscape approach]** concept is its recognition that the structural components of a landscape interact.
> *Source: Noss, 1983*

The **World Wide Fund for Nature (WWF)** and **IUCN** define the landscape approach as:

> The **[landscape approach]** is a framework for making landscape-level conservation decisions, developed by WWF and IUCN. It contributes to broad-scale approaches to conservation, such as WWF's ecoregion conservation programme and the ecosystem approach promoted by the Convention on Biological Diversity: international agreements like the Bern Convention and World Heritage Convention also recommend landscape-scale actions. The landscape approach helps to reach decisions about the advisability of particular interventions (such as a new road or plantation) and to facilitate the planning, negotiation and implementation of activities across a whole landscape. It integrates top-down planning with bottom up, participatory approaches. There are many definitions of landscape, here we use: a contiguous area, intermediate in size between an ecoregion and a site, with a specific set of ecological, cultural and socio-economic characteristics distinct from its neighbours. Conservationists use biogeographical characteristics to define 'functional conservation landscapes': other stakeholders such as farming communities, pastoralists or district officials use different parameters to define their cultural or livelihood landscapes – it is important to recognise these in large-scale conservation. Highlights of the landscape approach include:
>
> – defining opportunities and constraints for conservation action within the landscape;

– helping conservationists establish effective ecological networks, securing the integrity of ecosystems and viable populations of species;
– development of rapid assessment systems for landscape scale forest quality (both ecological and social), including identification of High Conservation Value Forests;
– setting out a stakeholder negotiation framework for land and resource use decisions and for balancing the trade-offs inherent in such large-scale approaches;
– recognizing and using overlapping cultural, social, and governance landscapes within biologically defined areas.

Source: WWF, 2002

25. Ecosystem Approach

As distinct from the landscape approach, the **[ecosystem approach]** focuses on safeguarding biodiversity, while placing human needs centre-stage. It extends biodiversity management beyond protected areas to an entire ecosystem. Both the landscape approach and the ecosystem approach, are closely related to sustainable natural resources management. The term ecosystem approach was first used in the early 1980s, but only gained common acceptance at the 1992 Rio Earth Summit where it became the primary framework for action under the CBD.

The **CBD** defines the ecosystem approach as:

… a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. […]
The CBD further identifies 12 principles of the **[ecosystem approach]**:

1. The objectives of management of land, water and living resources are a matter of societal choice.
2. Management should be decentralized to the lowest appropriate level.
3. Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.
4. Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should:
   (a) reduce those market distortions that adversely affect biological diversity;
   (b) align incentives to promote biodiversity conservation and sustainable use;
   (c) internalize costs and benefits in the given ecosystem to the extent feasible.
5. Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.
6. Ecosystems must be managed within the limits of their functioning.
7. The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.
8. Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term.
9. Management must recognize that change is inevitable.
10. The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.
11. The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.
12. The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

Source: CBD, 2000

The ecosystem approach is one of the cross-cutting issues of the **CBD**:

Application of the **[ecosystem approach]** will help to reach a balance of the three objectives of the Convention. […] It recognizes that humans, with their cultural diversity, are an integral component of ecosystems.

Source: CBD, 2011

The **[ecosystem approach]** recognizes the need for planning based on natural ecosystem boundaries rather than on political or bureaucratic borders and aims to achieve integration of the three goals of sustainability: sustainable use of natural resources, impartial sharing of the benefits derived from their use and conservation of natural resources. Central to the ecosystem approach is the acknowledgement that mankind is part of any ecosystem in which it exists, mankind is therefore placed as being central to of what the ecosystem approach entails: The ecosystem approach places human needs at the centre of biodiversity management. It aims to manage the ecosystem, based on the multiple functions that ecosystems perform and the multiple uses that are made of these functions. The ecosystem approach does not aim for short-term economic gains, but aims to optimize the use of an ecosystem without damaging it. Furthermore, it extends biodiversity management beyond protected areas while recognising that they are also vital for delivering CBD objectives.
Source: Euroturtle, 2011

List of abbreviations

BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (Federal Ministry for Economic Cooperation and Development)
CA	Conservation Agriculture
CBD	Convention on Biological Diversity
CDE	Centre for Development and Environment. University of Berne
CGIAR	Consultative Group on International Agricultural Research
COP	Conference of the Parties
CST	Committee on Science and Technology of the UNCCD
DSD	Dryland Science for Development Consortium
FAL	Bundesforschungsanstalt für Landwirtschaft (Federal Agricultural Research Centre)
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
GLASOD	Global Assessment of Human Induced Soil Degradation
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
GWP	Global Water Partnership
IAASTD	International Assessment of Agricultural Knowledge, Science and Technology for Development
IFOAM	International Federation of Organic Agriculture Movements
ILO	International Labour Organization
INBO	International Network of Basin Organizations
ISCO:	International Soil Conservation Organization
ISRIC	International Soil Reference and Information Centre
ISSS	International Society of Soil Science
IUCN	International Union for Conservation of Nature
IUF	International Union of Food, Agricultural, Hotel, Restaurant, Catering, Tobacco and Allied Workers' Associations
IUSS	International Union of Soil Sciences
IWRM	Integrated Water Resources Management
LADA	Land Degradation Assessment in Drylands
P	Mean annual precipitation
PET	Potential Evapotranspiration
PoW	Programme of Work
SARD	Sustainable Agriculture and Rural Development
SLM	Sustainable Land Management
SWC	Soil and Water Conservation
SWCS	Soil and Water Conservation Society
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USDA	United States Department of Agriculture
WCMC	World Conservation Monitoring Centre
WHO	World Health Organization
WOCAT	World Overview of Conservation Approaches and Technologies
WP	Water Productivity
WWF	World Wide Fund for Nature

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