British Journal of Earth Sciences Research
Vol.9, No.2, pp.28-37, 2021
Print ISSN: 2397-7728(Print),
Online ISSN: 2397-7736(Online)

CAUSES AND IMPACTS OF LAND DEGRADATION

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ABSTRACT*:* *Land degradation is the result of complex interaction among, physical, chemical, biological, socio-economic and political issues of local, national or global nature. Land degradation affects the economy and also has many negative impacts on agricultural productivity by reducing the fertility of agricultural land. Land degradation is increasing in severity and extent in many parts of the world, with more than 20% of all cultivated areas, 30% of forests and 10% of grasslands undergoing degradation. Millions of hectares of land per year are being degraded in all climatic regions. It is estimated that 2.6 billion people are affected by land degradation and desertification in more than a hundred countries, influencing over 33% of the earth´s land surface. The attitude of the community about the consequences of land degradation on agricultural productivity*

KEYWORDS*;* cause, impact, land degradation, deforestation, erosion,

INTRODUCTION

Definition of Land degradation is "the temporary or permanent decline in the productive capacity of the land" (UN/FAO) "the aggregate diminution of the productive capacity of the land, including its major uses (rain-fed, arable, irrigated etc.), its farming systems (e.g. smallholder subsistence) and its value as an economic resource" (also FAO) Land degradation includes all process that diminishes the capacity of land resources to perform essential functions and services in ecosystems (Hurni et al. 2010). (4) In terms of reduced productivity, land degradation deals with changes either in the physical environment, or in crop yields and livestock outputs. Land degradation is defined in many different ways within the literature, with differing emphases on biodiversity, ecosystem functions and ecosystem services (e.g., Montanarella et al. 2018). In this review, land degradation is defined as a negative trend in land condition, caused by direct or indirect human-induced processes including anthropogenic climate change, expressed as long-term reduction or loss of this definition applies to forest and non-forest land: forest degradation is land degradation that occurs in forest land. Soil degradation refers to a subset of land degradation processes that directly affect soil. Land degradation is a human-induced or natural process which negatively affects the land to function effectively within an ecosystem. Forest degradation is a sub-set of land degradation in forest remaining forest. In contrast, deforestation refers to the conversion of forest to non-forest that involves a loss of tree cover and a change in land-use. Internationally accepted definitions of forest (FAO 2015; UNFCCC 2013) (4) include lands where tree cover has been lost temporarily, due to disturbance or harvest, with an expectation of forest regrowth. Such temporary loss of forest cover therefore is not deforestation. The scientific literature on land degradation often excludes forest degradation, yet here we attempt to assess both issues.

ULR: https://doi.org/10.37745/bjesr.2013

Because of the different bodies of scientific literature, we assess land degradation and forest degradation under different sub-headings, and where possible draw integrated conclusions.

Causes of Land degradation

Land degradation has two causes direct cause of land degradation and indirect causes of land degradation. Direct causes of land degradation is mismanagement of the land by man. The indirect causes of this mismanagement may be land tenure regulations, policies related to export-import, land politics, drought, poverty, poor advisory and extension services, population pressures. In the preparation of a world map as a first systematic evaluation of the status of human- induced soil degradation, GLASOD identified five different causes of human interventions that have resulted in soil degradation worldwide. Deforestation and the removal of the natural vegetation for fuel wood, agriculture and industry, Overgrazing of the vegetation is particularly damaging where livestock concentrates around watering points destroying the land within a radius around wells and villages, Mismanagement of agricultural land, Overexploitation of the vegetative cover for domestic use, (Bio-) industrial activities cause soil degradation.

There are no reliable global maps of the extent and severity of land degradation (Gibbs and Salmon 2015; Prince et al. 2018; van der Esch et al. 2017), despite the fact that land degradation is a severe problem (Turner et al. 2016). The reasons are both conceptual, i.e., how is land degradation defined, using what baseline (Herrick et al. 2019) or over what time period, and methodological, i.e. how can it be measured (Prince et al. 2018). Although there is a strong consensus that land degradation is a reduction in productivity of the land or soil, there are diverging views regarding the spatial and temporal scales at which land degradation occurs (Warren 2002), and how this can be quantified and mapped. Proceeding from the definition in this report, there are also diverging views concerning ecological integrity and the value to humans. A comprehensive treatment of the conceptual discussion about land degradation is provided by the recent report on land degradation from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, IPBES (Montanarella et al. 2018). A review of different attempts to map global land degradation, based on expert opinion, satellite observations, biophysical models and a data base of abandoned agricultural lands.

Land degradation, in terms of degradation of soil and water resources, is partially or mainly due to non-appropriate land use. This mismanagement can find its origin in economic and social problems, population pressure, changes in market prices and technical reasons. (Donald Gabriels, Wim M. Cornelis)

Soil erosion and nutrient depletion

Soil erosion is mainly caused in areas of crop land expansion, particularly in sub-Saharan Africa, South America and Southeast Asia. The method is controversial for both conceptual reasons (i.e., the ability of the model to capture the most important erosion processes) and data limitations (i.e., the availability of relevant data at regional to global scales), and its validity for assessing erosion over large areas has been questioned by several studies (Baveye 2017; Evans and Boardman 2016 a, b; Labrière et al. 2015).

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Fig, 1. Gully erosion

Attempts to estimate the severity of land degradation through soil erosion estimates suggest that soil erosion is a serious form of land degradation in croplands closely associated with unsustainable land management in combination with climatic parameters, some of which are subject to climate change (limited evidence, high agreement). Climate change is one among several causal factors in the status and current trends of land degradation (limited evidence, high agreement). FAO [10] defines soil degradation " ... as a change in the soil health status resulting in a diminished capacity of the ecosystem to provide goods and services for its beneficiaries. Degraded soils have a health status such, that they do not provide the normal goods and services of the particular soil in its ecosystem"

Quantifying degradation

Forests has also proven difficult indicators that remote sensing or inventory methods can measure more easily than reductions in biological productivity, losses of ecological integrity or value to humans include reductions in canopy cover or carbon stocks. However, the causes of reductions in canopy cover or carbon stocks can be many (Curtis et al. 2018), including natural disturbances (e.g., fires, insects and other forest pests), direct human activities (e.g., harvest, forest management) and indirect human impacts (such as climate change) and these may not reduce long-term biological productivity. In many boreal, some temperate and other forest types natural disturbances are common, and consequently these disturbance-adapted forest types are comprised of a mosaic of stands of different ages and stages of stand recovery following natural disturbances. In those managed forests where natural disturbances are uncommon or suppressed, harvesting is the primary determinant of forest age-class distributions. Quantifying forest degradation as a reduction in productivity, carbon stocks or canopy cover also requires that an initial condition (or baseline) is established against which this reduction is assessed.

Which contradicts the forest area dynamics assessed by FAO (2016, Lindquist and D'Annunzio 2016). The loss rate in tropical forest areas from 2010 to 2015 is 55 000 km^2 yr-1. According to the FRA the global natural forest area also declined from 39.61 M km2 to 37.21 M km^2 during the period 1990 to 2015 (Keenan et al. 2015).

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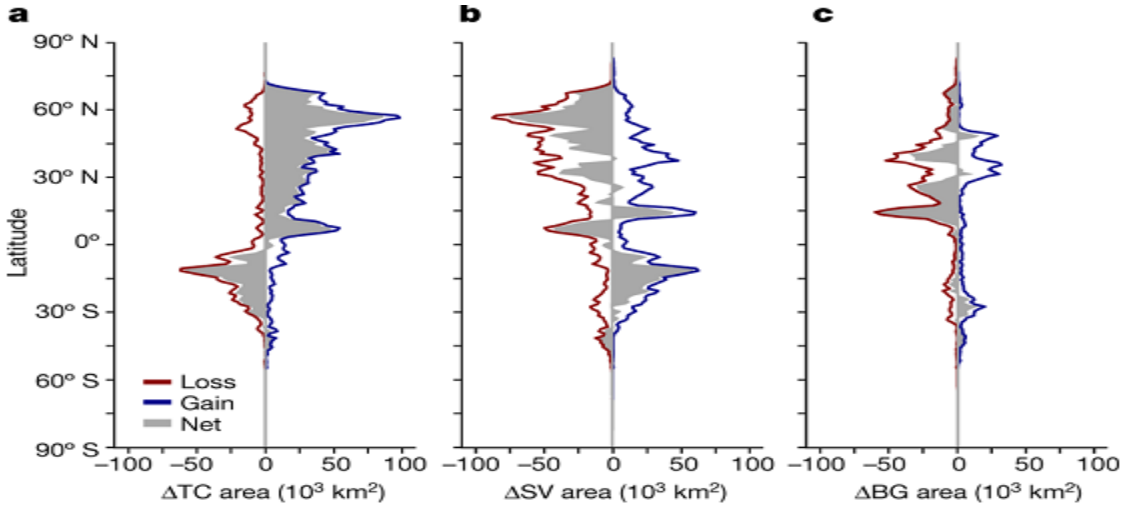

Figure; 2 diagrams showing latitudinal profiles of land cover change over the period 1982 to 2016 based on analysis of time –series of NOAA AVHRR imagery : a, Tree canopy cover change (ΔTC) . b, Short vegetation cover change (ΔSV). c, Bare ground cover change (ΔBG). Area statistics were calculated for every 1∘of latitude (song et al.2018).source of data: NOAA AVHRR.

Deforestation

Forests provide an important source of livelihood for local communities in Ethiopia (Jana, Lise, & Ahmed, 2014; Siraj et al., 2018). Deforestation and the removal of the natural vegetation for fuel wood, agriculture and industry is increasing at an alarming rate and this is causing serious land degradation on 579 million ha of which 50% is located in Asia, followed by South America with 17%. It is estimated for example that only 4 to 6% of Ethiopia is now forested where once it was 40%; another example is Ivory Coast which lost more than 50% of its forest in less than 3 decades. The World Bank estimates that about 3.9 million square miles (10 million square km) of forest have been lost since the beginning of the 20th century. In the past 25 years, forests shrank by 502,000 square miles (1.3 million square km) an area bigger than the size of South Africa. In 2018, The Guardian reported that every second, a chunk of forest equivalent to the size of a soccer field is lost.

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Region/subregion	1990-2000		2000-2010	
	1 000 ha/year	%	1 000 ha/year	%
Eastern and Southern Africa	-1841	-0.62	-1839	-0.66
Northern Africa	-590	-0.72	-41	-0.05
Western and Central Africa	-1637	-0.46	-1535	-0.46
Total Africa	**-4067**	**-0.56**	**-3414**	**-0.49**
East Asia	1762	0.81	2781	1.16
South and Southeast Asia	-2428	-0.77	-677	-0.23
Western and Central Asia	72	0.17	131	0.31
Total Asia	**-595**	**-0.10**	**2235**	**0.39**
Russian Federation (RF)	32	n.s.	-18	n.s.
Europe excluding RF	845	0.46	694	0.36
Total Europe	**877**	**0.09**	**676**	**0.07**
Caribbean	53	0.87	50	0.75
Central America	-374	-1.56	-248	-1.19
North America	32	n.s.	188	0.03
Total North and Central America	**-289**	**-0.04**	**-10**	**0.00**
Total Oceania	**-41**	**-0.02**	**-700**	**-0.36**
Total South America	**-4213**	**-0.45**	**-3997**	**-0.45**
World	**-8327**	**-0.20**	**-5211**	**-0.13**

Fig3. Annual change in forest area by region and sub-region, 1990-2010 (Source: Anon., 2010)

Overgrazing by livestock

Overexploitation of the vegetative cover for domestic use: 133 million ha of which 63 million ha is located in Africa and 46 million ha in Asia. In South America the overexploitation of vegetation for domestic use is largely confined to dry land areas of North-West Argentina and southern Bolivia where shrub is collected for firewood. Overgrazing is due to their meristem-tic tissues being located close to the ground level. Grasses are furthermore dormant during the season's which allows them to with stand frost and even snow. In contrast broad-leaved savanna woody species are not adapted to the longer periods of extreme cold temperatures and can therefore not establish in these areas. Different grass plant species grow during different times of the growing season. The dominance of the grass species in a specific grassland community is influenced by the season and the amount of rainfall received (Bezuidenhout et al., 2018).

Traditional farming system

It refers to a type of farming practice that farmers are following without properly identifying the relationship between crop soils requirement and without following several soil and water conservation measures which are highly vital for conservation of land resource and compromising of future generation benefits (Moltimore, 2005). The productive layer of dirt is called top soil. If this eroded away through back ward farming system, then land is very unproductive in producing crops soil can be eroded away by wind and Water. High winds can blow away loose soil from flatter, hilly terrain, Water erosion generally occurs on slopes and its severity increase with the severity of slope (Voteberg, 2009).

Over population is pushing the farmers to cultivate steep slope and neglected lands in the area for centuries. The physical characteristics of the area supported by traditional ways of land utilization had accelerated land degradation (Feyera Deresa* Tsetadirgachew Legesse May 2015) (3)

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Fig 4 traditional farming system up to down

Vegetative Cover

The lack of permanent vegetative cover in certain locations results in extensive wind erosion. Loose, dry, bare soil is the most susceptible; however, crops that produce low levels of residue (e.g., soybeans and many vegetable crops) may not provide enough resistance. In severe cases, even crops that produce a lot of residue may not protect the soil from rain swept and erosion. land degradation whether due to climate change, erosion or drought there is costs to be paid to manage the problems incurred. For instance the cost of fertilizer to boost yield, conservation and plantation are some of the results of land degradation

Population Growth

The population growth increasing numbers of people there has not been a related change in the pattern of agriculture, which is still essentially small holder relying on expanding the cultivated area, often into marginal land, rather than adopting intensification techniques. There is still a strong tendency to hold wealth as livestock, often cattle, further impacting grazing resources. One of the major causes of environmental degradation in Bilaspur could be attributed to rapid growth of population, which is adversely affecting the natural resources and environment. The three fundamental demographic factors of births, deaths and migration produce changes in population size; composition, distribution and these changes raise a number of important questions of cause and effect.

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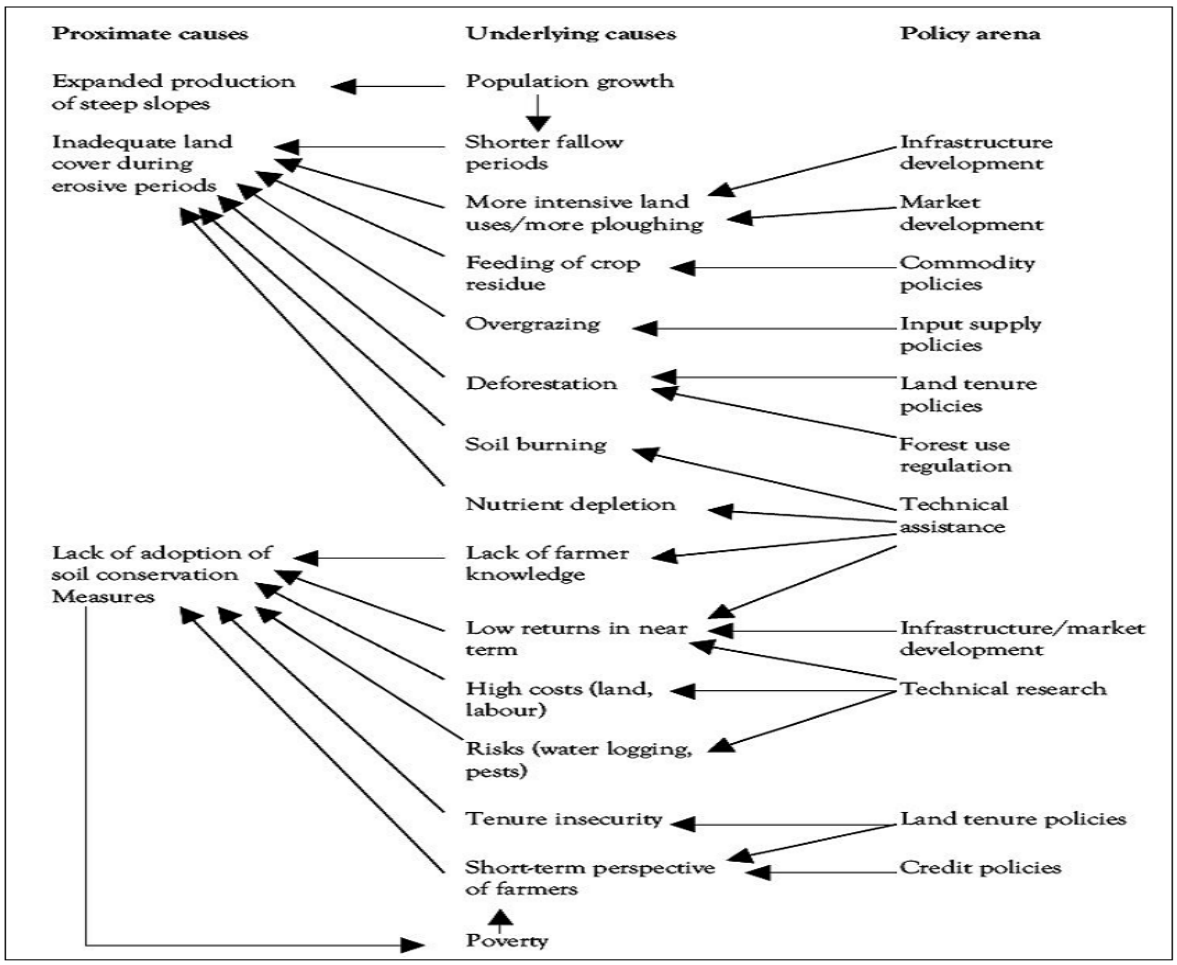

Fig 3 Couse of soil erosion (Fistum et al 1999)

Projections of land degradation in a changing climate

Land degradation will be affected by climate change in both direct and indirect ways, and land degradation will to some extent also feed-back into the climate system. Land degradation, if sufficiently widespread, may also feed back into the climate system by reinforcing on going climate change. Although climate change is exacerbating many land degradation processes (high to very high confidence), prediction of future land degradation is challenging because land management practices determine to a very large extent the state of the land. Scenarios of climate change in combination with land degradation models can provide useful knowledge on what kind and extent of land management will be necessary to avoid, reduce and reverse land degradation.

Types of impacts

Direct impacts on the land degradation

The direct impacts are those in which climate and land interact directly in time and space. Examples of direct impacts are when increasing rainfall intensity exacerbates soil erosion, or when prolonged droughts reduce the vegetation cover of the soil making it more prone to erosion and nutrient depletion. There are two main levels of uncertainty in assessing the risks of future climate water stress from droughts, and high surface wind speed. The second level of

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uncertainties, and where the uncertainties are much larger, relates to the above and belowground ecological changes as a result of changes in climate, such as rainfall, temperature, and increasing level of CO2. Vegetation cover is crucial to protect against erosion (Mullan et al. 2012; García-Ruiz et al. 2015). Changes in rainfall patterns, such as distribution in time and space, and intensification of rainfall events will increase the risk of land degradation, both in terms of likelihood and consequences (high agreement, medium evidence). Climate induced vegetation changes will increase the risk of land degradation in some areas (where vegetation cover will decline) (medium confidence). Landslides are a form of land degradation that is induced by extreme rainfall events. There is a strong theoretical reason for increasing landslide activity due to intensification of rainfall, but the empirical evidence is so far lacking that climate change has contributed to landslides (Crozier 2010; Huggel et al. 2012;Gariano and Guzzetti 2016), human disturbance may be a more important future trigger than climate change (Froude and Petley 2018). Erosion of coastal areas as a result of sea level rise will increase worldwide (very high confidence). In cyclone prone areas (such as the Caribbean, Southeast Asia, and the Bay of Bengal) the combination of sea level rise and more intense cyclones (Walsh et al. 2016b), and in some areas also land subsidence (Yang et al. 2019; Shirzaei and Bürgmann 2018; Wang et al. 2018; Fuangswasdi et al. 2019; Keogh and Törnqvist 2019),

Indirect impacts on the land degradation

The indirect impacts are those where climate change impacts and land degradation are separated in time and/or space. Examples of such impacts are when declining agricultural productivity due to climate change drives an intensification of agriculture elsewhere which may cause land degradation. The intensive management of agricultural land can lead to a loss of soil function, negatively impacting the many ecosystem services provided by soils including maintenance of water quality and soil carbon sequestration (Smith et al. 2016a). The degradation of soil quality due to cropping is of particular concern in tropical regions, where it results in a loss of productive potential of the land, affecting regional food security and driving conversion of non-agricultural land, such as forestry, to agriculture (Lambin et al. 2003; Drescher et al. 2016; Van der Laan et al. 2017). Climate change will exacerbate these negative cycles unless sustainable land managed practices are implemented.

CONCLUSION

The land degradation puts disastrous impact on the socio-cultural environment and ecological setting of the country. The major causes include rapid population increase, severe soil loss, deforestation, low vegetative cover and unbalanced crop and livestock production. In addition, topography, soil types and agro-ecological parameters are contributing factors in the degradation processes influenced by man. To control land degradation conservation measures throughout history are mainly focused on physical conservation structures which have less contribution for the addition of nutrients removed and to control soil erosion as compared to vegetation measures. However, as can be indicated in main text, land degradation can be prevented through different mechanisms depending on the nature and form of degradation. Soil erosion remains a key challenge for agriculture in several countries. Proper management of this valuable resource is vital to sustain long-term agricultural productivity. Soil conservation practices are tools the farmer can use to prevent soil degradation and build organic matter.

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These practices include crop rotation, reduced tillage, mulching and cover cropping and cross-slope farming is man controlling methods four the cause and impact of land degradation.

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