Ecological and Socio-Economic Implications of Free Grazing in Ethiopia: A Review

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Abstract: Livestock production in the tropics (including Ethiopia) is mainly sustained on free grazing as a major feed source. It is a known fact that the practice of livestock grazing is important for the growth of green biomass and composition of plant communities on grazing-lands. Moreover, grazing has the beneficial impact on biodiversity as extensive grazing contributes to the aesthetic and leisure importance of pastures. The practice can also contribute to the production of healthy feed of high quality. Grazing by livestock can also be used as a tool to limit the expansion of weeds and shrubs in open landscapes, but in most cases cannot stop or reverse natural succession. The conservation and protection of pastures requires the careful selection of razing management and appropriate number of grazing animals. Grazing species differ in their preference of habitat and plant species, which can enable the effective use of mixed grazing systems with different animal species. Thus, for purposes of biodiversity conservation, grazing should be combined with other practices, such as mowing, cutting or burning. Improper use of pasture such as both overgrazing and under grazing creates a threat for its biodiversity. Thus, both abandonment and overly intensive management of pastured grassland are harmful for biodiversity and should be avoided. Optimum grazing can be a tool to maintain or enhance biodiversity of grazed areas. The question, of which method or combination of methods is most suitable and most feasible in a particular area, depends on local biological and socio-economic factors. Research findings suggest that existing agro-environment schemes based only on blanket stocking rates are too crude to increase plant diversity and that site conditions must also be taken into consideration. In Ethiopia, the increase in number of livestock coupled with increase in human population has resulted in shrinkage of grazing lands and animals are limited to graze on overgrazed communal lands, road side and aftermath grazing and limited supplementation of straw. Besides, soil erosion and deforestation has worsened the situation. In line with this, one of the contributing factors to poor soil fertility, land degradation and erosion is the free grazing of animals. Free grazing is common practice in Ethiopia except in areas where grazing lands are limited in size and where the farming system favors growth of perennial cash crops. Strategic research is required into methods of achieving compliance with environmental protection and sustainable agricultural practice in developing countries including Ethiopia. In order to increase outputs from livestock, conserve soil and moisture and reforest degraded and over grazed communal grazing lands, controlling animals from freely grazing can be taken as alternative option of the negative effect of free grazing. This paper reviews ecological and economic benefits of free grazing, the effect of over grazing on natural resources and techniques to reduce the negative effect free grazing in Ethiopia.

***Keywords**:* Abiotic,Biotic, Ethiopia, Environment, Grazing, Livestock

1. Introduction

In developing countries, livestock play an important role in most small-scale farming systems. They provide traction to cultivate fields, manure to maintain crop productivity, and nutritious food products for human consumption and income-generation (Sere *etal.*, 2008). Irrespective of population of livestock in the country, however, the productivity per head is usually low mainly because of inadequate year round nutrition, unimproved genetic resources and prevalence of diseases and parasites. For example, the average milk yield is only 207.6 kg per cow per lactation which is lower than the average for East Africa and Africa which is 364.4 kg and 446 kg per animal, respectively (ILRI, 2000). Beef production per animal per year is 8.6 kg, while that for sub-Saharan Africa is 13.7 kg (Richardson and Smith, 2006). For instance, average carcass weight for Ethiopian sheep is 10 kg (FAO, 2001) which is lower than the values for neighboring countries such as Sudan, Somalia, Djibouti and Kenya which have sheep carcass yields of 13, 13, 12, and 13 kg/head, respectively (FAO, 2001). Among constraints of livestock production, inadequate livestock nutrition is a major factor affecting the development of viable livestock industries in many developing countries (Sere *et al.*, 2008). Like many developing countries, insufficient and poor quality feed, particularly during the dry season, is one of the most important constraints to Ethiopian livestock feeding system (Anderson, 1987). The most important livestock feed resources in the highland of Ethiopia are natural pasture, crop residues and stubble grazing (Alemayehu, 2004) the major feed source is grazing (CSA, 2015).

Grazing lands are important sources of livestock feed in developing countries (ILRI, 1999), although unrestricted access to such resources can result in overexploitation and land degradation. CSA (2015) indicated that grazing is the major type of feed (56.23 %)followed by crops residue (30.06 %), where the remaining portion of feed supply is covered by agro-industrial byproducts and improved fodder. Although grazing has such importance to the ecology and economy of grazers, casual free grazing system has contributed significantly to the land degradation problem in many parts of Ethiopia. The free grazing system has a negative effect on the conservation efforts, as trampling animals often damage physical conservation structures such as stone terraces and soil bunds. Thus, the free grazing system results in significant negative externalities, especially for farmers who do not own livestock, as they are forced to bear the additional cost of maintaining their plots. However, these same farmers may benefit from increased soil fertility arising from the manure left by the grazing animals.

Table 1: Animal feed resources in Ethiopia

S.No	Feed Type	Percentage
1	Grazing	56.23
2	Crop residue	30.6
3	Hay	7.44
4	Agro-industrial byproducts	1.21
4	Others feed/concentrate feeds	4.76
5	Improved fodder	0.3

Source:CSA (2015)

2. Benefits of Grazing

2.1Feed source for domestic and wild animals

Grazing land is vital for health and welfare of farm animal production (Smit*etal*., 2008)). Plant species diversity influences both the performance of livestock grazing on pastures, and the quality of the raw animal products. The positive influence of sward diversity on the performance of grazing animals was confirmed by Soder*et al*. (2007). The presence of herbs and specific plant species in the sward positively influences the fatty acid composition of milk and meat, with a particular influence on health promoting substances, such as polyunsaturated fatty acids. The greatest advantage of pasture-based milk and meat production is obtaining a product with higher content of unsaturated fatty acids and vitamins, known to be beneficial for human health (Martin *etal*., 2004;Couvreur*etal*., 2006). In addition, Pastushenko*et al*. (2000) have shown that pasture feeding in organic beef and veal production improved the quantity and composition of polyunsaturated fatty acids of meat. Wood *et al*. (2003) reviewed the information about fatty acid composition of pork, beef and lamb and concluded that feeding grass elevates the content of polyunsaturated fatty acids and vitamin E. Dillon *etal*. (2005) studied the feasibility of pasture-based milk production systems in temperate regions. They indicated that such systems were characterized by lower unit production costs, through lower feed and labor expenses, as well as reduced capital investment. The production of green forage from permanent grassland consumes less energy than crop cultivation, with relatively high energy and protein yields. As a result, low-input pasture provides cheap green forage (Soder*et al*., 2007). Kasperczyk (2008) emphasizes, that economical rationalization of pro-ecological use of meadows and pastures is possible only under sustained management and should be supported by further, reliable scientific investigations.

2.2Grazing as biodiversity protection

Due to its influence on the environment, animal grazing is used as a tool for protection and restoration biological and cultural value. According to Dolek and Geyer (2002), grazing is considered to be an important practice for the survival of many threatened plant and animal species. The most important function of animals grazed on threatened grazing area is to control plant species richness. This is a serious matter in the conservation and management of plant communities and biodiversity. In order to attain the expected results, the species of grazing animal and method of pasture management must be chosen carefully whilst taking into account the local natural conditions and the conservation goals of that particular area.

Numerous field experiments on plant communities have shown that herbivores often, although not always, increase plant diversity. In most cases, grazing was introduced as a prevention measure against the proliferation of shrubs. Van Braeckel and Bokdam (2002b) studied Biebrzanski National Park (Poland) in order to evaluate the effectiveness of cattle and horse grazing as a tool to prevent the succession of undesirable plants. Their results show that grazing animals prevented and limited the invasion of reeds, but did not restore desirable agglomerations of sedges and mosses. This indicates that a major role of extensive grazing is to preserve, not to restore desirable sward composition. Hoffmann (2002) described the successful use of cattle, horses and sheep to halt the expansion and succession of shrub species. Many authors have described the use of sheep grazing for nature conservation, both in the uplands and in the mountains (Nowakowski*et al*., 2000) as well as in the lowlands (Groberek, 2005). Sheep grazing inhibited the succession of undesirable plants and had a positive effect on the enrichment and diversity of floristic communities (Gutman*et al*., 1997; Niznikowski, 2003). Sheep were also successfully used for grassland conservation in France (Debayle, 2004). Harris (2002) reported that use of sheep was successful in the conservation of habitats for endemic plants, such as the Scottish primrose (*Primulascotica*) on the Orkney Islands.

In order to maintain and preserve biodiversity of open landscapes, a combination of practices including grazing, mowing, and reed and wood cutting were suggested by van Braeckel and Bokdam (2002b). Groberek (2005) reported that sheep of the native Polish breed Wrzosowka

(Hether Sheep) were successfully used to prevent undesirable plant succession in lowland areas. Opinions about the use of mixed grazing for environmental protection are not consistent. Some authors claim that mixed grazing can lead to restoration of plants diversity, while others believe that it reduces the biodiversity of a sword. Generally, many published results suggest that the introduction of large herbivores into natural grasslands may help to maintain and enhance its botanical diversity. However, in the examples published, grazing was not always the correct method for vegetation management, as demonstrated by Kohyani*etal*. (2008) in coastal dune habitats. Thus, the existing scientific evidence indicates that scale and environmental site conditions are both to be considered when grazing animals are introduced. The successful use of grazing for environmental protection and biodiversity enhancement requires careful planning. In all cases, the choice of breed, animal density and pasture management should be suited to local conditions and conservation goals in order to achieve the desired results. There is no universal solution, and grazing programs should be tailored to local conditions.

The biodiversity of grazing-land is important not only as a tool to protect plant and animal communities, but also in sustaining their agricultural productivity. Studies show that increase in grassland productivity results in a decline in number of plant species in many habitats (Marty, 2006). Sustainable farming systems such as extensive or organic farming, with the use of farm animal grazing, are seen as a potential solution to continued biodiversity loss. According to some workers (Hansen *et al*., 2001; Bohner, 2007), organic and low-input production systems support greater genetic and biotic diversity of agricultural ecosystems). In regions with rich soils, the number of species on organic fields has been found to be up to 10 times higher compared to conventional fields (Heineken, 1990).

2.3.The role of grazing animals on general ecosystem

Grazing animals can affect an ecosystem through defoliation, treading and leaving excreta (Duncan, 2005; Wasilewski, 2006). The transport of seeds is another significant way in which grazers can influence plant diversity (Olff and Ritchie, 1998). Natural fertilization and transport of nutrients in animals' excreta is also important for grassland and adjacent biocenoses which may be used by herbivores for feeding and resting. It may be assumed that wild plants are adapted to herbivores since they have evolved together. However, the intensity of defoliation, treading and natural fertilization in farming landscapes may exceed the levels occurring in natural systems, thus adversely affecting grazing land ecosystems. Defoliation is the main way in which herbivores affect plant communities. Periodic defoliation is vital for controlling succession of plants (Rook *et al*., 2004).Intensive defoliation, on the other hand, inhibits the development of trees and shrub seedlings and supports mass growth of grasses (van Braeckel and Bokdam, 2002a). Rook *et al*. (2004) concluded that the main mechanism through which grazing animals influence pastures is their dietary selection, which in consequence creates and maintains the structural heterogeneity of pasture swards Treading or trampling creates gaps in the sward and has a positive effect on the establishment of annual and bi-annual species. (Van Braeckel and Bokdam, 2002a). Treading of the soil surface creates gaps thus allowing seeds to sprout, which in effect speeds up the growth of grasses, and eventually prevents soil erosion (Warda and Rogalski, 2004). The extent of that impact depends largely on the size of grazing animals and the number of individuals per surface area. For example, Bartoszuk*et al*. (2001) suggest that size is an advantage of using cattle for pasture conservation, as heavy animals prevent the growth of weeds by trampling and disturbing the soil with their hoofs. According to Vavra (2005), grazing animals can protect specific plant seeds by churning the soil and creating mulches which cover them. On the other hand, trampling may reduce stream bank stability and increase soil erosion (Vavra, 2005). The risk of erosion increases when a soil is wet, when animals cut the canopy very short (less than 20 mm) or when stocking rate is too high (Russell *et al*., 2001).

Moreover, the presence of grazing cattle reduced the pressure of small predators on nests and nestlings. The positive effects far exceeded nest losses caused by the cattle themselves (Mazurek 2003). Animal manure plays an important role in creating and preserving biological diversity. The excreta produced by herbivores during grazing act as a natural fertilizer and influence seed distribution. Manure is a rich source of nutritive substances essential for green biomass growth. The dispersal of faces results in species and structural diversity of flora (Peco*et al*., 2006). However, intensive grazing can also cause over-fertilization of pastures, disturbing organic matter and the nutrient circulation balance, thus negatively influencing the biodiversity of a whole ecosystem. For example, a decrease in wader populations on mown and grazed peat grassland is observed when the farmland is drained and heavily manured (Kleijn*et al*., 2001). Possible positive effects of grazing include the removal of dead growth, the opening of the canopy to allow earlier soil warming in the spring, the decreased moisture losses from the plant, the removal of some older leaves that may be infected and the intercept of significant amounts of rainfall (PAI, 2004).

2.4Importance of grazing for plant species diversity

Grazing disturbance has different effects on native and exotic plants, and on various plant functional groups. Grazing also often favors exotic annual grasses, which have higher growth rates and seed dispersal rates than perennials (Holmes & Rice, 1996). Annuals therefore sustain populations by rapidly dispersing and colonizing open patches, while perennial recruitment is more severely limited by defoliation and trampling (Seabloom*et al*., 2003). Grazing is almost always detrimental to perennial grasses (Milchunas and Lauenroth, 1993). Many exotic perennial species have been shown to be superior competitors than natives, and this competitive advantage may be amplified under grazing pressure (Thomsen *etal*., 2006; Corbin and D'Antonio, 2009). Exotic perennials have also been shown to be able to colonize more rapidly after disturbance than native perennials. Additionally, grazing is often detrimental to native forb species (Hayes and Holl, 2003). Livestock may be effectively used to control exotic invasive perennial grasses, but it may also have a detrimental effect on native species.

3. Cons of Overgrazing

3.1 Effects of overgrazing on vegetation

Botanical composition of the pasture is influenced by the joint effect of several environmental factors. In an experiment, Jones and Bunch (1995) found that the spread of a specific plant species was more affected by the annual precipitation than by the presence of animals. Grazing animals also have an effect on the botanical composition by trampling and selective grazing. Furthermore, animal faces and urine change the element content of soil and plants. Species composition is also influenced by the time of the year that a pasture is grazed. Hyder*et al.* (1975) pointed out that repeated heavy grazing during any particular month in the growing season had approximately three times higher effect on key species as did grazing during the months when plants were senescent.

The way that a plant community responds to a specific grazing pressure depends on the season effect. The area covered by Desmodium spp. decreased as the stocking rate increased; however, the same conditions did not have the same effect in the next year (Aiken, 1990).

Moreover, high grazing pressure decreases plant density. However, this may not decrease the total plant production of a given community, because the roots of other plants may simply occupy that space in the soil. These other plant species are often less productive and less palatable, often weedy forbs and brush, which would result in decreased animal productivity (PAI, 2004). According to Pratt (2002), it is important to notice that weeds do not make the land unhealthy; they appear because the land is unhealthy.

High grazing pressure changes the botanical composition of the pasture (Jávor, 1999). Török and West (1996) studied the influence of marked population growth of mouflon on the vegetation composition of 7 rock grassland communities by re-sampling after 30-50 years. The results showed environmental degradation of the communities: the presence of protected plant species decreased and that of degradation indicators increased. The rate of degradation depended on the type of the substrate. Brizuela and Cid (1993) stated that the first signs of overgrazing were a decrease in legumes and an increase in forbs and in bare soil. Similarly to overgrazing, the lack of grazing also has negative impacts on pastures of continental climate, for instance it entails the spread of weed and shrub species (Jávor*et al*., 1999). In an experiment of Longhi*et al*. (1999) species number was higher within ungrazed, fenced areas or areas where topography provided protection from grazing. Moreover, species number was correlated with herbage height, which is an indicator of grazing intensity. On the other hand, Paulsamy*et al*. (1987) found that both protected and grazed sites had equal numbers of species with different floristic composition.

Fuls (1992) claimed that long-term patch-overgrazing induced substantial vegetation retrogression with reductions in basal cover up to 90%. According to Arianoutsou*et al.* (1985), in the absence of grazing pressure the plant cover were 30% trees, 10% tall shrubs and 25% sub-shrubs. Under high grazing pressure the plant cover was mainly low woody shrubs. The grazing of a cattle herd was investigated in our experiment on the pasture of Hortobágy. Bare soil was found at over utilized areas, such as camps for rest, water and salt sources. As a result of the fact that the camps were not moved approximately for one decade the area covered with no vegetation extended to 0.1 hectares. Plant species at the bank of over utilized areas were grazing tolerant, not native and not typical of the land, such as Loliumperenne, Polygonumaviculare and Chenopodium album.

3.2Effects of overgrazing on soil properties

Increased livestock numbers in arid regions cause overgrazing which results in reduced infiltration and accelerated runoff and soil erosion. Results of several studies indicate that at the macro- and mesoscales soil erosion can increase dramatically due to overgrazing, causing increases of 5 to 41 times over the control at the mesoscale and 3 to 18 times at the macroscale (Sharma, 1997). Villamil*et al*. (1997) pointed out those inappropriate cattle grazing practices, such as overgrazing harm the quality of natural pastures and soil properties. The soil structural degradation in the upper horizons are approved by high bulk density values, high dry mechanical resistance and low structural stability in comparison with the climax situation. Soil and sward are in close connection, which determines the changes in soil physical, chemical and microbiological properties. This fact is especially true in areas where animals are grazed for a long time (Kátai, 2003). Grassland soils usually have extreme physical and chemical properties as well. Soil microorganisms play a significant role in developing soil fertility. The dominant characteristics influencing the existence and activity of soil microbes are soil water content and storing capacity, texture, size and rate of pores (Kátai, 1994). However, treading may decrease habitable pore space and increase soil bulk density, which negatively affect soil microbes (Kátai, 1998).

Zhang *et al.* (2001) stated that heavy grazing can cause grassland deterioration because of heavy defoliation and treading, and is often used for weed control. Sheep Night Penning, a form of heavy grazing, has developed into a successful method of removing the native vegetation and establishing a new pasture. Results show that high sheep density for a short duration removes almost all of the above-ground natural vegetation, but does not significantly affect the soil bulk density, the penetration resistance, and the air permeability. Jiang *et al.* (1996) also found that sheep nigh penning combined with grazing has eliminated the natural vegetation containing shrubs. The removal of natural vegetation is caused by the fact that the concentrations of ammonium-N and nitrate-N in the soil were high enough to be toxic to plant roots during and after sheep night penning (Zhang *et al*., 2001).

Abril and Bucher (1999) measured the changes in soil characteristics, nutrient availability and microbial activity on sites utilized by different grazing intensities in Argentina. Three sites were selected for comparison: a highly restored (no grazing for 20 years); a moderately restored (8 years of restoration); and a highly degraded (extremely overgrazed). The following parameters decreased as the grazing intensity increased: the soil moisture (4.5 to

2.25%), the organic matter (4.68 to 1.45%), and the nitrogen content (0.28 to 0.14%). Microbial activity ranged from 0.89 at the restored sites to 0.22 mg CO_2/g/week at the highly degraded site. According to LingHao*et al*. (1997) an average of 12.4% of the total carbon initially stored in soils (0-20 cm soil layer) has been lost due to overgrazing over the 40-year period. Most carbon loss was from the active and the slow soil carbon pools which had a residence time of decades. Villamil*et al*. (2001) claim that topsoil horizons show a reduction in depth in grazed sites, mainly as a consequence of soil compression caused by animal hooves. They found that total porosity values in the top few centimeters are lower in grazed sites, primarily due to the collapse of macro-pores (>50 μm) and larger meso-pores (50-9 μm). Evans (1996) observed that degradation occurred mostly along fences where often more than half the soil was exposed to trampling and weathering. Similarly, Moles (1992) described that bare soil is commonly found along tracks, for example around gateways or farm buildings where animals concentrate. Most bare soil, sometimes referred to as ‘sheet erosion’ (Whitlow, 1988) is created by sheep at small breaks of slope where they initiate scars by rubbing against the vegetation (Evans, 1977). Scars have been extended by the constant disruption of the soil surface by hooves, being used not only as scratching posts but also for shelter, so that vegetation cannot colonize and stabilize the surface (Evans, 1977). Tallis and Yalden (1983) also noted in their study that in case the soil surface is continually disturbed by animals during the growing season, the seedling germination and the invasion by plants is inhibited.

Overgrazing means grazing land with livestock in such numbers as to adversely affect the growth, quality or species composition of vegetation on that land to a significant degree (Statutory Instrument, 1996). Overgrazing can mean different things to the glazier and the range manager. For the glazier, it implies that the pasture can no longer carry as many animals as before, or that its productivity has declined so that the performance of the animal either in terms of live-weight gain or offspring reproduction has worsened. To the range manager therefore: the carrying capacity of a pasture or range is the number of animals of a specified type that can subsist on a unit area and produce at a required rate over a specified period, usually a season, a year, or longer. Overgrazing is believed to be the most important cause of soil degradation worldwide (Oldemann*et al*., 1991), sharing about 35.8% of all forms of land degradation. However, degradation caused by overgrazing is especially widespread in Australia and Africa, where it accounts for 80.6% and 49.2% respectively of all soil degradation, and least extensive in Europe (22.7%) (Warren and Khogali, 1992).

An optimum stocking rate allows grazing animals to produce at the most economical rate (Cowlishaw, 1969). The fact that overgrazing is not a function of animal numbers, but rather a function of time, has to be emphasized. Overgrazing occurs when animals are kept in a paddock too long or brought back too soon, the latter means that a plant is grazed before it has recovered from a previous grazing (Pratt, 2002).

Plant communities are disturbed when animals graze them. Farm animals can make easy the establishment of invasive plants by trampling and defoliating established species, thereby reducing their competitive ability and creating bare patches, and by disrupting nutrient cycles (Dorrough*et al.*, 2004). However, grazing removal also represents a disturbance (Hayes &Holl, 2003). Moderate grazing has been shown to promote community diversity (Fujita *et al*., 2009), and livestock exclusion can result in diversity loss by allowing certain species out-compete other species and establish dominance (Schultz *et al*., 2011).

4. Optimizing Livestock Production and Free Grazing

4.1Awareness creation

Creating of awareness creation to livestock farmers and experts at different levels through provision of intensive training, experience sharing and visits to successful zero grazing practices, strengthening farmers training centers and development of pilot learning sites as demonstration plots in potential areas is a key for the successful implementation of zero grazing.

4.2Practice zero grazing and land rehabilitation

Zero grazing is a grazing system that prevents livestock from grazing freely in open pasture. In this system, livestock is confined to a stall and fed with cut and carried fodder (harvested forage plant material) and other types of feed (concentrate, wheat bran etc.). Zero grazing systems help address issues of lack and degradation of grazing land, low productivity of dairy cows, low quality fodder and disease spread between free grazing cattle. It is also the ideal way to maintain improved breeds. Interventions focusing on improving water and soil conversation techniques and reforestation must be implemented on a large scale to revitalize degraded lands. Abatu*etal*. (2009) state with the current condition of the communal grazing lands; the sustainable utilization of the rangeland ecosystems is not possible. Practices like reforestation, soil conservation and water management are also crucial to sustain existing agricultural land.

4.3Management of grazing animals

Grazing is a key disturbance that shapes the structure and function of grassland communities (McNaughton 1983a, 1985). Structurally, grazing modifies the species composition, richness, vertical profiles, plant traits, and a number of other attributes of grasslands (McIntyre and Lavorel 2001; Rodrı´ guez*etal*., 2003). Functionally, grazing alters the flow of energy and the cycling of materials, both directly, through defoliation, trampling, and dung and urine depositions, and indirectly, through modification of species composition and species interactions (Hobbs *et al*., 1996). The relationships between a structural trait, species diversity, and a functional trait, primary productivity, is at the core of a current debate within the more general, but also current discussion on the relationship between biodiversity and ecosystem function (Naeem and Wright, 2003). As stated above, grasslands and their grazers provide one of the strongest and widespread cases for studying the relationship among diversity, productivity, and disturbance. Grazing drastically alters plant species composition, particularly in mesic grasslands, and it also affects above-ground net primary production (Oesterheld*et al*.,1999).

Grazing intensity is a key management variable influencing the structure and composition of pastures. A decrease in grazing intensity is assumed to favor biodiversity as a result of the increased heterogeneity of pastures (Grime, 1979). This has been confirmed by surveys of the changes in the composition of plant (Marriott *et al*., 2004) and animal species (Van Wieren, 1998) in grasslands. Additionally, while there are clear differences between herbivore species of livestock in their grazing behavior and impact on grazed communities (Dumont *et al*., 1995; Loucougaray*et al*., 2004), the breed, sex and age of the animals allowed to graze are often based on anecdotal evidences or at best on empirical studies with limited applicability (Rook *et al*., 2004), with the result that the expected biodiversity benefits are not reaped (Kleijn*et al*., 2001). Traditional livestock breeds are often recommended for grazing management to meet conservation objectives (Tolhurst and Oates, 2001) as, in addition to their adaptation to harsh environmental conditions (D’hour*et al*., 1998).

The degradation of the landscape may be a short-term phenomenon and recovery is possible after grazing pressures have been greatly reduced. This occurs because animal population crash as the vegetation cover is grazed out. This phenomenon can also be found in cold climates where, for example, reindeer have been introduced and thrived until their preferred forage has become grazed out (Leader and Williams, 1988). BCMF (2002) categorized the tools for managing over utilized grasslands. Several studies were carried out about bio-indicators of overgrazing. Read (2002) suggests reptiles as bio-indicators of the initial effects of heavy cattle grazing in a South Australian chenopod shrub land. Paton *etal.* (1997) conducted a regression for usage of grasslands by cattle for Spanish environmental conditions in which a plant species (Plant ago major) was used as a bio-indicator.

4.4Livelihood diversification

Livelihood diversification can also aid in decreasing pressure on grazing lands. Industries such as tourism and non-agricultural livestock related businesses can alleviate pressure on Ethiopia's grazing land and natural resources.The cultural mindset throughout Ethiopia equates livestock with wealth, and prioritizes quantity vs. quality. As households continue to engage in diversified industries and are able to improve their income and quality of life, livestock's association with wealth will gradually decrease.

5. Conclusion

Livestock grazing in Ethiopia is mainly based on extensive grazing of communal grazing lands and arable lands. Animals grazing communal lands are believed to perform poorly which is a reflection of nutrition, health and breeding related problems. Animal grazing is a natural process of forage utilization, because herbivores produce in the environment where evolution formed them. This is the most appropriate, low cost tool for meat production. A significant portion of world grasslands are over utilized by livestock. Although a parcel of land is not overgrazed there are some parts where signs of degradation can be found. These special areas are attractive for ungulates because there is water, supplement and salt sources, camps or shelters. Overgrazing has detrimental effects on soil and vegetation but changes are reversible. High grazing pressure decreases plant density, changes botanical composition, and often accelerates the invasion of unpalatable species. Moreover, overgrazing increases area covered by no vegetation, reduces infiltration, soil moisture and fertility, accelerates runoff and soil erosion, increases soil bulk density, penetration resistance, soil ammonia and nitrate content and changes soil microbial activity. Nevertheless, all these negative impacts can be prevented and/or reversed by proper grassland management practices. Strategies of grazing land management such as grazing management, treatment of crop residues and livelihood diversification are the methods to reduce the negative impact of free grazing and use the grazing land properly in Ethiopia.

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