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Original Research Article

Effects of livestock grazing on key vegetation attributes of a remnant forest reserve: The case of Desa'a Forest in northern Ethiopia

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ABSTRACT

The study was conducted in Desa'a Forest with the objective of investigating livestock-forest interaction. This study also evaluated the grazing pressure on Desa'a Forests from livestock, the potential of forests biomass feed production and current livestock density relation to the sustainable stocking rate. Data on socio-economic and community perception about livestock-forest interaction were collected through structured questionnaire on 90 households. To determine the species composition, abundance, density and diversity of woody plants, using stratified random sampling, four transect lines were laid out in east, west, north and south direction. Accordingly, the results are representative of Desa'a Forest. In the study area, 90% of the respondents (81 households) entered their livestock into Desa'a Forest and only 10% of the respondents (9 households) did not use Desa'a Forest. A total of 63 woody plant species were identified in the study area. According to farmers and pastoralists' opinion, 49.15%, 15.25%, 28.81% and 6.79% of woody species were identified as highly palatable, palatable, less palatable and unpalatable respectively. The mean herbaceous biomass production in Desa'a Forest is 1255.86 kg/ha. The predicted mean annual browse biomass production was 3000.72 kg/ha. The potential stocking rates for Desa'a Forest were 68480.39 TLU/year obtained based on the amount of fodder available to the livestock in the forest. The available potential browsing unit per hectare in the centre, North-West direction and south-east direction was 1432.66 BU/ha, 665.83 BU/ha and 203.66 BU/ha, respectively. Only 5.65% of the total surveyed households practice forage development which are the key to overcome feed shortage and decrease the pressure from the forest.

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1. Introduction

Forests and woodlands are estimated to occupy 650 million ha or about 22% of the total land area of Africa, which corresponds to about 17% of the global forest cover (FAO, 2001). Firewood is the most important forest product and the main source of energy for most African households, accounting for 91% of all wood consumption. According to the FAO (2001), the forests of the East Africa region account for 21% of the forest area of Africa. However, the annual rate of deforestation in the region has increased from 0.7% during the period 1981–1990 (FAO, 1993) to 1% between of 1990–2000 (FAO, 2001). Ethiopia is one of the countries in this region with annual deforestation rate of 0.8% (FAO, 2001). The loss of forest cover in the country's highlands is not a recent phenomenon. However, the extent and intensity of forest loss to occur over the last hundred years has been severe.

The main agents of deforestation include agricultural expansion, grazing, consumption of firewood and charcoal, and forest fire. Poverty and rapid population growth are the main causes of deforestation. Owing to the severe deforestation, the recent data on forest resources of Ethiopia reported in (FAO, 2010) puts Ethiopia among countries with forest cover of 10–30%. According to this report Ethiopia's forest cover (FAO definition) is 12.2 million ha (11%). This process has a negative impact on the contribution of the forestry sector to the national income. Moreover, the degradation and depletion of the forest resource base has a major impact on other natural resource uses and sectors in the economy such as agriculture, and water resource, energy and biodiversity conservation. Such depletion of forest vegetation is particularly severe in the highlands of northern Ethiopia (Berhanu, 2000; Nyssen et al., 2004); almost all available land is under cultivation or used for pasture. Scattered, remnant forest stands of African pencil cedar (Juniperus procera Hochst. Ex Endl.) which are presumed to be the dominant natural forest type of the region, suggest that the highlands were once covered by these forests.

Forests and woodlots cover less than 1.6% of the area of Tigray (BoPED, 1995). Deforestation is due to cutting trees for fuel, timber and agricultural implements, and clearing forests to expand agricultural land. Forests, woodlots and grazing lands have been predominantly common-pool resources or open access resources in the region (Berhanu et al., 2000; Fujisawa, 2004), which resulted in wide-spread environmental problems, namely soil erosion, soil nutrient depletion, moisture stress, deforestation and overgrazing. The severe shortage of fuel wood made rural communities increasingly dependent on animal dung for fuel, which exaggerates the problem of declining soil fertility (Berhanu, 1998; Fitsum et al., 2002), but mainly contributes to an increased pressure on remnant forest stands. Although about 40% of the total land area is used for grazing (BoPED, 1995), shortage of feed sources is the major livestock production problem (Berhanu et al., 2000), which also increases pressure on remnant forest stands. On the other hand, Tigray is also known for its different efforts to address those problems. Major strategies of environmental rehabilitation concerning forests include establishment of exclosures, community woodlots and enforcement of grazing restrictions (Berhanu, 1998; Adhikari et al., 2004; Mekasha et al., 2014). Since 1991, the role of local communities in resource management has been increasing as the present government recognizes the importance of local participation in environmental and development projects. Nevertheless, little evidence exists about the nature of local level institutions and organization for resource management in Tigray and their effectiveness (Berhanu et al., 2000).

Desa'a Forest acts as a climate buffer between the Danakil deserts in the Afar region and the highlands of Tigray (Zenebe, 1999). Desa'a forest is one of the 59 National Forest Priority Areas (NFPAs) in the Ethiopia, which means that endangered endemic plant and animal species and genetic resources in general are protected, and that unique and representative habitats have to be conserved (TGE, 1994). Although Desa'a forest is a protected area, it is subject to illegal cutting and grazing, resulting in the reduction of forest cover, biodiversity loss and land degradation. Desa'a forest is a dry Afromontane forest that is located in a matrix of agriculture and strongly grazed Acacia shrub savannah (Janssens, 2009). It can be stated that this dry secondary forest is highly degraded (Zenebe, 1999). It has an average tree height of 3 m and is dominated by thorny shrubs and the trees Olea europaea subsp. cuspidata (Wall. Ex G.Don) Cif. (or African Olive) and African pencil cedar, while other dominant species are Carissa edulis Vahl, Dodonaea viscosa var. angustifolia (L.f.), Benth and Maytenus obscura (A.Rich.), and Cufod (Janssens, 2009). Natural regeneration is rather low like in most Tigray forests (Janssens, 2009).

Grazing is still practiced in traditional forest management systems in many parts of the world. In mountain environments, where agricultural activities are constrained by climate, animal husbandry is one of the livelihood options available to many farmers. In the Mediterranean region of North Africa, forest grazing is still a popular tradition (Karmouni, 1997). Forest grazing is also widely practiced in Bhutan and Himalayan coniferous forests (Roder et al., 2002). According to Mekasha et al. (2014), the multipurpose utilization of forest resources including forest grazing has a long tradition in the Swiss Alps. It is also a very common practice in the montane forests of Ethiopia. Although Desa'a Forest is a protected area, it is subject to grazing, resulting in the reduction of forest cover, biodiversity loss and land degradation. Livestock grazing is a very important element of household income in many communities in Tigray. This is also true in case of communities around Desa'a Forests as their livelihoods depend on livestock and forests. Therefore, the overall objective of this study was to assess the effect of livestock and remnant montane forest reserve interactions at Desa'a Forest in northern Ethiopia. More specifically, the paper aims to:

1 Assess the socio-economic characteristics and perception of the community on forest and livestock interaction.
2 Quantify the current magnitude of grazing pressure on key vegetation attributes in Desa'a Forest.
3 Determine actual and potential the above-ground biomass production of feed in the study area.
4 Explore the potential and mechanism of introducing fodder trees in the farming system to alleviate grazing pressure inside the forest.