

Socio-Ecological Impacts of Invasive Plant Species in Ethiopia: A Review Paper

Wakshum Shiferaw^{1*}, Tamrat Bekele², Sebsebe Demissew² and Ermias Aynekulu³

¹Arba Minch University, College of Agricultural Sciences, Natural Resources Management, P.O. Box 21, Arba Minch, Ethiopia

²Addis Ababa University, College of Natural Sciences, Plant Biology and Biodiversity Management, P.O. Box 3434, Addis Ababa, Ethiopia

³World Agroforestry Centre (ICRAF), UN Avenue, P.O. Box 30677, Nairobi, Kenya.

Received May 27, 2019; Accepted June 03, 2019; Published March 24, 2020

ABSTRACT

Ethiopia has diverse vegetation ecosystems and home to large number of flora, fauna and microbial species. These provide suitable ecosystem services for environmental and diverse economic outcomes. However, there are threats to socioeconomic and biodiversity by invasive alien plant species (IPS). They cause threats to biodiversity, economic and health problems in Ethiopia. This paper addresses the ecological impacts of IPS on biodiversity in the major types of ecosystems, examine the impacts on socio-economic; discuss mitigation measures of the IPS in Ethiopia. Some of these species include *Prosopis juliflora*, *Parthenium hysterophorus*, *Eichhornia crassipes*, *Lantana camara* and Acacia species, which are the major threats to biodiversity losses. Water bodies, wetlands, disturbed vegetation types (e.g. Acacia-Commiphora vegetation type), agro-ecosystems, road sides, urban green areas, range lands are under threat of IPS nowadays in the country. Results revealed that under *P. juliflora* thicket for instance, 96% of woody species were constituted by *P. juliflora* than the overall 3.9% of woody native plant species. Moreover, it was also found that number of cattle, sheep, goats and camels were reduced by 56.2%, 25.2%, 19.2% and 48.6%, respectively after the invasion of *P. juliflora* in South Afar region. To minimize and control such invasions, different strategies are being applied such as eradication by utilization of *P. juliflora* in Afar region for example, and mechanical control of *P. hysterophorus* in different parts of the country. For use of sustainable ecosystem services, strategies such as integrated management strategies, participation of all stockholders and multidisciplinary research approaches within and across countries should be designed to reverse the situations.

Keywords: Biodiversity, Ecosystem, Ethiopia, Impact, Invasive, Plants, Socio-economic

INTRODUCTION

Ethiopia has great geographic diversity, and macro and micro-climatic variability. However, there are threats its biodiversity through habitat conversion, invasive species, and unsustainable utilization of resources of biodiversity [1]. In addition they cause for the deterioration and reduction of livelihood options of the communities in the invaded areas. Alien plant species are plant taxa occurrence in a given area results from their introduction (intentionally or accidentally) by human activity out of their ecosystems or ranges whereas invasive plants are alien plants that recruit reproductive offspring, often in very large numbers, spread rapidly whereas alien species [2]. **Figure 1** shows those mesquites (*Prosopis juliflora*), parthenium weed (*P. hysterophorus*), water hyacinth (*E. crassipes*), *L. camara*, *Parkinsonia aculeate*, Acacia species and *Cryptostegia grandiflora* are identified as IPS in Ethiopia [3]. This paper addresses the ecological impacts of IPS on biodiversity in the major types

of ecosystems, and discusses the reasons why IPS in Ethiopia constitute a threat to socioeconomic and biodiversity, examine the impacts on socio-economic, discuss its use and suggest mitigation measures of the IPS in Ethiopia.

Corresponding author: Wakshum Shiferaw, Arba Minch University, College of Agricultural Sciences, Natural Resources Management, Tel: +251911972481; E-mail: waaqsh@yahoo.com

Citation: Shiferaw W, Bekele T, Demissew S & Aynekulu E. (2020) Socio-Ecological Impacts of Invasive Plant Species in Ethiopia: A Review Paper. J Agric Forest Meteorol Res, 3(2): 282-286.

Copyright: ©2020 Shiferaw W, Bekele T, Demissew S & Aynekulu E. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

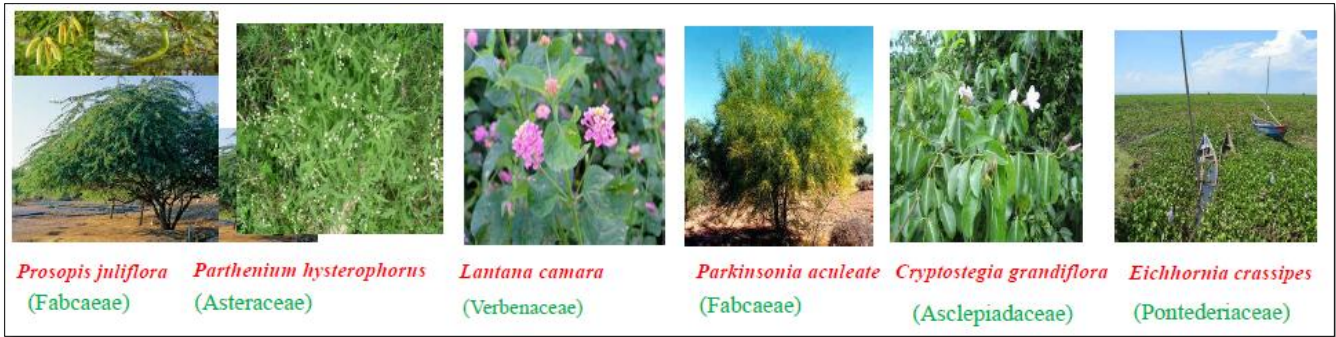


Figure 1. Showing the most serious invasive alien plants in Ethiopia.

METHODS AND MATERIALS

To compile this paper, books, research papers, manuals, reports and proceedings were reviewed and used.

RESULTS

Livestock holdings of pastoralists and agro pastoralists were declined in arid and semi-arid lowlands of Afar region due to invasion *P. juliflora*. The *P. juliflora* thickets in Afar Region in Ethiopia had impacts not only the pastoral

livelihoods but also restrict easy movement of human beings and its livestock through blocking roads [4]. Findings by Shiferaw et al. [5] revealed that invasion of *P. juliflora* had showed significant negative effects on native trees ($F=211$, $P<0.0001$) and the higher number of trees 1203 (96.1%) under *P. juliflora* canopy was contributed by *P. juliflora* than 49 (3.9%) of native trees (Figure 2).

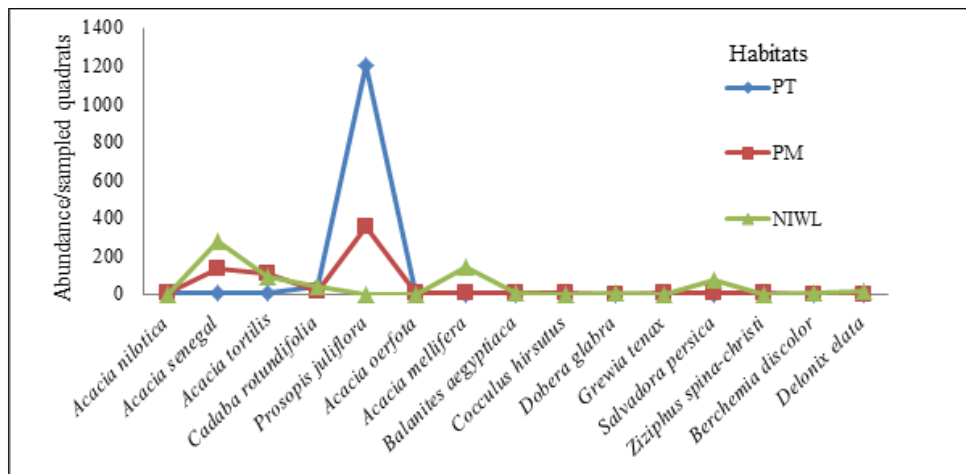


Figure 2. Abundances of woody species in PT (*P. juliflora* thicket), PM (*P. juliflora* mixed with native species) and NIWL (non-invaded wood lands) habitats, southern Afar wood land.

Findings of Shiferaw et al. [4] also showed that only in 2017/18 cropping season post invasion of *P. juliflora* in South Afar region were reduced number of cattle, sheep,

goats and camels by 56.2%, 25.2%, 19.2% and 48.6%, respectively (Table 1).

Table 1. Status of the livestock status before and after *P. juliflora* invasion in South Afar region.

Livestock	Number before invasion of <i>P. juliflora</i>	Number after invasion of <i>P. juliflora</i>	Number	%
Cattle	362	158	204	56.2
Sheep	377	282	95	25.2
Goats	412	332	80	19.4
Camels	214	110	104	48.6

Source: Wakshum Shiferaw Gameda

Invasive plant species are threatening biodiversity in Ethiopia and elsewhere in the world (Table 2). *P. juliflora*, *P. hysterophorus* and *E. crassipes* are the three most aggressive invasive species in Ethiopia. They are invaders that will have the largest impacts that directly modify ecosystems (Table 3). They are invaders however, the

potential irreversibility of the damage of invasion and the indecision of the costs they may incur stand out as challenges to their management [6] (Table 4). *P. juliflora* is among alien plant invasions which have major impacts on ecosystem service values and the livelihoods [7].

Table 2. Identified and prioritised invasive alien species in Ethiopia [8].

Scientific names	Common names	Scientific names	Common names
<i>E. crassipes</i>	Water hyacinth	<i>P. juliflora</i>	Mesquite, Prosopis, Woyanezaf (Amh)
<i>L. camara</i>	Lantana, Wefkolo (Amh)	<i>P. hysterophorus</i>	Parthenium, Congress weed, White top, Feremsisa (Orm)
<i>P. hysterophorus</i>	Parthenium, Congress weed, White top, Feremsisa (Orm)	Striga species	Striga
<i>P. juliflora</i>	Mesquite, Prosopis, Woyanezaf (Amh)	<i>E. crassipes</i>	Water hyacinth
Striga species	Striga	<i>L. camara</i>	Lantana, Wefkolo (Amh)
Acacia species*	Fullsa (Orm)	Acacia species*	Fullsa (Orm)
Orobanche species	Orobanche , Atequrit (Amh)	-	-
<i>Cuscuta campestris</i>	Cuscusta	-	-
<i>A. mexicana</i>	Argemone, Nech Lebash (Amh)	-	-
<i>Verbesina encelioides</i>	Verbesina	-	-
Opuntia species	Opuntia, Qulqual (Amh)	-	-

* Probably a native species like *A. drepanolobium*, Orm=Afaan Oromo, Amh=Amharic

Table 3. Distribution of IAPS across regions in Ethiopia.

Oromia	Somali	Afar	Tigray	Amhara	South	Gambela
<i>P. hysterophorus</i>	<i>P. hysterophorus</i>	<i>P. juliflora</i>	Striga species	Striga species	<i>E. crassipes</i>	<i>E. crassipes</i>
<i>P. juliflora</i>	<i>L. camara</i>	<i>P. hysterophorus</i>	Orobanche species	Orobanche species	<i>P. juliflora</i>	-
Striga species	<i>P. juliflora</i>	Acacia species	<i>P. hysterophorus</i>	<i>P. hysterophorus</i>	<i>A. mexicana</i>	-
<i>L. camara</i>	-	-	Opuntia species	Opuntia species	<i>P. hysterophorus</i>	-
<i>E. crassipes</i>	-	-	<i>P. juliflora</i>	<i>P. juliflora</i>	-	-
Orobanche species	-	-	-	<i>E. crassipes</i>	-	-
Acacia species	-	-	-	-	-	-
<i>Argemone mexicana</i>	-	-	-	-	-	-
<i>Mimosa pigra</i>	-	-	-	-	-	-
<i>M. diplotricha</i>	-	-	-	-	-	-
Opuntia species	-	-	-	-	-	-

Table 4. Invasiveness and ecosystem effect status of top twenty IAPS in Ethiopia [9].

Species	Ecosystems highly affected*	Distribution status
<i>P. hysterophorus</i>	1,2,3,4,5,6,7,8	High
<i>P. juliflora</i>	1,2,3,4,5,6,7,8	Moderate
<i>Opuntia ficus indica</i>	3,4,5,6,	Moderate
<i>O. stricta</i>	3,4,5,6,	Moderate
<i>M. diplotricha</i>	1,2,3,4,5,6,8	Moderate
<i>M. pigra</i>	3,4,7	Low
<i>Cryptostegia grandiflora</i>	2,3,4,7,8	Low
<i>L. camara</i>	1,2,3,4,5,6,8	High
<i>A. drepanolobium</i>	1,3,4	Moderate
<i>A. saligna</i>	2,3,4,5,	Low
<i>Parkinsonia aculeata</i>	2,4,5,6	Low
<i>Nicotiana glauca</i>	1,2,3,4,5,6	Moderate
<i>Argemone ochroleuca</i>	1,2,3,4,5,6	High
<i>Xanthium strumarium</i>	1,2,3,4,5,6	High
<i>X. spinosum</i>	1,2,3,4,5,6	Moderate
<i>Psidium guajava</i>	8	Low
<i>Senna didymobotrya</i>	1,2,3,4,5,6,8	High
<i>S. occidentalis</i>	2,4,5	Moderate
<i>Calotropis procera</i>	1,2,3,4,5,6,7,8	Moderate
<i>Ricinus communis</i>	2,4,5,6	Moderate

1=Cultivated land; 2=Roadside; 3=Grazing areas; 4=Non-cultivated land; 5=Rural villages; 6=Urban areas; 7=Riverside; 8=Forest areas

CONCLUSION

Invasive alien species are found in all taxon or organisms and exist all over the world in all ecosystems. Invasive alien species are colonizing the native ecosystems; have either positive or negative consequences on socio-economic and the ecosystem services. Among the best control measures are prevention of seed dispersal, integrated management strategies and management by utilization.

REFERENCES

1. EBI (Ethiopian Biodiversity Institute) (2014) Ethiopian's fifth national report to the conservation biodiversity.
2. Shine C, Kettunen M, ten Brink P, Genovesi P, Gollasch S (2009) Technical support to EU strategy on invasive species (IAS) – Recommendations on policy options to control the negative impacts of IAS on biodiversity in Europe and the EU. Inc: Final report for the European Commission. Institute for European Environmental Policy (IEEP), Brussels, Belgium, p: 35.
3. Shiferaw W, Demissew S, Bekele T (2018) Invasive alien plant species in Ethiopia: Ecological impacts on biodiversity a review paper. Int J Mol Biol 3: 171-178.
4. Shiferaw W, Demissew S, Bekele T (2019) Encroachments and socio-ecological impacts of *Prosopis juliflora* (Sw.) DC. (Fabaceae) in Afar National Regional State, northeast Ethiopia. PhD Thesis, Addis Ababa University, Ethiopia
5. Shiferaw W, Demissew S, Bekele T, Aynekulu E (2019) In: Invasive alien species: threat to sustainable livelihoods and ecosystems health. Invasive impacts of *Prosopis juliflora* on plant diversity and regeneration potential of native species in Southern Afar Region, Northeast Ethiopia. 29th Annual Conference of the

Biological Society of Ethiopia. May 3-4, Addis Ababa, Ethiopia

6. McNeely JA, Mooney HA, Neville LE, Schei P, Waage JK (2001) A global strategy on invasive alien species. IUCN Gland, Switzerland and Cambridge, UK, p: 50.
7. Shiferaw H, Bewket W, Alamirew T, Zeleke G, Teketay D, et al. (2019) Implications of land use/land cover dynamics and *P. juliflora* invasion on ecosystem service values in Afar region, Ethiopia. *Sci Total Environ* 675: 354-366.
8. Global Environment Facility (GEF) (2002) Removing barriers to invasive plant management in Africa. Inc: Country Report on National Stakeholders Workshop on Invasive Alien Species, August 17-18, 2002. Addis Ababa, Ethiopia.
9. Fessehaie R, Tessema T (2014) Alien plant species invasions in Ethiopia: Challenges and responses. In: International Workshop on Parthenium Weed in Ethiopia, Addis Ababa.