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# Ecological and Economic Dimensions of the Lantanca-amara (*Lantana Camara* L.) and Challenges in Ethiopia

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## ABSTRACT

*Lantana camara L. is one of the worst invasive alien species that are categorized worldwide. The objective of this review paper was to review ecological and economic dimensions of the invasive species- lantanca-amara and challenges in controlling expansion of lantanca-amara. It is considered a problem weed in many of the countries to which it has been introduced the flowers prolifically and the seeds are dispersed by birds and can grow in individual clumps or as dense thickets, crowding out more desirable species. Prevention of invasive alien invasive species is the most effective management strategy because it minimizes the risk of environment. Utilization of Lantana camara L. for various purposes, prevention of its dispersal into non-infected areas, use of fire, mechanical and biological control and awareness creation are the suggested prevention strategies that can bring solutions to the risk posed within the country. Integrated, coordinated and multi-stakeholder and multiple level actions that the community, government and development partners shall participate in the eradication of the invasive plant L. camara.*

**Keywords:** *Biological control, Environment, Invasive alien species, Lantana camara,*

## INTRODUCTION

Invasive alien species are species which are introduced unintentionally or intentionally into a natural environment with serious negative consequences for their new environment and alter ecosystem structure and function (Reda & Tewelde, 2018). Invasive alien species are the most important global problems experienced by natural ecosystems (Tadele, 2014). Biological invasion is a natural process and recent accelerated rate of invasions is clearly man made phenomenon and constitutes one of the most important effects that humans have created on the earth (Abebe, 2018).

The increase in the movement of these invasive alien species due to various reasons such as increased transport, trade, travel has accelerated their rate of introduction everywhere and these activities provide pathways for these species to cross bio-geographical barriers that would usually block their way, with harmful consequences on native biological diversity (Geleto, 2018).

Thus, as one of the greatest drivers of native biodiversity loss, invasive alien species can pose a threat to ecosystem integrity and function.

*Lantana camara L.* (Verbenaceae), a fast-growing woody thicket-forming shrub, is native to tropical and sub-tropical South and Central America and currently widely distributed in many countries including Ethiopia (Tadele, 2014). It is among the top ten invasive weed species on earth and can aggressively establish in open forest lands, plantations, farmlands and wastelands. Lantana camara L. (Verbenaceae) grows under a wide range of climatic conditions and occurs on a variety of soil types reflecting its wide ecological tolerance(Gemeda et al., 2019).

L. camara is considered a problem weed in many of the countries to which it has been introduced the flowers prolifically and the seeds are dispersed by birds and can grow in individual clumps or as dense thickets, crowding out more desirable species(Syed & Guerin, 2007).

In disturbed native forests, it can become the dominant understory species, disrupting succession and decreasing biodiversity. Its allelopathic qualities can reduce vigour of plant species nearby and reduce productivity in orchards. It can affect agriculture by outcompeting native pastures by interfering with

the mustering of cattle, and by causing death of stock by poisoning (Belay & Hailu, 2017). However, no adequate recent information exists about the ecological and economic dimensions of the invasive species- lantanca-amara and policy challenges in Ethiopia. Therefore, this review aims to review ecological and economic dimensions of the invasive species- lantanca-amara and policy challenges in controlling expansion of lantanca-amara and in Ethiopia.

### *Lantana Camara* L. As A Global Invader

Lantana is a widespread and problematic invasive plant with negative effects in over 60 countries globally(Shackleton et al., 2017). It originates from tropical America and was commonly introduced toother countries around the world, mainly by British colonialists, as an ornamental and/or living. It is now invasive in many parts of Africa, Asia and Oceania. The distribution and density of lantana is still increasing in many parts of the world, even in areas where it has been present for many years. Lantana is estimated to have invaded 5 million ha in Australia, 13 million ha in India and 2 million ha in South Africa and is continuing to spread in these countries(Shackleton et al., 2017). Lantana has many traits that make it a good invader, including all-year flowering and fruit production in many areas, especially if adequate moisture and light are available; adaptation to long-range dispersal by birds and some mammals; high establishment rates; the ability to coppice; poisonous leaves; high phenotypic plasticity; the ability to hybridise; vegetative reproduction; and allelopathy (Mihertu, 2018).

Where it invades, lantana produces dense thickets, which have a negative impact on biodiversity, livestock and people. As the density of lantana increases, species richness decreases, probably as a result of the allelopathic effects and direct competition of this noxious weed(Vol, 2013).

### Invasive Alien Plants and Biodiversity

Among the invaders that will have the largest impacts are those that directly modify ecosystems. They have cascading effects for resident biota (plants, animals and micro-organisms). Exotics can affect ecosystems by altering system-level flows, availability or quality of nutrients, food, and physical resources (e.g. living space, water, heat or light)(Argaw, 2016). Many literatures suggest that introduced ecosystem engineers either: increase habitat complexity or heterogeneity which tends to cause abundances and /or species richness to raise or decrease complexity tends to have the reverse effect on ecosystem services(Mihertu, 2018). Ecosystem services can be categorized into four main services in general; (1) Provisioning service (e.g. food, freshwater, fiber, fuel, genetic resources, (2) Regulating services (e.g. air quality regulation, climate regulation, water regulation) (3) Cultural services are non- material benefits, (e.g. aesthetic values, recreation/tourism, spiritual/ religious values, (4) Supporting services. Overarching, indirect, and occur on large temporal scales (e.g. photosynthesis, primary production, nutrient cycling.

## Negative Impact of Lantana Camara

### Biodiversity Loss

Lantana camara L. colonizes disturbed sites, impacting croplands, and range lands. It generates allele chemicals by roots in the soil through root exudates(Mihertu, 2018). These alleleo chemicals inhibitors(like phenolicacids and alkkaloids) inhibit the germination, growth, and yield of neighboring plants through the mechanism called non-resource mediated interference and this m may adversely affect plant species diversity by displacing mature vegetation or limiting juvenile recruitment(Gemeda et al., 2019).

The other mechanism by which Lantana can affect biodiversity is through competition for resources (e.g. water, nutrients, sunlight). In addition to allelopathy, it fast growth and unpalatable nature (due to its un palatability the weed experience relatively little pressure from natural predators compared to those which have evolved in their native land favored the weed to affect biodiversity by competing out native species(Abebe, 2018).

### Agricultural Loss

The adverse impacts of Lantana camara L. on agriculture have been studied in several parts of the world(Dogra, 2018). Lantana camara L. may have an indirect effect on crop production due to ho t for many insect pests that can affect human health. In addition to its effect on root and shoot growth, biomass, and host for vectors, the weed can affect mustering of cattle (by out-competing native pastures that are preferable feed for the cattle) hence affect agriculture. Lantana may also affect agriculture by providing shelter for threatening wild animals like wild cats, hyena (these animals may consume cattle, goat, and

sheep), warthog (can damage crops) and others(Abebe, 2018).

## Uses of Invasive Alien Plants

Introducing species to new locations has had tremendous contributions to societal development. Human welfare has been improved due to the introduction of many crops out of their native range.17Accidental and deliberate introduction of some species, however, resulted into unexpected negative outcomes. Some species turned into invasive species presenting complex and dynamic problems to society (Shiferaw et al., 2018).

## Management of Invasive Alien Plants

The potential irreversibility of the damage of invasion and the indecision of the costs they may imply impose countries a preventive approach to their management. Prevention not allowing a potentially invasive species to become established in the first place is the first line of defense.

The main management responses after a species has invaded are mitigation and adaptation. Mitigation can reduce or eliminate the likelihood that a species will become established or spread, and decrease or eliminate the presence of an invader(Gemeda et al., 2019). Adaptation, on the other hand, involves changes in behavior in order to reduce the impact of an invasive species(Shiferaw et al., 2018).

## *Lantana Camara* L. Prevention Methods

Prevention of invasive alien invasive species is the most effective management strategy because it minimizes the risks (like environmental) associated with utilization of other methods (for example chemicals) and reduces management costs(Kefelegn, 2015). People should reduce utilization of *Lantana camara L*. as an ornamental plant in the vicinity of their home or crop fields. This may also help prevention of *Lantana camara L*. further in Ethiopia. Furthermore, at a regional level, each regional government must have a biosecurity plan that covers invasive plants like Lantana camara L. in its area(Belay & Hailu, 2017).

## Mechanical Control

Mechanical measuresmay minimize disturbance to nearby vegetation and effective in killing the weed they also had their own limitation. The use of bulldozers and tractors, and plowing by Oxen may set the difficulty in removing *Lantana camara L*. where large areas are invaded and may result in regrowth from stumps and/or increased seedling germination from the disturbed soil. Mechanical measures can also make areas susceptible to soil erosion and other opportunistic weeds (since the measures may result in soil disturbance) unless proper care and follow up is considered(Amp et al., 2015). Likewise, if care is not well-thought-out grubbing, the slashing of branches and extensive digging of the root system may also result in the establishment of coppicing from slashed branches of *Lantana camara L*(Shackleton et al., 2017).

## Fire

Regular burning will reduce the capacity of invasive alien species to survive; however, initial kill rates are variable. This method will depend on the suitability of available fuel loads, litter moisture content, fire intensity, temperature, relative humidity, soil moisture and season. Pasture re-establishment can then provide competition to inhibit *Lantana camara L*. seed germination (Amp et al., 2015). Although, *Lantana camara L*. burns readily during hot, dry conditions, even when green, moderate and low-intensity fires can promote the persistence and spread of its thickets, rather than reducing them.

Furthermore, the elimination of competing native plant species (native plant species that are not fire tolerant) and increases in soil nutrients following burning (since burning can promote the release of nutrients from organic matter) can increase Lantana camara L. germination (Shackleton et al., 2017).

## Chemical

Another expensive but effective method for management of Lantana camara L. is the utilization of Chemicals but its effectiveness depends on plant size, time of application and way of application. Numerous herbicide treatments can be used and are said to be effective when applied as a foliar spray or to the base of the stems and cut stumps(Shackleton et al., 2017). Like the other management strategies utilization of chemicals requires care and follow-up.

## Biological Control

Biological control can be considered relatively as the best and most desirable control option for the control of Lantana camara L. because it will not be influenced by constraints (because the other management options like mechanical and

chemical are dependent on the land use, extent and density of the invasive populations, accessibility to invaded areas, economic value of land, and the associated costs)(Shiferaw et al., 2018). In addition, utilization of chemicals may not only be expensive and difficult but may also result in long-term environmental pollution and possible serious problems which may come upon in the future.

## Conclusion and Recommendation

Ethiopia has diverse ecosystems which are home to large number of flora, fauna and microbial species. However, there are threats to ecosystem services and biodiversity loss due to habitat conversion, invasive species, unsustainable utilization of biodiversity resources, replacement of local varieties and breeds, and climate change and pollution. Invasive alien species such as plants are exotic which are introduced deliberately or unintentionally outside their natural habitat naturally or through human activities. In new areas, invasive alien species are colonizing the native ecosystems; have either positive or negative consequences on the ecosystem services. Invasive alien species are found in all taxon or organisms and exist all over the world in all ecosystems. Therefore, it needs for an integrated, coordinated and multi-stakeholder and multiple level actions that that the community, government and development partners shall participate in the eradication of the invasive plant L. camara. This would require the restriction of further spread of L. camara into non invaded areas, restriction use of Lantana in gardens and strategically controlling infestations by mechanical mechanism.

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