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Ecological and Economic Dimensions of the Paradoxical Invasive Species- *Prosopis juliflora* and Policy Challenges in Ethiopia

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Abstract

Prosopis juliflora, a dry land tree or shrub, introduced in Ethiopia in the 1970's for land reclamation and windbreak has become a serious policy challenge. The species has replaced large areas of pasture lands and has grown to be a noxious weed in Ethiopia. It has had serious repercussions on the biodiversity of the area, and livelihood of pastoralists and agro-pastoralists. Despite the potential of the species for various uses, in Ethiopia *Prosopis juliflora* is only utilized for animal feed, fencing and charcoal at smaller scale. The conventional control methods are expensive and it could be argued that the utilization of the species is the best option to control the invasion for many invaded areas. There is an urgent need for identification and implementation of optimal strategies in Ethiopia which, however, seems very difficult given the absence of clear national policies and strategies in the management of invasive species.

Keywords: invasive species, *Prosopis juliflora,* pasture, pastoral, biodiversity

1. Introduction

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 (Ewel et al., 1999). Accidental and deliberate introduction of some species, however, resulted into unexpected negative outcomes. Some species turned into invasive species (IS) presenting complex and dynamic problems to society (Ewel et al., 1999; McNeely, 2001). Here, the term invasive is used to refer to ''species that are introduced to their non-native ranges and are invading a new location causing ecological and economic problems''(Hyder, Leung, & Miao, 2008).

Invasive species threaten important ecosystems with serious repercussions on human wellbeing and economic development of societies. The impact of invasive species is more critical in the developing world where livelihood is primarily dependent on agriculture(Chenje & Mohamed-Katerere, 2006). Consequently, invasive species management is one of the strategic intervention areas in achieving the Millennium Development Goal1- to halve hunger and poverty by 2015 (Chenje & Mohamed-Katerere, 2006; Rangi, 2009). Apart from their direct effect on livelihood, invasive species are one of the five drivers of biodiversity loss together with habitat loss, over exploitation, climate change, and pollution(Millennium Ecosystem Assessment, 2005).

The multifaceted problems of IS has been at the top of policy agenda throughout the world. How to control, eradicate and prevent IS are the main challenging questions that need to be addressed in policy design(Emerton & Howard, 2008). The policy challenge posed by IS in developing countries is particularly serious as they arise in complex social, economic and political problems prevalent in these countries(Chenje & Mohamed-Katerere, 2006). Invasive species pose a complex policy problem especially when they have both beneficial and harmful aspects. A very good example of such a species is *Prosopis juliflora* (*Prosopis* henceforth) which is now a policy dilemma for many countries where it is introduced. The issue of this invasive species in Ethiopia is particularly interesting as the invasion is on internationally important biodiversity sites of the country and due to the relation of the problem to susceptible livelihoods of pastoralists and agro-pastoralists.

2. Arrival and Establishment of *Prosopis* in Ethiopia

Prosopis is a perennial multipurpose dry land tree or shrub native to South America and the Caribbean. It is a fast-growing, often evergreen and drought resistant plant of desert and semi-desert areas. *Prosopis* is one of the species of the family *Fabaceae* (Leguminosae), subfamily *Mimosoideae* and genus *Prosopis* (N. M. Pasiecznik et al., 2001). It has trunk diameter about 1.2m and has height ranging from 3 -12 m which seldom reaches around 20m

(Jama & Zeila, 2005; as cited in N. M. Pasiecznik et al., 2001). *Prosopis* has been introduced in many parts of the world (Africa, Asia and Australia) during the last 100-150 years. The species is now established in Africa; including Ethiopia, Kenya, Eritrea and Sudan (Bokrezion, 2008; N. M. Pasiecznik et al., 2001). When, from where and how *Prosopis* was introduced in Ethiopia is not well documented and there are different narrations on its arrival and spread. Some believe that Ministry of Agriculture introduced the species during the 1970's indiscriminately to both degraded and high quality pastures, including those in the Afar National Regional State(ANRS), to serve as a shade tree and wind break for plantations, and for land reclamation(Dubale, 2008; Kebede, 2009). Others, however, contend that the introduction of the species to the ANRS, the most invaded part of the country, is done by foreigners working in the area in the late 1970's or /and 1980's(Kebede, 2009; Sertse & Pasiecznik, 2005). The spread of the species was also facilitated later by the Food for Work Program between 1986 and 1988(Sertse & Pasiecznik, 2005). Unfortunately, this introduced *Prosopis* species in Ethiopia, like many African countries and India, is the most aggressive of all *Prosopis* (the Genus *Prosopis*) species and is of inferior germplasm. This particular *Prosopis* species is thorny, not long stemmed and non erect *Prosopis* with pods of poor human palatability (Ethiopian Institute of Agricultural Research (EIAR), n.d.; Flintan, 2009; Tegegn, 2008).

The indigenous knowledge of *Prosopis* was not introduced along with the species in Ethiopia, just like many other countries. Hence, under lack of proper management, the species has become a noxious invasive species in many parts of the country. It has now established in the ANRS, Somali National Regional State, East Hararghe Zone, South Omo Zone, Borana Zone and Dire Dawa Administrative Council, in the altitude range between 450 to 1000 masl (Berhanu & Tesfaye, 2006; Biodiversity Analysis and Technical Support for USAID/Africa(BATS), 2008; Dubale, 2008; EIAR, n.d.; Haile, 2008; Kebede, 2009; N.M. Pasiecznik, S.K. Choge, Rosenfeld, & Harris, 2007; Prosopis Technical Working Group(PTWG), 2009; Shiferaw, Teketay, Nemomissam, & Assefa, 2004). Ryan (2011) estimates that 1 million hectares of land is already invaded where about 700 000 hectares of the invasion occurs in the ANRS. Since its introduction, *Prosopis* has reduced the local biodiversity of the semi-arid and arid ecosystems of the country mainly rangelands and river-sides (Berhanu & Tesfaye, 2006; EIAR, n.d.; Jama & Zeila, 2005; Kebede, 2009). Large areas of grazing and farm lands are now being invaded reducing the livestock production of the arid and semi-arid region.

On the other hand, *Prosopis* is also known for providing various socioeconomic and ecological benefits as it is able to grow well on arid lands where other plants fail to survive. In Ethiopia, communities have already started benefiting from the tree through its uses for firewood, windbreak, fencing and in the production of charcoal and animal feed(Berhanu & Tesfaye, 2006; Haile, 2008). The fact that this invasive species is both beneficial and harmful puts many on dilemma. Experts and local people in many parts of the world are simply indecisive whether *Prosopis* is an opportunity or a threat (Bokrezion, 2008; Jama & Zeila, 2005). According to assessment made by EIAR and other national and international organizations, *Prosopis* is now named 'number one priority invasive weed in Ethiopia'(Sertse & Pasiecznik, 2005). However, the policy challenges in the country in the management of *Prosopis* still remain not well addressed. The policy challenge in *Prosopis* management is well attended to if the ecological and economic dimensions of the species are well understood under current situation or possible management scenarios.

3. Ecological Dimensions of *Prosopis*

Prosopis, being a drought tolerant plant, primarily threatens the Desert and Semi-desert scrubland, and Acacia-Comiphora woodland ecosystems of Ethiopia(Institute of Biodiversity Conservation (IBC), 2005). These ecosystems account a large proportion of the total land mass of the country and host several national parks. They embrace nationally and internationally valuable natural heritages and are, particularly, home for pastoralists and agro-pastoralists whose life is dependent on the services of these ecosystems (Berhanu & Tesfaye, 2006; IBC, 2005). These ecosystems host many animal and plant species, a large number of which are endemic to the area. Some of the endemic and endangered plants include *Acacia prasinata*, *Boswellia ogadensis*, *Euphorbia doeloensis*, *E. ogadensis* and *Indigofera kelleri*.These ecosystems also harbor many globally threatened and vulnerable mammal and bird species. Among the threatened mamamals are; African Wild Ass(endemic), Grevy's Zebra and Black Rhinoceros are globally threatened (Ensermu, Sebsebe, Zerihun, & Edwards, 1992).

Horn of Africa biodiversity hotspot, as per Conservation International's biodiversity hot spot categorization, has also a large portion of its cover in the boundaries of these threatened ecosystems. This hotspot is one of the 34

biodiversity hotspots of the planet where over 50 percent of the planet's plant species and 42 percent of all terrestrial vertebrate species are endemic. They are also the most threatened areas in the world and each spot already lost at least 70 percent of its original natural vegetation. The Horn of Africa is even more degraded hotspot where around 95 percent of its original habitat is already lost(Conservation International, 2012a, 2012b).

Although the areas invaded by *Prosopis* are highly prioritized nationally and internationally, the species has continued to degrade these already vulnerable ecosystems at an alarming rate (Dubale, 2008; Flintan, 2009; IBC, 2005). It is a highly drought tolerant, fast growing and has outstanding coppicing power which gave it competitive advantages over native species of the invaded regions. This fact coupled with the already lost natural immunity of the region due to severe environmental degradation in the past highly hastened the rate of invasion and aggravated the problem posed by the species (Berhanu & Tesfaye, 2006; IBC, 2005; Shiferaw et al., 2004). A vast area of land is now invaded and the impact of the species on biodiversity is expected to exacerbate in the future(Ryan, 2011).The invasion has reduced palatable indigenous pasture species; *Chrysopogon plumulosus*, *Cenchrus ciliaris*, *Setaria acromelaena* and indigenous trees; *Acacia tortilis*, *Acacia Senegal*, *Acacia nilotica* (Dubale, 2008; Haile, 2008). The invasion of *Prosopis* has already reached highly valuable protected areas. It has already been reported that *Prosopis* encroachment in Allideghi Wild Reserve has caused serious reduction in species richness and basal cover of native herbaceous vegetation, threatening wild animals such as the endangered Grevy's Zebra(Kebede, 2009). Furthermore, in Awash Nation Park, *Prosopis* is now developing into a serious threat(Pines, 2009; Prosopis Technical Working Group(PTWG), 2009).

On the other hand, *Prosopis* has a potential for positive ecological impact. *Prosopis* trees could reduce soil loss due to water and wind erosion. It is also proved to be effective in improving soil fertility and is useful for reclaiming moderately saline soils and degraded lands. These properties of the tree have made the species suitable instrument to fight desertification in dry regions. These benefits of the species are behind the introduction of the species in Ethiopia and the species has positively contributed in this respect(Berhanu & Tesfaye, 2006; Jama & Zeila, 2005). It is also suggested that *Prosopis* could be considered a potential tree for sequestering carbon dioxide and may be instrumental in the mitigation of climate change (Jama & Zeila, 2005; Yemane, 2007).

4. Socio-economic Dimensions of *Prosopis*

The ecological impacts of *Prosopis* has been translated into social, economic and political dimensions in the country. The most important socio-economic impact of *Prosopis* is associated with its replacement of pasture lands and native trees of browsing value, which are the sole sources of feed for the livestock of pastoral communities. Pastoralists are the most affected by the invasion as their livelihood mainly relies on livestock production system. Agro-pastoralists of the invaded region are also one of the most affected by the invasion having their farm and pasture lands replaced by *Prosopis*. In extreme cases, these people have been compelled from their farm lands as a direct consequence of *Prosopis* invasion (Dubale, 2008; Giessen, 2011; PFE, IIRR, & DF, 2010; Rangi, 2009; Ryan, 2011).It has been reported that over the five years between 2003 and 2008 alone camel ownership in invaded areas of the ANRS has dropped by almost one-third as a result of *Prosopis* invasion. The effect of the species on the number of calves and heifer is even more pronounced where the reduction rate is five-fold. The decrease in the number of sheep and goats in the same period is estimated to be higher than one-third (Zelalem, 2000). Another survey done by Haile(2007) concluded that during a ten year period from 1997-2007, the invasion caused 80 percent loss in livestock and estimated 85 percent reduction in milk yield. *Prosopis* has the potential to have more serious consequences on the wellbeing of the pastoral and agro-pastoral communities. It may lead to serious food insecurity and may even trigger tribal conflicts for the remaining few pasture and farm lands (Berhanu & Tesfaye, 2006; Dubale, 2008).

The negative features of *Prosopis* are not limited only to its replacement of pastures and farm lands. It has harmed the wellbeing of local people directly through damages on human health, animal health and public infrastructures. The spines of *Prosopis* are poisonous to humans and animals and cause serious injuries (Giessen, 2011). Moreover, animals which are feeding exclusively for extended period on the pods of *Prosopis* contract health problems such as constipation, dental configuration and reduced productivity, and sometimes may even die(Dubale, 2008). The moist microclimate created by *Prosopis* thickets also creates conducive habitat for mosquito (Ryan, 2011) thereby reportedly increasing the prevalence of malaria in the invaded regions of Ethiopia (Dubale, 2008).Increase in malaria cases is reported in the invaded regions of Kenya substantiating the evidences on the association of the species with malaria outbreak(Mwangi & Swallow, 2005). The thick *Prosopis* thickets have also constrained the mobility of

people and blocked access to land, roads and watering points(Berhanu & Tesfaye, 2006; Ryan, 2011). Besides, local people associate the formation of *Prosopis* thickets with increase in the incidences of attacks by predators such as hyena, lion, leopard and jackal, and rise in crop damages from wild herbivore such as warthog and bushpig. (Dubale, 2008). This may be because *Prosopis* thickets serve as hiding places for the predators or preys (Dubale, 2008) or even may be traced to imbalance created in the food web due to loss of important plant species.

Even though the benefits of *Prosopis* are not well realized in Ethiopia, plantations and natural forests of the tree and closely related trees of the Genus *Prosopis* provide valuable products such as timber and charcoal in USA; honey in Mexico; animal feed in Brazil; gums, fodder and firewood in north-eastern India; charcoal and human foods in South America, and firewood in Africa (Tegegn, 2008). The wood of *Prosopis* has excellent structural stability and can be used for producing high quality furniture, flooring, fiber boards, railway cross-beams etc. *Prosopis* wood can as well be used as fuel wood, charcoal, and fencing (Flintan, 2009; N.M. Pasiecznik et al., 2007). The flowers of *Prosopis* are excellent sources of pollen and nectar and are used to produce high quality honey. The exudates gums harvested from *Prosopis* trees are important inputs in food, pharmaceutical, chemical and manufacturing industries. The crushed pods and seeds of *Prosopis* have also proved to be valuable feeds for livestock especially during drought periods where other feeds are scant. Other products of the species include tannins, dyes, medicine, live fencing, and shade (Girma, Urge, & Animut, 2011; Jama & Zeila, 2005; Tegegn, 2008).

Owing to its unique tolerance to the harsh environment of dry lands, the species has become an important source of livelihood for the poor, hence sometimes referred as 'the poor man's tree' (Choge & Pasiecznik, 2005). For example, in Haiti *Prosopis* provides 70 percent of the energy need of the population and supports the livelihoods of 150 000 people annually. In dry land India, the tree satisfies 70 percent of the energy needs (Jama & Zeila, 2005). However, the use of the species in Ethiopia is quite limited. In general, most of the reports agree that local people consider the tree as a menace rather than as an opportunity (eg. EIAR, n.d.; Haile, 2008; Seboka, 2009). But the attitude of people towards the species is influenced by socio-economic and gender differences. Villages where *Prosopis* is relatively more utilized, for instance, tend to have relatively positive attitude towards the species. It is also observed that in these villages' men see the species more useful than women as the men are more involved in utilization activities (EIAR, n.d.; Haile, 2008; Laxén, 2007; Walter, 2011). *Prosopis* is currently used at small scale as forage, firewood, for charcoal production, live fencing, and wind break, and the species is rated 'best' by the locals for such uses. Feed and charcoal production activities have been initiated as a strategy for eradicating the species through reducing seed load in the soil by crushing the seeds and pods of the plant for feed production, and through cutting down the tree for making charcoal(EIAR, n.d.; Flintan, 2009; Tegegn, 2008).

5. Policy Challenges in the Management of *Prosopis*

To combat the serious threats posed by invasive species, it is crucial to devise management strategies and policies. Even though *Prosopis* has already revealed its multifaceted and critical problems in Ethiopia, there has not been clear policy or strategy towards *Prosopis* or to invasive species management in general(Fessehaie, 2012). It is, however, recognized as a major threat to biodiversity and economic wellbeing of society by plans such as the Environmental Policy of Ethiopia (EPE) and the Biodiversity Strategy and Action Plan (NBSAP) and Forest Resource Strategy of the country *(Berhanu, n.d.; IBC, 2005)*. In contrary to this plans, however, the National Action Plan of the country recommended *Prosopis* tree as a potential tree to combat desertification (Anagae, Reda, Tesfaye, Admasu, & Ayalew, 2004; Environment Protection Authority, 1998) signifying the existing policy dilemma towards *Prosopis*. This contradiction of policy directions indicates lack of coordinated design of one policy direction based on a comprehensive analysis and understanding of the problem. Such coordinated effort seems difficult in Ethiopia where institutional mandates in the management of invasive species are unclear and fragmented interventions are common (Anagae et al., 2004). Nevertheless, the Afar National Regional State Pastoral, Agriculture, and Rural Development Bureau (PARDB) drafted a regulation which outlines strategies and the roles and responsibilities of different institutions towards the prevention and control of *Prosopis*. This draft regulation is now waiting the endorsement of the regional council (Tegegn, 2008). It is expected that this regulation may provide better institutional environment for the management of *Prosopis* in the ANRS, the most affected part of the country.

Despite lack of coordinated strategy and policy towards *Prosopis* in Ethiopia, there are many fragmented and small scale efforts to prevent and control the spread of the species. In many parts of the world various control methods have been applied to prevent or control *Prosopis*. The universal control methods for *Prosopis* include: mechanical;

manually or using machines; chemical; by applying herbicides, biological controls; by introducing pathogens and predators, and prescribed burning (Tegegn, 2008). The relatively common control method applied in Ethiopia is the uprooting of the tree manually. The mechanical control of *Prosopis* is, however, very labor intensive and expensive, and is economically feasible only for high value lands (N.M. Pasiecznik et al., 2007) It can also serve simply for control of the spread of the species and is not effective to eradicate it. An example could be a manual control using hand tools in the ANRS which cleared only 10 hectares over 6 years but the area was reinvaded after a while(BATS, 2008; Dubale, 2008).

The experience of USA, Argentina, Paraguay, South Africa, Sudan, Oman, Pakistan and Australia have already proved that it is very difficult or even impossible to fully eradicate the *Prosopis* species using the available methods(Choge & Pasiecznik, 2005; N.M. Pasiecznik et al., 2007; Victor, Pillay, & Al-Minji, 2007). Particularly, in USA the unsuccessful eradication attempt took extensive efforts for almost a century (N. M. Pasiecznik, 2002; N.M. Pasiecznik et al., 2007). The mechanical and chemical control methods are especially ineffective (Zimmermann & Pasiecznik, 2005). This is the result of the uniquely resistant nature of the tree to the control methods. Unless uprooted, cutting the tree will lead to more vigorous growth as the tree has high coppicing ability. On the other hand, prescribed burning kills only young trees and is ineffective for mature trees of *Prosopis* (Berhanu & Tesfaye, 2006). Chemical control methods using herbicides are not successful as well, owing to the thick bark and small leaves with a protective waxy layer of the *Prosopis* plant which all result into poor uptake of the chemical(N.M. Pasiecznik et al., 2007). In Ethiopia, taking into account the cost associated with the conventional control methods of *Prosopis* trees and their ineffectiveness (Ryan, 2011), it looks that these methods are hardly the panacea for larger portion of the population suffering from the invasion.

Experience of other countries consistently substantiates the ineffectiveness of eradication efforts through conventional methods. Besides, there are evidences that *Prosopis* trees are benefiting many communities in their non-native range such as India and Sudan. Especially in Sudan, the net effect of *Prosopis* on communities was supported by benefit-cost analysis research by Laxen (2007) who showed that the benefits of *Prosopis* out weighted the costs particularly for the Gandatom Scheme area in Sudan. It can, therefore, be well argued that exploring the options for the utilization of *Prosopis* could be a good strategy both as an eradication (or control) option and even as an instrument for poverty alleviation.

In Ethiopia, the government, and FARM Africa, an international NGO, working in the ANRS have initiated an effort to eradicate the spread of *Prosopis* through utilization. This effort has been realized through establishing cooperatives involved in processing the species' pod and wood for feed and charcoal production respectively (BATS, 2008; Sertse & Pasiecznik, 2005).

6. Eradication by Utilization

An important utilization scheme was introduced in Ethiopia by the government and FARM Africa in the two most invaded districts of the ANRS; Gewane and Amibara. The *Prosopis* management project launched for this purpose initially established four pilot cooperatives; Serkamo and Sedhafagae from Amibara district, and Gelaladura and Beida from Gewane. These cooperatives clear *Prosopis* from invaded land, use the wood for charcoal and fuel wood production, crush the pods and seeds of *Prosopis* trees and finally restore the cleared lands. They work under bylaws which require cutting the tree at least 10 centimeters below the ground to avoid coppicing, protecting indigenous trees species and restoring cleared land. Serkamo, Sedhafagae and Gelaladura cooperatives with a total membership of 179 were able to clear 396 hectares of land in a one year period between Oct 2004 and Sept 2005, and earned 113 176 USD. They also created 233 509 man-days of labor opportunities for daily laborers (Dubale, 2008; Tegegn, 2008). Even though the above initiative in the ANRS is likely the relatively significant utilization effort in the country, there are also similar schemes by other stakeholders and the tree is also becoming a source of livelihood in other regions, such as Dire Dawa, the largest city in eastern part of the country (Sertse & Pasiecznik, 2005).

The utilization effort is not, however, free from challenges. Charcoal production in the ANRS was banned for sometime because illegal charcoal producers are using it as a cover up to produce charcoal from protected tree species (Dubale, 2008; Fessehaie, 2012). This problem emanates from the fact that it is difficult to determine the wood source from the final charcoal product (BATS, 2008). Furthermore, some argue that promoting the utilization of *Prosopis* may encourage its spread. This is based on the contention that if people are gaining from the utilization they will tend to facilitate the growth of the species rather than clearing lands from the tree. Those arguing against

the utilization effort suggest that an integrated control is required that involves the conventional methods (Fessehaie, 2012; Flintan, 2009). A potentially related problem was also observed in the ANRS where the four pilot cooperatives are operational. It was reported that three of the four cooperatives usually left the stumps of cut *Prosopis* trees against the bylaw that strictly demands removing the stumps(Tegegn, 2008).The argument is sound and utilization of the species could promote the spread of the species. But this contention hardly lays enough ground to halt the utilization efforts and only underscores the need for a cautious utilization strategy. Managing invasive species on common pool resources like pasture lands through mobility of communities is very difficult due to a free-rider problem. Government intervention, on the other hand, doesn't seem promising due to lack of resources. Therefore, mechanisms which create immediate incentives to people to eradicate invasive species could be very effective. It is, however, essential to make sure that these mechanisms do not work against the precious biodiversity and long term economic development of the area. It should also be noted that though eradication by utilization is an attractive strategy, an optimum strategy is determined by both socioeconomic and ecological conditions (Finnoff, Settle, Shogren, & Tschirhart, 2009) and the conventional control methods could be cost-effective under certain circumstances. It is also crucial to take in to account the high biodiversity value of the area in finding optimal solutions and policy design.

7. Conclusions and Recommendation

In Ethiopia, local people generally have negative attitudes towards *Prosopis*. It has replaced economically important pasture and farm lands and is threatening pastoral and agro-pastoral livelihoods. It has also impacted human and animal health and has become a threat to infrastructures like roads and water points. Moreover, the invasion has turned into a major driver of biodiversity loss in the invaded regions. Many important pasture and tree species have declined after the invasion with serious implications on endemic and other important animal populations. *Prosopis* has invaded parts of Allideghi Wild Reserve and Awash National Park and is now growing into a serious problem. The tree, however, has positive ecological and economic benefits. It has been used in Ethiopia for soil conservation, as wind break and recently as a source of charcoal and animal feed. But the indigenous knowledge on the management and utilization of the species has not been introduced fully. Even though there are now initiatives in the utilization of the species, the scales of these efforts seem to be small to offset the negative consequences of the tree. The tree is now utilized in Ethiopia for limited number of uses; charcoal and feed production, shade, and live fencing. The experience of many countries, nevertheless, shows the unexploited potentials of the tree in Ethiopia and the possibility that the attitude of local people towards *Prosopis* may change with further utilization of the species.

In Ethiopia, *Prosopis* is categorized an invasive weed and small scale eradication or control efforts exist in invaded regions. The failure of extensive eradication efforts in many countries using the conventional control methods, makes utilizing *Prosopis* an effective strategy to control its spread. The same view is also supported by many researchers who investigated the *Prosopis* problem (Choge & Pasiecznik, 2005; Mwangi & Swallow, 2005; N.M. Pasiecznik et al., 2007; Ryan, 2011; Seboka, 2009). Utilization of *Prosopis* in general could even be effective in many places throughout the world. However, utilizing such invasive species requires utmost care in order not to damage biodiversity and compromise long term economic opportunities in the invaded region. In addition, the impact of *Prosopis* is site specific and one control method is hardly feasible. There is a need to consider the social, economic, political and economic environment when deciding which control method to use. For high value lands, for instance, the labor intensive and expensive control methods could still be economically sound. This calls for integrated study of *Prosopis* invasion under different socio-economic and ecological conditions and determining the optimal strategies under different circumstances. To this effect, Ethiopia needs to design clear policy and detailed strategies in controlling invasive species in general and *Prosopis* in particular. Institutional mandate in managing invasive species should also be well specified.

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