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THE INFLUENCE OF PROSOPIS JULIFLORA ON FARMLAND AND RANGELAND IN BALADWEYNE, HIRAN-SOMALIA

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ABSTRACT

This study investigates the influence of Prosopis juliflora on farmland and rangeland in Beledweyne-Hiran, Somalia. The objectives of this study were; To examine the influence of Prosopis juliflora on the plant species biodiversity on farmlands and rangelands. To identify the effect of Prosopis juliflora on pasture and agriculture productivity on rangeland and farmlands, to investigate the Causes of the invasion and displacement of Prosopis juliflora on farmlands and rangelands,

This study adopted a quantitative research design, particularly a descriptive design. Structured questionnaires were conducted with 80 participants. Our analysis showed that Prosopis juliflora negatively influences farmland and rangeland in Beledweyne. A higher proportion of the respondents (80%) agreed that Prosopis juliflora outcompetes native plant species for resources such as light, water, and nutrients, reducing the abundance and diversity of the native plant species.

Prosopis juliflora also affects pasture and agriculture productivity. A higher proportion of the respondents (81.3) agreed that there is a negative relationship between the increase in Prosopis juliflora invasion and fodder/feed availability on grazing lands.

In this study, it is found that there were many factors that cause of invasion and displacement of Prosopis juliflora.

A higher proportion of the respondents (85%) agreed that the success of the Prosopis juliflora invasion is largely attributed to the high number of seeds produced and their efficient dispersal mechanisms.

The researchers recommended Organizing people (forming a task force) to manually manage Prosopis in areas with potential uses such as farming, settlement, grazing and other uses prior to the species maturing and bearing fruit and to raise the public awareness, especially in pastoral and

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agro-pastoral areas, about the effects of Prosopis on agricultural productivity, human health, and the ecosystem is also essential.

In line with this, cost-effective and simple control methods that can be accomplished by these groups should be identified and implemented.

Keywords: PROSOPIS JULIFLORA, FARMLAND AND RANGELAND

INTRODUCTION

Invasive alien species are those that become established in a new environment, and then proliferate and spread in ways that are destructive to biodiversity and human Interests (GISP, 2004). Invasive species pose global biological and economic challenges. Over the past four decades, Prosopis taxa have emerged as a major invader of the arid and semi-arid regions of the world (Tewodros et al., 2015). The spread of invasive alien species (IAS) is now recognized as one of the greatest threats to the ecological and economic wellbeing of the planet. These species are causing enormous damage to biodiversity and on agricultural systems we depend on. Health effects on human beings and animals are increasing and impacts on biodiversity irreversible (Selamnesh, 2015). Introduced alien species outcompete, infect or transmit diseases, compete, attack, or hybridize with native ones (Wittenberg and Cock, 2001). Recent decades have seen a rise in the global recognition of invasive plant species like Prosopis Juliflora as serious ecological problems because of their ability to colonize new areas and reduce plant biodiversity, both of which have an adverse impact on the forest's ecosystem services (Valery et al., 2004; Peltzer et al., 2010; Sholto-Douglas et al., 2017; Ward et al., 2018).

Prosopis juliflora L. (here in after referred to as Prosopis) is one of the world's worst woody invasive plants (Berhanu and Tesfaye, 2006; Ros et al., 2014).

For a variety of causes, invasive alien species have been deliberately or accidentally introduced to many countries. In regard to their economic significance, biodiversity aspect, ecological quality, or a combination of those aspects, several of these species have demonstrated their value in their new habitats. Therefore, the specific objectives of this study were:

1. To examine the influence of Prosopis juliflora on the plant species biodiversity on farmlands and rangelands in Beledweyne, Hiran-Somalia.
2. To identify the effect of Prosopis juliflora on pasture and agriculture productivity on farmlands and rangelands in Beledweyne, Hiran-Somalia.
3. To investigate the Causes of the invasion and displacement of Prosopis juliflora on farmlands and rangelands in Baledweyne, Hiran-Somalia.

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METHODOLOGY

This research used quantitative design especially descriptive design. Descriptive research design is a scientific method that involves observing and describing the behavior of a subject without influencing it in any way.

The population of this study comprised of 100 respondents including local people in the areas affected by the Prosopis juliflora in Beledweyne-Somalia. Experienced elders for rearing livestock, farmers, and those involved in livestock and crop production field were the target of this type of study. The target population consisted of old people who are willing to participate in the study. Data was collected from this target population in Baledweyne district Somalia.

The sample for this study consisted of 80 respondents from the target population. The sample size was determined by using Slovene Formula to come up with an appropriate sample size to be used in the study. The sample size was calculated mathematically using the formula below

N = Total Population (100) n = Sample size?

e = the margin of error or the level of significance, that is 0.05 n= N / (1 + (N*e^2)) Substituting into the formula,

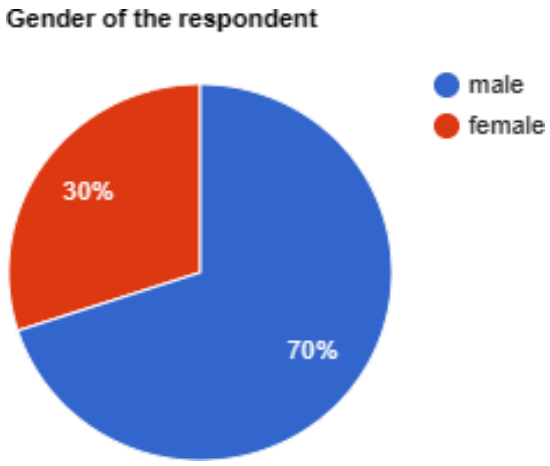
n = 100/ (1+ (100*0.05^2)

= 100/1 + 0.25

= 100/1.25 Therefore n = 80.

DEMOGRAPHIC DATA OF THE RESPONDENTS

Figure 4.1: Genders of the respondents



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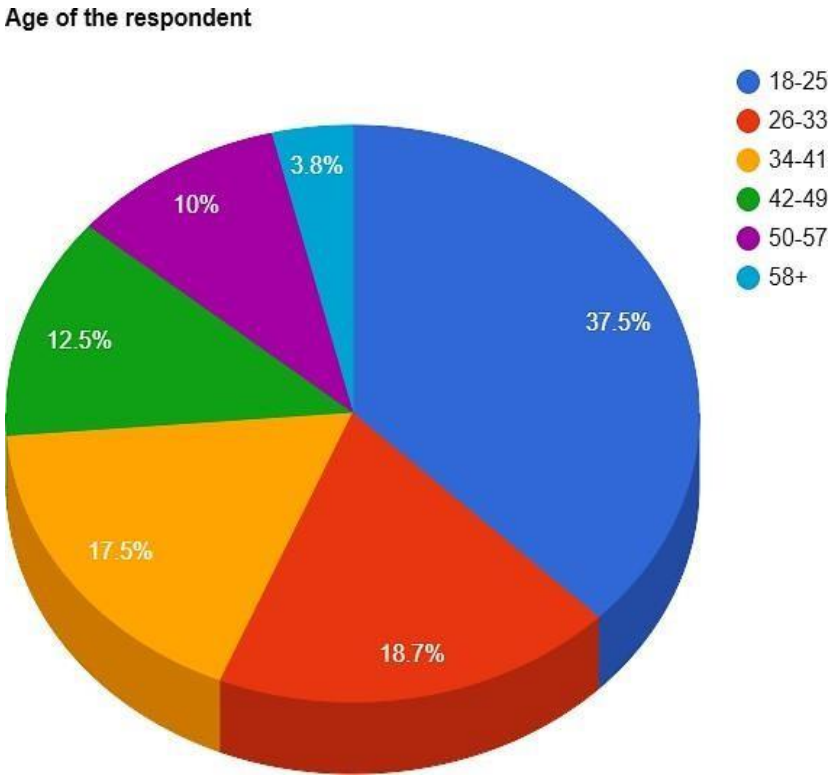
The above Pie chart presents the gender demographic of the respondents, showing that 70% (56) were male and 30% (24) were female. As such, the majority of the respondents were male.

Figure 4.2: Age of the respondents



The pie chart presented above reveals that **37.5%** of the participants were in the age range of 18-25 years, **18.8%** between 26-33 years, **17.5%** between 34-41 years, **12.5%** between 42-49 years, **10%** between 50-57 years and the remaining **3.8%** were 58 years and over.

Objective one (Influence of Prosopis juliflora on plant biodiversity).

	Frequency	Percent
Strongly agree	35	43.8
Agree	34	42.5
Neutral	7	8.8
Disagree	3	3.8
Strongly disagree	1	1.3

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Total	80	100.0

According to the above table, **43.8%** of respondents strongly agreed that Prosopis juliflora has a negative impact on plant biodiversity. **42.5%** of respondents agreed with this statement, while **8.8%** of respondents held a neutral opinion. **3.8%** of respondents disagreed and only **1.3%** of respondents strongly disagreed with the statement.

	Frequency	Percent
Strongly agree	53	66.3
Agree	20	25.0
Neutral	5	6.3
Disagree	2	2.5
Total	80	100.0

The results of the above table indicates that a significant majority of the respondents, **66.3%** strongly agreed that Prosopis Juliflora can easily replace the native plant species valuable for the ecosystem. An additional **25%** of the respondents agreed with this statement. A small proportion **6.3%** chose neutral, and only **2.5%** of the respondents disagreed.

	Frequency	Percent
Strongly agree	24	30
Agree	42	52.5
Neutral	10	12.5
Disagree	3	3.8
Strongly disagree	1	1.3
Total	80	100

The above table shows that **30%** of the respondents strongly agreed that Prosopis juliflora has a competitive advantage over native plant species, leading to a reduction in their abundance and

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diversity. An additional **52.5%** agreed with this viewpoint. Meanwhile, **12.5%** indicated that they had a neutral perspective on the matter. **3.8%** disagreed and only **1.3%** strongly disagreed.

	Frequency	Percent
Strongly agree	20	25
Agree	45	56.3
Neutral	10	12.5
Disagree	2	2.5
Strongly disagree	3	3.8
Total	80	100

The above table shows that out of 80 respondents, **25%** of them strongly agreed that Prosopis juliflora reduces the cover and density of native vegetation, leading to a decrease in plant biodiversity. **56.3%** of the respondents agreed with this, while **12.5%** chose a neutral viewpoint. Only **2.5%** of the respondents disagreed and **3.8%** of them strongly disagreed.

	Frequency	Percent
Strongly agree	32	40
Agree	41	51.2
Neutral	4	5
Disagree	1	1.3
Strongly disagree	2	2.5
Total	80	100

According to the above table**, 40%** of the respondents strongly agreed that Prosopis juliflora can reduce the availability of medicinal and culturally important plant species. **51.2%** of the respondents agreed. **5%** had a neutral viewpoint .1**.3%** disagreed and the other **2.5%** strongly disagreed.

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	Frequency	Percent
Strongly agree	19	23.8
Agree	38	47.5
Neutral	20	25
Disagree	1	1.3
Strongly disagree		2.5
Total	80	100

The above table shows that **23.8%** of the respondents strongly agreed, **47.5%** agreed, **25%** held a neutral perspective, **1.3%** disagreed and **2.5%** strongly disagreed with the statement that Prosopis juliflora hosts pests and insects which damage the health of the plants, leading to a decrease in plant diversity.

	Frequency	Percent
Strongly agree	24	30
Agree	37	46.3
Neutral	15	18.8
Disagree	3	3.8
Strongly disagree	1	1.3
Total	80	100

The above table describes that **30%** of the respondents strongly agreed that Prosopis juliflora can create dense thickets, which can make it difficult for other plant species to grow and survive **46.3%** of the respondents agreed. **18.8%** had a neutral view. **3.8%** disagreed and **1.3%** strongly disagreed with the statement.

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	Frequency	Percent
Strongly agree	30	37.5
Agree	35	43.8
Neutral	11	13.8
Disagree	2	2.5
Strongly disagree	2	2.5
Total	80	100

The above table shows that **37.5%** of the respondents strongly agreed that there is a negative relationship between the increase in Prosopis juliflora invasion and fodder/feed availability on grazing lands. Additionally, **43.8%** of them agreed with the statement. On the other hand, **13.8%** of the respondents held a neutral perspective on the matter, while **2.5%** disagreed and **2.5%** strongly disagreed with the statement.

	Frequency	Percent
Strongly agree	35	43.8
Agree	36	45
Neutral	6	7.5
Disagree	1	1.3
Strongly disagree	2	2.5
Total	80	100

According to the above table, **43.8%** of the respondents strongly agreed that in areas where Prosopis juliflora spread, it has destroyed natural pastures and led to fewer and lower quality rangeland sites available to pastoralists. **45.0%** of the respondents agreed with the statement, while **7.5%** held a neutral perspective. However, **1.3%** of the respondents disagreed with the statement, and **2.5%** held a strongly disagreeing viewpoint.

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	Frequency	Percent
Strongly agree		25
Agree	43	53.8
Neutral	7	8.8
Disagree	7	8.8
Strongly disagree	3	3.8
Total	80	100

Based on the above table, **25.0%** of the respondents **strongly agreed** that Prosopis juliflora can suppress the growth of grasses under its canopy and biodiversity, while **53.8%** of the respondents **agreed** with the statement. Meanwhile, **8.8%** of the respondents had a **neutral** stance on the issue. **8.8%** of the respondents **disagreed** with the statement and only **3.8%** of the respondents **strongly disagreed** with the statement.

	Frequency	Percent
Strongly agree	25	31.3
Agree	35	43.8
Neutral	16	20.0
Disagree	3	3.8
Strongly disagree	1	1.3
Total	80	100

As indicated by the above table, **31.3%** of the respondents strongly agreed and **43.8%** of the respondents agreed that Prosopis juliflora has degraded rangelands and forage grass productivity in terms of quantity and has declined drastically as a result, while **20.0%** of the respondents had a neutral perspective. Only **3.8%** of the respondents disagreed with the statement and **1.3%** of the respondents strongly disagreed with the statement.

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	Frequency	Percent
Strongly agree	24	31.0
Agree	41	51.2
Neutral	13	16.3
Disagree	1	1.3
Strongly disagree	1	1.3
Total	80	100

The above table describes that **51.2%** of the respondents agreed that theinvasion of Prosopis juliflora on the plant decreases the size of the farm andthe roots of Prosopis make it difficult to plough lands, **31.0%** strongly agreed, **16.3%** held a neutral perspective while **1.3%** disagreed and **1.3%** of the respondents strongly disagreed.

	Frequency	Percent
Strongly agree	27	33.8
Agree	30	37.5
Neutral	19	23.8
Disagree	3	3.8
Strongly disagree	1	1.3
Total	80	100

The above table shows that **37.5%** and **33.8%** of the respondents agreed and strongly agreed, respectively that the invasions of Prosopis juliflora can lead toa decline in the overall health of crops, making them more susceptible to pests and insects while **23.8%** of the respondents had a neutral perspective. Only **3.8%** disagreed and **1.3%** strongly disagreed with the statement.

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	Frequency	Percent
Strongly agree	22	27.5
Agree	40	50.0
Neutral	14	17.5
Disagree	4	5.0
Total	80	100

The above table describes that **50%** of the respondents agreed that Prosopis juliflora delays seed germination and reduces plant growth in terms of roots, shoots, leaf reduces stem diameter, and plant height, **27.5%** strongly agreed, **17.5%** held a neutral perspective and only **5.0%** disagreed.

	Frequency	Percent
Strongly agree	32	40.0
Agree	32	40.0
Neutral	13	16.3
Disagree	2	2.6
Strongly disagree	1	1.3
Total	80	100

According to the above table, **40%** of respondents strongly agreed and **40%** agreed that the presence of animals is usually important for Prosopis juliflorato be dispersed over long distances and to germinate, **16.3%** held a neutral viewpoint, **2.6%** disagreed and only **1.3%** strongly disagreed with the statement.

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	Frequency	Percent
Strongly agree	22	57.5
Agree	46	27.5
Neutral	8	10
Disagree	4	5
Total	80	100

The above table shows that **57.5%** of respondents strongly agree that the success of Prosopis juliflora's invasion is largely attributed to the high number of seeds produced and their efficient dispersal mechanisms. **27.5%** agreed**, 10%** held a neutral perspective, and only **5%** disagreed.

	Frequency	Percent
Strongly agree	25	53.8
Agree	43	31.3
Neutral	7	8.8
Disagree	3	3.8
Strongly disagree	2	2.5
Total	80	100

The above table reflects that **53.8%** of respondents strongly agreed that heavy rains in the area make seeds fall from the trees and the following flooding ensures widespread dissemination of the seeds. **31.3%** agreed, **8.8%** held a neutral opinion, **3.8%** disagreed and **2.5**% strongly disagreed.

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	Frequency	Percent
Strongly agree	39	48.8
Agree	33	41.3
Neutral	6	7.5
Disagree	1	1.3
Strongly disagree	1	1.3
Total	80	100

Per the information in the above table, **48.8%** of respondents strongly agreedthat Prosopis juliflora can tolerate a wide range of environmental conditions,including drought and high temperatures, making it well-suited to areas affected by climate change. **41.3%** agreed, **7.5%** held a neutral perspective, **1.3%** disagreed and **1.3%** strongly disagreed.

	Frequency	Percent
Strongly agree	20	25
Agree	40	50
Neutral	14	17.5
Disagree	6	7.5
Total	80	100

The above table indicates that **25%** of respondents strongly agreed and **50**% agreed that civil war has helped the spread of Prosopis juliflora. **17.5%** held a neutral viewpoint and **7.5%** disagreed.

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	Frequency	Percent
Strongly agree	25	31.3
Agree	40	50
Neutral	9	11.3
Disagree	3	3.8
Strongly disagree	3	3.8
Total	80	100

According to the data in the above table, **31.3%** of respondents strongly agreedand **50%** agreed that the lack of government policy and regulation has contributed to the invasion of Prosopis juliflora. **11.3**% held a neutral perspective, **3.8%** disagreed and **3.8%** strongly disagreed.

LITERATURE REVIEW

Native to Central and South America - spreading from southern Mexico to Panama and from the Caribbean Islands to northern South America (Venezuelaand northern Peru) - (HARRIS et al. 2003, p.153; PASIECZNIK et al. 2001, p.4; WICK and THIESSEN et al. 2000, p. 60; NOOR and

SALAM 1993, p.83) P.juliflora has been introduced globally over the last 200 years. Today, it can be found in various semi-arid and arid climate zones including further parts of Southern America, India and Pakistan, Australia and the Pazific, and several countries in Africa, the Arabic Peninsula, and the Middle East. (PASIECZNIK et al. 2001; p.13; WICK and THIESSEN et al., 2000, p. 60; IQBAL and SHAFIQ 1997, p.459).

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SALAM 1993, p.83) P.juliflora has been introduced globally over the last 200 years. Today, it can be found in various semi-arid and arid climate zones including further parts of Southern America, India and Pakistan, Australia and the Pazific, and several countries in Africa, the Arabic Peninsula, and the Middle East. (PASIECZNIK et al. 2001; p.13; WICK and THIESSEN et al., 2000, p. 60; IQBAL and SHAFIQ 1997, p.459).

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Introduction of Prosopis Juliflora into Africa

The introduction of Prosopis juliflora into Africa is believed to have probably even taken place earlier. According to PASIECZNIK et al. (2,001), the precise introduction history is not definite, but introductions into Senegal in 1822, South Africa around, 1880, and Egypt around 1900 have been documented.

In the case of Sudan, Prosopis was introduced by RE Massey from the Egyptian Department of Agriculture at Giza and from South Africa both in 1917 (EL FADL 1997 in PASIECZNIK et al. 2001, p.16; MAGID 2007, p.2). Its spread throughout the country has taken place over a period of decades, as it was first confined to small research areas before it was increasingly introduced into rural areas according to LAXÉN Prosopis had established itself in about half of the total 26 states Sudan comprises of by early 2000 (MAGID 2007, p.14; LAXÉN 2005, p.14). 1. In Kenya, Prosopis juliflora was first introduced in the late 1970s by the National Irrigation Board (NIB), in collaboration with the Finland government to help in solving environmental and energy problems in irrigation schemes within the ASALs [4].

The year of introduction into Somalia is not yet clear, however, there is little documentation that might give some ideas about the introduction. For example, AFRICARE (1983)7 reported the introduction of Prosopis juliflora in Somalia as part ofa reforestation project for sand dune stabilization in a refugee impacted areas in the Hiranregion of central Somalia. In this study, eighteen tree/shrub species were planted and have become established. Among the tree species, Prosopis juliflora out-performed all other tree species. The testing of Prosopis chilences as part of a reforestation project in southern Somalia was reported by Leslie (1989)8. The introduction of the Prosopis juliflora in Somaliland was reported in 1959 by Mooney, the first forest officer to the protectorate. Mooney (1959) noted small experimental planting at Sheikh, Gaan Libah, Lafarug, Berbera and Manjassah. The species listed are Eucalyptus camaldulensis, Pinus halepensis, Prosopis sp. and Acacia sp. San dunes stabilization program started in Marka and Shalanbood in 1973. Up to 1980 about 5,900 ha were claimed as stabilized (FAO, 1984).

The species used in the stabilization included Commiphora spp., and Anacardium occidental. No mention on Prosopis juliflora.

Prosopis juliflora Swartz (Leguminosae subfam. Mimosoideae) is a perennial, fast- growing, often ever-green and drought resistant plant that grows in semi-arid areas as well as desert like conditions. Worldwide, there are about 44 recognised species of the genus Prosopis, which have been identified and listed by BURKHART (1976) 2 assembling the most extensive taxonomic listing available to this date.

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Family: Leguminosae 650 genera, 18,000 species

Sub-family: Mimosoideae 50-60 genera, 650-725 species

Tribe:

Mimoseae 5 tribes

Group:

Prosopis 9 groups

Genus:

Prosopis 4 genera

CONCLUSIONS

This research was concerned with the influence of Prosopis juliflora on farmland and rangeland in Beledweyne, Hiran-Somalia. Prosopis juliflora is a powerful invader with several special features that promote its rapid invasion of new areas. This invasive species is currently becoming a problematic weed in Somalia, especially in the southern and central parts of the country. The aggressive invasion of Prosopis juliflora is displacing native tree species. The invasion also leads to the shrinkage of therangelands and farmlands and will therefore threaten the existence of the community. This research shows that Prosopis juliflor affects the diversity of the plants by easily replacing the native plant species valuable for the ecosystem and has a competitive advantage over native plant species leading to a reduction in their abundance and diversity. It also reduces the cover and density of native vegetation, leading to a decrease in plant biodiversity, reduces the availability of medicinal and culturally important plant species, hosts pests and insects which damage the health of the plants, and creates dense thickets that hinder the growth and survival of other plant species. The study also found that Prosopis juliflora affects pasture and agriculture productivity. The increase in Prosopis juliflora invasion has a negative impact on pasture and agriculture productivity in rangelands and farmlands. Prosopis juliflor leads to a decline in fodder/feed availability, destroyed natural pastures, suppressed thegrowth of grasses and reduced biodiversity, degraded rangelands, decreased the size of farms, led to a decline in the overall health of crops, delays seed germination and reduced plant growth. The study investigated the causes of the invasion and displacement of Prosopis juliflora on farmlands and rangelands. Results show that the majority of respondents agreed that the presence of animals, a high number of seeds produced, heavy rains, and environmental tolerance all contribute to the success of Prosopis juliflora's invasion. A significant portion of respondents also agreed that civil war and lack of government policy contributed to the invasion.

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RECOMMENDATIONS

- Identify areas with potential uses such as grazing, farms and settlements, and implement preventive measures such as avoiding mature plants as fencing, removing ripe pods, and quarantining livestock for at least six days before transferring them to new areas.
- Raising public awareness, especially in pastoral and agro-pastoral areas, about the effects of Prosopis on agricultural productivity, human health, and the ecosystem is also essential. In line with this, cost-effective and simple control methods that can be accomplished by these groups should be identified and implemented.
- Organize people (form a task force) to manually manage Prosopis in areas withpotential uses such as farming, settlement, grazing and other uses prior to the species maturing and bearing fruit.

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