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THE ROLE OF INVASIVE SPECIES IN SUPPORTING HOUSEHOLDS LIVELIHOODS: A CASE OF BOMA WARD IN MAFINGA TOWN COUNCIL

BY

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ABSTRACT

Invasive species are conventionally framed as ecological threats, yet their socio-economic roles are paradoxical. This study examines the role of invasive species in supporting household livelihoods in Boma Ward, Mafinga Town Council, Iringa-Tanzania. The specific objectives were to identify the types of invasive species, examine their socio-economic implications, and analyze local management strategies. A mixed-methods approach was employed, collecting data from 69 households through conducting surveys, interviews, and observations. Key findings reveal that species like Eucalyptus spp., Lantana camara, and pines are widely utilized. Contradicting their negative reputation, 80% of respondents recognized them as a business opportunity, with 47% of engaged households earning substantial annual income (TZS 300,000–1,000,000) from their sale. However, these benefits coexist with challenges, including reduced agricultural yields and a severe lack of access to training and financial support for management. The study concludes that households are pragmatically assetizing an environmental problem to build resilience. It recommends that policymakers move beyond eradication-only approaches and develop supportive frameworks to formalize these ventures, enhancing their safety and sustainability while mitigating negative impacts.

STUDENT'S DECLARATION

I Linda C. Kabwa, declare that this dissertation is my own original work and that it has not been presented to any other Institute for a similar or any other degree award.

Signature……

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SUPERVISOR'S CERTIFICATION

I Mr. Ismail Zuberi Ngolloh, certify that I have read and hereby recommend for acceptance by the Institute of Rural Development Planning the dissertation entitled "The role of invasive species in supporting households' livelihoods: a case of Boma Ward in Mafinga Town Council" in fulfilment of the requirements for the Bachelor Degree in Environmental Planning and Management of the Institute of Rural Development Planning.

Signature……

Date……

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ABBREVIATIONS AND ACRONYMS

BOM	Boma Ward
CBOs	Community Based Organizations
FAO	Food and Agriculture Organization
GISP	Global Invasive Species Programme
HESLB	Higher education Student Loan Board
IPM	Integrated Paste Management
IRDP	Institute of Rural Development Planning
IS	Invasive Species
NGOs	Non-Governmental Organizations
NISSA	National Invasive Species Strategy and Action Plan
SES	Socio-Ecological Systems
SLA	Sustainable Livelihoods Approach
SSA	Sub-Saharan Africa
SUA	Sokoine University of Agriculture.
SLF	Sustainable Livelihoods Framework
TAFORI	Tanzania Forestry Research Institute

TARI	Tanzania Agricultural Research Institute
TFS	Tanzania Forest Services
URT	United Republic of Tanzania
WB	World Bank
WFPs	Wild food plants
WWF	World wild fund for nature
UNDP	United Nations Development Progremme
NBS	National Bureau of Statistics

DEFINITIONS OF KEY TERMS

Income Diversification

Is a household livelihood strategy aimed at managing risk and stabilizing income by developing a varied portfolio of activities and income source. A common strategy for building resilience against economic and environmental shocks is income diversification, whereby households engage in a portfolio of activities to manage risk and stabilize their earnings (Ellis, 1998).

Definition of Natural Capital

Natural capital is the stock of natural ecosystems and resources that yields a flow of valuable goods and services into the future. This stock includes geology, soil, air, water, and all living organisms. Natural capital comprises the world's stocks of natural assets, which provide critical ecosystem services essential for human well-being and economic prosperity (Costanza *et al.,* 1997). These elements combine to provide essential ecosystem services that sustain human life and economic activity.

Definition of Livelihood Security

Livelihood security is defined as the adequate and sustainable access to income and resources to meet basic needs. (Scoones, I. 1998). These resources include food, cash, and other assets that allow households to withstand shocks and stresses, maintain or enhance their capabilities and assets, and provide sustainable opportunities for the next generation.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Invasive plant species are defined as non-native plants that spread rapidly and cause ecological, economic, or social impacts (Richardson *et al.,* 2000). Globally, they have been responsible for biodiversity loss, habitat alteration, and significant economic costs (Pimentel *et al.,* 2005). In rural communities, however, these species can also be integrated into local economies, providing fuelwood, fodder, building materials, and medicinal resources (Shackleton *et al*., 2007). Globally, invasive species are recognized as one of the most significant drivers of biodiversity loss, ecosystem change, and economic damage, costing hundreds of billions of dollars annually in control efforts and lost productivity (IPBES, 2019). The narrative surrounding invasive species having traditionally been overwhelmingly negative, focusing on their threats to native species, agricultural systems, and water resources.

Understanding the effects (benefits and costs) of invasive species on livelihoods and human well-being Invasive Species important for guiding policy formulation and management (Shackleton *et al*., 2018). Including from the Polar Regions to tropical forests, and from wild lands and waters to agriculture and suburbia. Biological invasions are one of the most significant drivers of environmental change and degradation. The problem addressed in this report Invasive Species the linkage between poverty, establishment and spread of species outside of their original range. There are two main dimensions to the problem. One Invasive Species the connection

between poverty and the likelihood of the introduction, establishment or spread of invasive species (Article, 2018).

In Africa, the dualistic nature of invasive species is particularly pronounced. While species like *Lantana camara* and *Parthenium hysterophorus* devastate grazing lands and crop yields, others have been adopted by communities. For instance, the prickly pear cactus (*Opuntia ficus-indica*), invasive in parts of East Africa, is cultivated for its fruit and used as a living fence, while *Prosopis juliflora* (mesquite) provides crucial charcoal and fodder resources in the drylands of the Horn of Africa, despite its negative impacts on groundwater and biodiversity (Schreckenberg *et al*., 2022). This creates a complex management dilemma where eradication efforts may directly conflict with the subsistence needs of local households who have come to depend on these resources.

Although invasive species are widespread in Tanzania and cause serious negative impacts on livelihoods as a result of yield losses and increased labor costs associated with invasive species management, few data on the impacts are available in the literature and the magnitude and extent of the costs are largely unknown. We estimated the cost of invasive species to agriculture, the most important economic sector in Africa, (Eschen *et al., 2021)*. The biological invasions have been increasing at multiple spatial scales and the management of invasive species Invasive Species becoming more challenging due to confounding effects of climate change on the distribution of those species. Identification of climatically suitable areas for invasive species and their range under future climate change scenarios are essential for long-term management planning of these species (Babu *et al.*, 2018).

However, in Iringa region, an emerging body of literature is beginning to highlight a paradoxical reality, in certain socio-ecological contexts, particularly in developing countries, some invasive species have been integrated into local livelihood strategies. These species can provide tangible benefits such as food, fodder, construction materials, and even income generation, creating a complex trade-off between their ecological costs and their socio-economic benefits (Shackleton *et al.,* 2019). Much research has focused on ecological impacts, but the role of invasive species for livelihoods and human well-being Invasive Species less well known.

1.2 Statement of the Problem

The proliferation of invasive species in Boma Ward, Mafinga Town Council, is perceived as an environmental challenge. However, the preliminary observation indicates that local households are actively utilizing these species for various livelihood purposes. The current policy environment, which advocates for eradication, risks undermining these unofficial livelihood strategies without offering sustainable alternatives, potentially increasing household vulnerability. Therefore, a critical problem exists where a lack of empirical data on the socio-economic benefits derived from invasive species leads to policies that are misinformed and potentially detrimental to the community's livelihood security. This study seeks to investigate this problem to inform more balanced and effective policy. Alteration of ecosystem functions and processes, these species are considered as one of the potential threats to conservation in the ecosystem (Estes and Small, 1981). Wild food plants (WFPs) play an important role in the traditional dietary habits of various indigenous communities worldwide, particularly in mountainous regions (Gillani *et al*., 2024).

1.3 Significance of the study

To Policymakers: The findings were providing evidence-based insights to help Mafinga Town Council and Iringa regional authorities develop more nuanced and socially just invasive species management policies that consider both ecological integrity and human well-being. The Knowledge from invasive Species study aims at making strategic choices about resource allocation that maximize positive change in communities and livelihoods The Impact on Ecosystem Services, Economic Consequences, Social Dimensions, Integrated Management Strategies, and Policy Implications also to provide a structured approach. To the Community: The study was document and validate local knowledge and practices, empowering the community of Boma Ward with data that can be used to negotiate management strategies or advocate for alternative resources if control measures are implemented analyzing complex is related to livelihoods while facilitating informed Invasive decision-making regarding interventions aimed at alleviating and managing the increasing invasive species.

To Academia: It were contributing to the growing body of literature on the complex socio-ecological dynamics of invasive species, particularly in the under-researched context of Tanzanian highland communities, and were identify areas for further research. the research findings were also be useful by IRDP for further studies.

1.4 Research Objectives

1.4.1 General objective

The general objective was to examine the role of invasive species in supporting household's livelihoods.

1.4.2 Specific objectives

i. To identify types of invasive species grown in the study area.

ii. To examine socio-economic implications of invasive species on communities' households' livelihoods.

iii. To examine strategies that local communities employ in managing invasive species for better household's livelihood outcomes.

1.5 Research questions

i. What Invasive Species types are grown in the study area?

Variables

- Types of invasive species
- Sources of invasive species
- Awareness on invasive species

ii. What are the socio-economic implications of invasive species on communities' livelihoods?

Variables

- Purpose of use
- Income generated from invasive species
- Impact on Agriculture and livestock
- Livelihood Security Indicators
- Business Opportunity

iii. What ways that local strategies in managing invasive species for better livelihood outcomes?

Variables

- Method of control
- Access to resources

- Challenges encountered

1.6 Scope of the Study

The study was conducted at Boma ward in Mafinga council in Iringa region. The study was focus on the role of invasive species and their support on the household's livelihood of communities, particularly in terms of socio- economic and environmental dimensions also the research was focus on woody and herbaceous invasive plant species that are readily utilized by households. It covers their uses for subsistence and cash income. It was not focus on the detailed ecological impacts of these species or microbial invasive. The study was grounded in the Sustainable Livelihoods Framework (SLF), analyzing how households use invasive species as assets within their livelihood strategies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical review

2.1.1 Definitions and concepts

Invasive Species are non-native (alien) organisms that are introduced either intentionally or accidentally into a new environment, where they establish, spread rapidly, and cause ecological, economic, or social harm (Simberloff *et al.,* 2013; Shackleton *et al*., 2019). These species often outcompete native flora and fauna, disrupt ecosystem services, and alter habitats, leading to biodiversity loss and livelihood challenges (URT, 2019).

Households refer to the basic social and economic units within a community, typically consisting of individuals living together and sharing resources for survival, including food, income, and shelter (Chambers and Conway, 1992). In rural settings like Boma Ward, households primarily depend on agriculture, livestock, and forest resources for livelihoods (Mwaseba *et al.,* 2022).

Livelihoods encompass the means by which individuals and households secure basic needs (food, income, shelter) through access to and use of resources (natural, financial, social, human, and physical capital) (Scoones, 1998). In rural Tanzania, livelihoods are often agro-based, involving farming, livestock, and forest product harvesting (URT, 2019).

2.1.2 Ecological theory

Ecosystem Services Framework: This framework posits that ecosystems provide essential services that support human livelihoods, including food production, water purification, and climate regulation (Millennium Ecosystem Assessment, 2005). Invasive species can disrupt these services, leading to reduced agricultural yields and compromised food security. For instance, invasive plants may outcompete native crops for resources, thereby diminishing agricultural productivity (Pimentel *et al*., 2005).

Biological Invasion Theory: This theory examines the processes through which non-native species establish and spread in new environments, often leading to ecological and economic consequences (Richardson *et al*., 2000). Understanding these dynamics Invasive Species crucial for assessing the potential impacts of invasive species on local ecosystems and livelihoods.

2.1.3 Livelihoods framework

Sustainable Livelihoods Approach: This approach emphasizes the importance of various forms of capital natural, human, financial, physical, and social in sustaining livelihoods (Scoones, 1998). Invasive species threaten natural capital by degrading ecosystems, which can lead to decreased agricultural productivity and food insecurity. The framework highlights the need for a holistic understanding of how different forms of capital interact and influence livelihood outcomes.

Vulnerability Framework: This theory focuses on the susceptibility of communities to external shocks, including those posed by invasive species (Adger, 2006). It emphasizes that socio-economic factors, such as poverty and access to resources, play

a significant role in determining a community's vulnerability to the impacts of invasive. Vulnerable communities may lack the resources to adapt to changes brought about by invasive species, exacerbating their livelihood insecurity.

2.1.4 Economic theories

Cost-Benefit Analysis: This economic theory Invasive Species essential for evaluating the impacts of invasive species management. It involves comparing the costs of managing invasive against the benefits derived from maintaining healthy ecosystems and productive livelihoods (Mäler *et al*., 2003). Effective policies must consider these economic implications to ensure sustainable management practices.

Market Failure Theory: Invasive species often lead to market failures, where their impacts are not fully accounted for in economic activities (Barbier, 2007). This theory underscores the need for government intervention and community-led initiatives to address the socio-economic consequences of invasive.

2.1.5 Social theories

Social Capital Theory: This theory posits that the relationships and networks within a community contribute to its resilience (Putnam, 2000). Communities with strong social ties are better equipped to collectively address the challenges posed by invasive species, enhancing their adaptive capacity and livelihood security.

Adaptive Management Theory: This approach emphasizes the importance of flexibility and learning in managing ecosystems (Holling, 1978). Communities can develop adaptive strategies to cope with the impacts of invasive species, thereby enhancing their resilience and livelihood security.

2.1.6 Sustainable Livelihoods Framework (SLF)

Pioneered by researchers at the Institute of Development Studies (IDS) and widely adopted by DFID and other development agencies (Scoones, 1998; DFID, 1999). The SLF provides a holistic tool for understanding how households, within a specific context, construct livelihoods by combining various assets or capitals. Human, Social, Natural, Physical, and Financial. Traditionally, "Natural Capital" refers to stocks of natural resources like soil, water, and native trees. This study proposes that under certain conditions, invasive species can become a form of "natural capital" for households. They are a stock from which flows of useful products and services are derived.

2.1.7 Complementary Theoretical Perspectives

The Niche Theory and Opportunity: Ecological niche theory suggests that invasive species succeed by occupying an "empty" or underexploited niche in a new environment (Shea and Chesson, 2002). This can be extended socio-economically. IS may occupy a "livelihood niche" they provide a resource that is scarce due to environmental degradation, land pressure, or poverty. For example, where native trees are scarce, Lantana fills the niche for cheap, available fuelwood. Households are not passive victims but active agents who identify and exploit this new "opportunity" presented by the invasion.

The Diffusion of Innovation and Social Learning: Rogers' (2003) theory of diffusion of innovation explains how new ideas and technologies spread through a social system. The utilization of an invasive species can be seen as an innovation. Knowledge about

the uses of Lantana (e.g., for basket weaving) or Tithonia (as green manure) likely spreads through social networks via early adopters. This theory can guide the research to investigate how knowledge about invasive species use is shared and adopted within the community of Boma Ward.

The Environmental Entitlements Framework: Proposed by Amartya Sen and developed by Leach *et al.*, (1999), this framework argues that the value of an environmental resource is not inherent but is determined by a person's "entitlements" the set of legal and social means they have to access, control, and benefit from it. A household's ability to benefit from Eucalyptus depends on their land tenure (can they plant trees?), their labor (can they process the poles?), and their market access (can they sell them?). This theory shifts the focus from the resource itself to the social rules and relationships that govern its use.

2.2 Empirical review

2.2.1 Plant species preferences

In Mafinga Council, the agricultural landscape Invasive Species characterized by a variety of plant species, including both native and invasive species. The primary crops cultivated by local farmers include maize, beans, and cassava, which are staples in the region. However, invasive species such as Lantana camara, Eucalyptus spp., Tithonia diversifolia, and Parthenium hysterophorus, among others (Kweka *et al.*, 2020). These species have been reported to affect crop yields, pasture availability, water resources, and biodiversity all central to rural livelihood systems.

Studies on Eucalyptus Species (Mkaratusi). Tall, fast-growing trees with aromatic leaves. Eucalyptus is primarily planted and cultivated for timber, poles, and fuelwood.

It is not typically considered "invasive" in the same aggressive, spreading manner as Lantana. In Boma Ward, it is likely a major source of household income and fuel, but its cultivation could have local environmental impacts. its native to Australia and some islands to its north. Introduced to Tanzania during the colonial era for timber, firewood, and reforestation projects. Its negative impacts include: Allelopathy it releases chemicals that suppress the growth of understory plants, high Water Consumption, it can lower water tables, potentially drying up streams and wells. Role in Livelihood Extremely important. Planted on farms for building poles, firewood, and timber, which are major sources of income. Also used for shade and as windbreaks expanding on farm lands of Ethiopia at an alarming rate and efforts of local authorities to control the expansion have become sources of conflict and wide spread grievances among smallholder farmers in Gurage Zone. Focus Group Discussion, key Informant Interviews as well as Household Survey were used as data collection methods (Jama *et al.,* 2000). The result from the ordered logit estimation indicated households' perception to be influence by demographic and socio-economic factors such as age and educational level of household head and total land holding. Households, who have favorable perception towards eucalyptus tree, continue planting it despite the negative perception of experts and local officials and their efforts to control its expansion (Mahuku *et al.,* 2015).

Studies on Lantana camara (Lantana, Mbarika in Swahili): It is a native to Central and South America. It was introduced to Tanzania in the 19th century as an ornamental garden plant. Its nature: A thicket-forming shrub with prickly stems. It produces chemicals that suppress the growth of other plants. Its berries are spread widely by birds, allowing it to invade forests, grasslands, and farms rapidly. It is one of the

world’s worst invasive Research is consistent in showing the high utility of Lantana. In a study in the Moshi Rural District, Tanzania, Ngethe *et al.,* (2018) found that households primarily used Lantana for fuelwood (97% of respondents) and fencing (76%), valuing its fast growth and availability despite its ecological drawbacks. Similarly, its use for crafting furniture and baskets has been documented in Ethiopia and Kenya, showing a regional pattern of artisanal use (Shackleton *et al.,* 2017). A scrambling shrub with colorful, multi-hued flowers (often pink, orange, and yellow) and small, dark berries. It has a strong scent. Originally introduced as an ornamental plant. Impact: It forms dense, impenetrable thickets that choke out pasture grasses, native plants, and make access to land difficult. It is toxic to livestock if ingested. It is one of the most widespread and damaging invasive in Tanzania.

Studies on. Prosopis juliflora (Mesquite, Mkikuyu in Swahili): In the dryland regions of Tanzania (e.g., Babati) and Kenya, the invasive Prosopis is a classic example of a "conflict" species. Nyangito *et al.,* (2021) documented its dominance as a source of high-quality charcoal and fodder, especially during droughts, making it a critical economic resource despite its negative impacts on water tables and biodiversity. A thorny tree or shrub with fine, feathery leaves and long seed pods. Often introduced for charcoal production, fodder, or to stabilize soil in dry areas. Its spread into higher-altitude areas like Mafinga is possible due to its aggressive nature. Impact, it invades riverbanks, grasslands, and farmlands, depleting water tables and forming thorny thickets. However, as noted in the proposal, communities often use it for charcoal, timber, and fodder, creating a complex livelihood trade-off.

Studies on Tithonia diversifolia (Mexican Sunflower): Research from western Kenya and parts of Tanzania has cemented Tithonia's role as a "fertilizer tree." Govere *et al.,*

(2020) reviewed its adoption by smallholder farmers for soil fertility improvement, noting its preference over chemical fertilizers due to its zero cash cost, even though its collection is labor-intensive. It is a native to Central America. It was introduced to Africa as an ornamental plant and later promoted for soil fertility improvement (green manure). Its nature a robust perennial shrub that grows aggressively along roadsides, riverbanks, and abandoned farmland. It is a strong competitor that can form dense stands. Role in Livelihood. A complex case. It is used by some farmers as a green fertilizer to improve soil nutrients for crops. It is also used as fodder for livestock. However, its aggressive growth often makes it a problem outside of managed fields.

Studies on Parthenium hysterophorus (Santa Maria Feverfew, Gugu Karashi): It is a native to the tropical Americas (Gulf of Mexico region). It is a recent and devastating invader in Tanzania. And how it spread to Tanzania/E. Africa: It was first reported in the 1970s, likely introduced through contaminated grain shipments or attached to machinery. It has spread rapidly through vehicle movement and livestock. Its nature: A fast-growing annual herb that produces thousands of seeds and toxins (parthenin) that suppress other plants. It is a major allergen for humans and toxic to livestock.

Studies on Chromolaena odorata (Siam Weed, Mahama Kinyunya): Origin and History: Native to Central and South America. It was introduced to West Africa in the 1930s and has since spread across the continent. how it Spread to Tanzania: Likely through movement of livestock and contaminated farm equipment from other parts of Africa. Its nature: A scrambling shrub that forms dense, impenetrable thickets. It is highly flammable in the dry season. It outcompetes native grasses and plants.

Studies on Pine Tree (Pinus spp.). Origin and History: Native to the Northern Hemisphere (North America, Europe, Asia). Introduced to Tanzania for commercial

timber plantations (e.g., Sao Hill in Iringa Region). Its nature and Debate: Similar to Eucalyptus, it is a planted commercial species with invasive traits. It acidifies the soil, making it unsuitable for many native plants and crops. It can self-seed and spread into adjacent natural grasslands and moorlands. Its role in Livelihood: Provides jobs in plantations and is a source of timber and resin. However, its expansion often conflicts with local land uses.

How They Spread Globally and into Tanzania (Boma Ward)

- **Global Spread Pathways:**

Intentional Introduction: For ornament (Lantana, Tithonia), forestry (Eucalyptus, Pine), or agriculture (fodder, green manure).

Accidental Introduction: As contaminants in crop seed (Parthenium), attached to machinery, or via ship ballast water.

- **Spread within Tanzania and into Boma Ward:**

Human Transportation: The main highway through Mafinga is a major corridor. Seeds of Parthenium and Chromolaena are carried on vehicles and trucks.

Livestock Movement: Animals eat fruits (e.g., Lantana berries) and disperse the seeds through their dung over long distances.

Natural Dispersal: Wind (Parthenium seeds), water (along rivers), and birds (which eat and disperse Lantana and Chromolaena seeds).

Agricultural Exchange: The movement of planting material, tools, and livestock between farmers inadvertently spreads weeds like Parthenium.

2.2.2 Socio-Economic Implications of Invasive Species on Communities' Household's Livelihoods.

The socio-economic implications of invasive species in Mafinga Council are significant. Invasive plants can lead to reduced agricultural productivity by outcompeting native crops for resources such as water, nutrients, and sunlight. Most of attempted efforts to control invasive plants include traditional approaches which are generally not efficient in terms of time consumed and amount of plants removed (Kiunsi, 2013).

This competition can result in lower yields, which directly impacts food security and the income of local farmers. Additionally, the presence of invasive species can increase the costs of farming due to the need for additional labor and resources to manage these plants. For instance, farmers may need to invest more time and money in weeding and controlling invasive species, which diverts resources away from other productive activities. Using occurrence data of six of the most problematic invasive alien plants (Babu *et al.*, 2018). Moreover, invasive species can have indirect effects on community health and well-being. For example, some invasive plants may harbor pests or diseases that can affect livestock, further threatening the livelihoods of pastoralists in the region. In areas where they spread, invasive species can destroy natural pasture, displace native trees, and reduce grazing potential of rangelands(Article, 2018).

The overall economic burden of managing invasive species can exacerbate poverty levels among vulnerable populations, making it a critical for livelihood security concurrently, majority of rural people have very low income to spare for hired labor.

Concurrently, and majority of rural people have very low income to spare for hired labor (Farrugia, 2016).

The biological invasions have been increasing at multiple spatial scales and the management of invasive species Invasive Species becoming more challenging due to confounding effects of climate change on the distribution of those species. Identification of climatically suitable areas for invasive alien species and their range under future cli- mate change scenarios are essential for long-term management planning of these species. Using occurrence data of six of the most problematic invasive alien plants (Babu *et al.,* 2018). However, they also contribute to Income and Subsistence: A seminal study by Shackleton *et al.,* (2017) across several countries found that over 90% of households used IS for subsistence, and 50% derived cash income from them. In Tanzania, the sale of Prosopis charcoal provided a significant secondary income source for pastoralists in arid areas.

Poverty Alleviation and Safety Nets: Research by Shackleton and Shackleton (2016) in South Africa emphasized that products from invasive plants often serve as a "green social security net," helping poorer households to meet basic needs and reduce vulnerability to shocks like crop failure. This safety net function is likely critical in Boma Ward during difficult seasons.

2.2.3 Strategies That Local Communities Participate in Managing Invasive Species for Better Household's Livelihood Outcomes.

In most developing countries, community involvement in control of invasive plant species Invasive Species hindered by number of factors. Lack of awareness about harmfulness of these species Invasive Species attributed to poor access to extension

education among local farmers (Obiri, 2011). Local communities in Mafinga Council have developed various strategies to manage invasive species and mitigate their impacts on livelihoods. Community participation Invasive Species crucial in these management efforts, as local knowledge and practices play a significant role in addressing the challenges posed by invasive plants. Some of the key strategies include: Awareness and Education Collaborative Management. Utilization of Invasive Species. Policy Advocacy. Utilization-Based Management: The most common strategy is active harvesting for use. This is a form of sustainable exploitation that can suppress population growth. Ngethe *et al.,* (2018) found that continuous cutting of Lantana for fuelwood and fencing helped control its spread in managed areas, though it persisted in unmanaged landscapes.

Physical and Cultural Control: Communities employ manual weeding, burning, and seasonal clearance. A study in Uganda by Mugwanya *et al.,* (2021) found that collective action through farmer groups was more effective at managing Parthenium than individual efforts. Cultural practices, such as specific tillage techniques during certain moons, have also been documented but are often overlooked in scientific literature.

Adaptive Livelihood Diversification: Evidence shows that households adapt their livelihood strategies to the invasion. For example, in areas where grazing is diminished by Lantana, studies show a shift towards charcoal production from the invader itself or an increase in small-scale trading (Shackleton and Shackleton, 2016).

Additionally, control of invasive species could demand adequate resources, especially manpower. However, labor availability from youth could be a problem following increased urban migration. Concurrently, majority of rural people have very low

income to spare for hired labor, most of attempted efforts to control invasive plants include traditional approaches which are generally not efficient in terms of time consumed and amount of plants removed (Ngondya *et al.,* 2017). This includes physical uprooting, slashing, burning and occasionally chemical spraying (Manning and Miller, 2011).

2.3 Information gap

Table 1: Information Gap

Title	**Author**	**Major findings**	**Information Gap**
Invasive species and poverty: The role of invasive species in affecting livelihoods.	Shackleton, M. *et al.,* (2007)	Invasive species can negatively impact agriculture, reduce biodiversity and increase labor for rural households.	Does not quantify the long-term socio-economic impacts on household security.
Invasive species and their impacts on ecosystem services and human well-being.	Pejchar, L. and Mooney A (2009).	Invasive species alter ecosystem services such as water supply, food security and land productivity.	Lacks localized case studies showing direct links to household or community livelihood strategies.
Biological invasions: Economic and Environmental costs of alien plant, animal and species.	Pimentel, D. *et al* (2005).	Highlights the economic burden of invasive species globally across agriculture, forestry and health sectors.	Insufficient focus on how these costs translate onto livelihood insecurity at the household level.
Alien species and human well-being: A framework for impacts.	Bacher, S. *et al* (2018).	Proposes a conceptual framework to assess the effect of alien species on human well-being.	Lacks empirical evidence on how different livelihoods (e.g. Fishing, farming)

			are specifically affected.
Livelihood impacts of invasive species: Evidence from water hyacinth in East Africa.	Mailu, M. (2001)	Water hyacinth affects fishing transportation, and access to water, threatening local livelihoods.	Limited to a single species and region; lacks broader generalization across multiple livelihood types.

2.4 Conceptual framework

Figure 1 shows the conceptual framework for understanding the role of invasive species in supporting household livelihood in Mafinga Council integrates various components that influence this livelihood relationship. It emphasizes the interconnections between ecological, social, and economic factors, illustrating how invasive species impact livelihoods and how communities are benefited. By examining the ecological, social, and economic dimensions, it highlights the importance of community engagement and adaptive management in addressing the changes posed by invasive species. Understanding people's perceptions Invasive Species crucial for understanding behavior and developing effective management strategies to maintain, preserve and improve biodiversity, ecosystem services and human well-being (*Explaining People ' s Perceptions of Invasive Alien Species : A Conceptual Framework*, 2019). By adopting a conceptual framework that encompasses these dimensions, researchers and policymakers can gain a holistic understanding on the relationship between invasive species and livelihood security. This comprehensive perspective can guide the development and implementation of targeted interventions

that address the underlying causes and promote sustainable agriculture, ecosystem resilience, and food security in these regions.

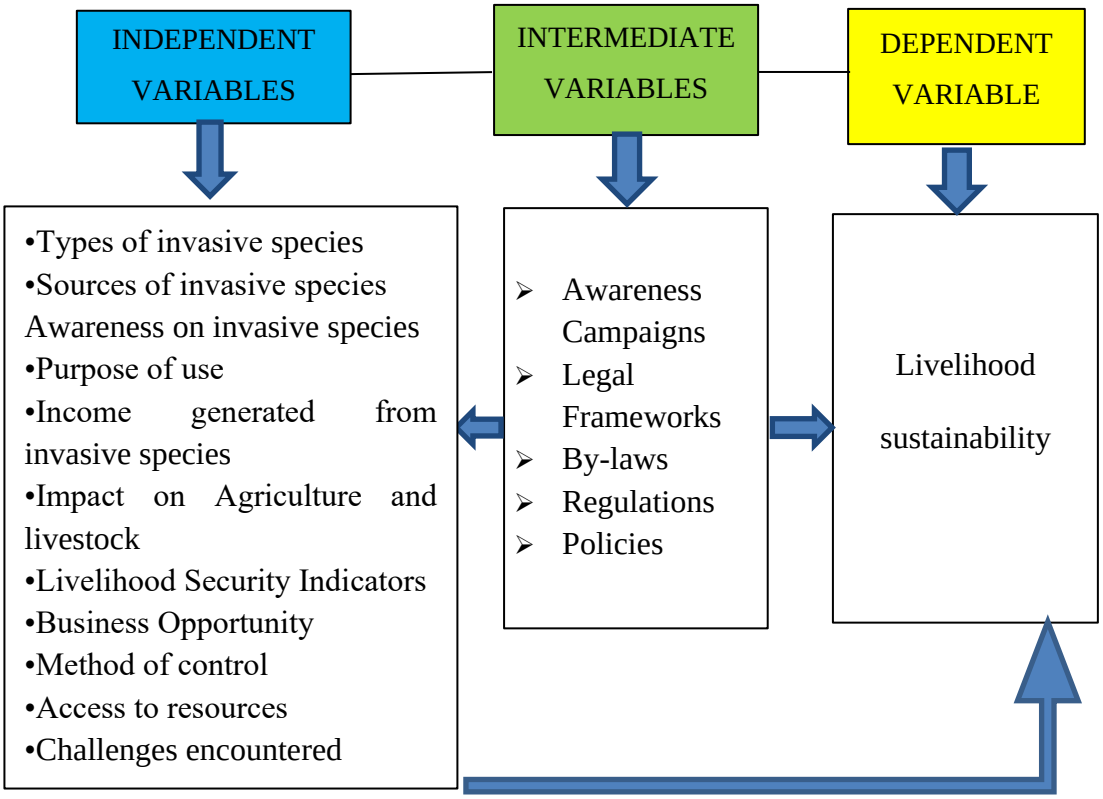

Figure 1: Conceptual frame work

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study Area

The study was conducted in Mafinga district of Iringa Region as shown in Figure 2. The reason for selecting this particular area is because of the adoptive nature of plants species growing as a source of income and the socio-economic development to many livelihoods who occupy at Boma ward, as this is due to the existence and presence of invasive species. This area has witnessed growing ecological disturbances and opportunities due to invasive plant and animal species, which directly affect agriculture, water availability, and natural resource.

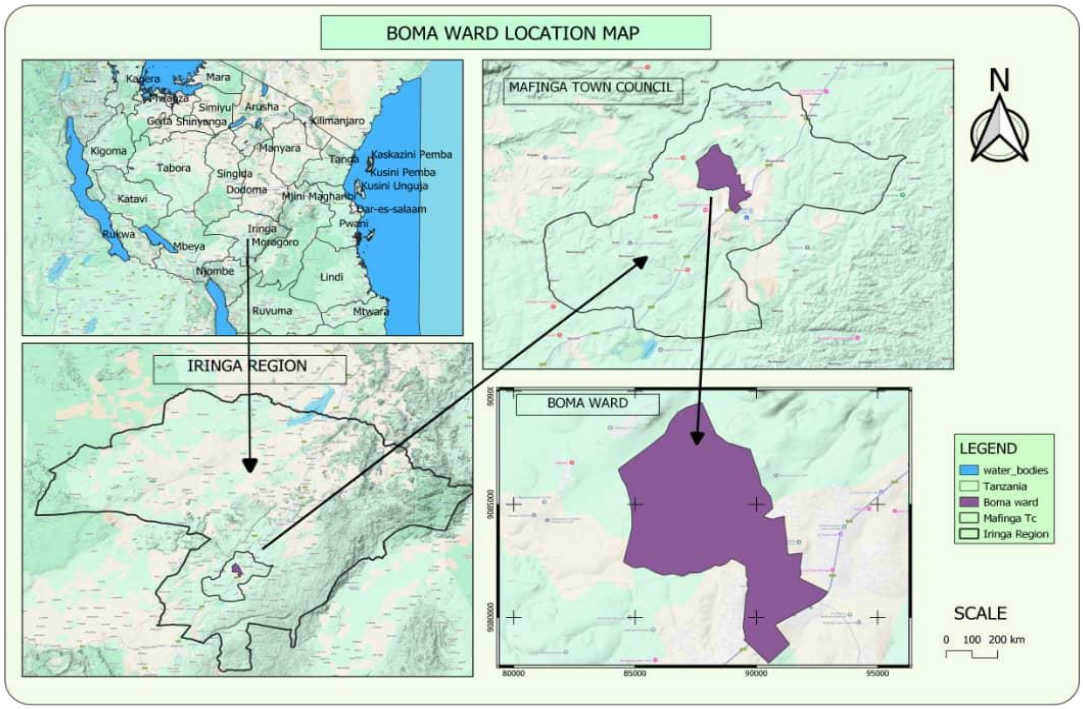

Figure 2: Boma Ward location map

3.2 Research Design

This study adopts a mixed-methods research design, integrating both quantitative and qualitative approaches to comprehensively explore the role of invasive species and livelihood security. The quantitative component was to assess measurable impacts such as crop yield reductions and income gain, while the qualitative aspect provided an insight into perceptions, coping strategies, and community experiences.

3.3 Data Types and Data Sources

The study was utilized both qualitative and quantitative data to ensure a comprehensive understanding of the research problem.

- Quantitative data and Qualitative data were collected directly from primary sources through field surveys, interviews, and observations. This data was providing first-hand insights into the experiences and perceptions of households.

- Also, data was obtained from secondary sources such as existing literature, government reports, and statistical databases such as the Tanzania National Bureau of Statistics (NBS), and previous research studies. This data was help contextualize the findings and support the analysis with historical and comparative information.

3.4 Data Collection Methods and Tools

To gather accurate and relevant data, a combination of qualitative and quantitative data collection methods was employed. Each method is paired with a specific tool designed

to maximize data quality and relevance. Table 2, shows methods and tools used in this study.

Table 2: Matrix Table Showing Data Collection Methods and Tools

Objectives	Variables	Methods	Tools
Types of plant species grown in the study area	Types of invasive species	Observation	Digital Camera
		Interview	Questionnaire
		Interviews	Questionnaires
		Documentary review	checklist
		Field observations	Checklists
	Awareness on invasive species	Documentary review	checklist
Socio-economic implications of invasive species on communities' livelihoods	Income generated from invasive species	Field observations	Checklists
		Interview	Questionnaire
	Impact on Agriculture and livestock	Field observations	Checklists
		Documentary review	Document
Local communities participate in managing invasive species for better livelihood outcomes	Livelihood Security Indicators	Field Observations	Checklists
	Business Opportunity	Interview	Questionnaire
	Method of control	Documentary review	Document
	Access to resources	Field observation	Checklist and Note book
		Interview	Questionnaires
	Challenges encountered	Field observation	Checklist

3.4.1 Surveys

Structured and semi-structured questionnaires were prepared and used to obtain information from household heads, local leaders, utility providers, and government agents concerning perceptions on the effects of solid waste management practices

(Appendix 1). Also, Structured questionnaires were administered to a representative sample of market vendors and customers. The questionnaires were including both closed and open-ended questions to capture quantitative data and qualitative insights (e.g., personal experiences, suggestions for improvement). The tool where be designed in both English and Kiswahili to accommodate language preferences and ensure clarity. The survey where be conducted face-to-face to increase response rates and allow for clarification of questions when necessary.

3.4.2 Key Informant Interviews (KIIs)

Key Informant Interviews was conducted with individuals who have in-depth knowledge of the invasive species support on livelihoods. These may include market leaders, health officers, municipal council officials, and representatives from NGOs involved in different projects. A semi-structured interview guide was used to allow flexibility in probing deeper into specific issues while maintaining consistency across interviews. Appendix 2 shows method was provided rich, contextual data that complements the survey findings.

3.4.3 Direct Observation

Non-participant observation was used to assess the physical condition, accessibility. An observation checklist where be developed to systematically record data on the number of households. This method was help validate self-reported data and provide an objective assessment of the invasive species on livelihoods support.

3.4.4 Document Review

Relevant documents such as reports, and previous research studies was reviewed to gather background information and secondary data. This method was help triangulate findings from primary data sources and provide a broader understanding of the policy and institutional context.

3.5 Sampling

3.5.1 Sampling Frame

The sampling frame refers to the list or database from which the sample was drawn. In this study, the sampling frame were consisting of all registered and unregistered households occupying within Boma ward, as well as population in this study was a small-scale farmers, individuals and traders who are benefiting from forestry product from the invasive species from Mafinga council.

3.5.2 Sampling Unit

The sampling unit is the individual element from the population that where be selected for study. For this research, the sampling units are: The population in this study consisted of Local Individual households (both male and female) dependent on farming, livestock keeping and forest resources, Community leaders and elders, ward agricultural and environmental officers, Representatives from NGOs and CBOs working in the areas of environment and rural development.

3.5.3 Sample size

The sample size for the survey was determined by using Yamane formula, which is commonly used for calculating sample sizes in social research. The formula used in this study is shown in Equation (i).

$$n\frac{(1+N(e\hat{}2))}{N} \quad \text{.....(i)}$$

$$n = \frac{(1+9803(0.12^2))}{9803} \quad \text{.....(ii)}$$

Where:

n= Sample size

N=Number of household's

e= Margin of error (Expressed as a decimal) 12%

n=9,803/ (1+9,803(0.12^2)) = 69 respondents.

So, respondents were 71 including key informants as shown in table 3. Smallholder farmers, Pastoralists Community leaders, Environmental officers, Representatives of NGOs involved in ecosystem management.

Table 3: Sample size composition

Respondents	Number
Households	69
Environmental officers	1
Community leaders	1

3.5.4 Sampling procedure

Sampling procedures refer to the techniques used to select individuals from the sampling frame. This study employed a combination of probability and non-probability sampling methods, depending on the target group and research tool.

- **Probability Sampling**

The study uses Simple Random Sampling this technique were ensure equal chance of responses to be selected in the study area.

- **Non-Probability Sampling**

Purposive Sampling, was used to select key informants, such as community leaders, and officials. These individuals are chosen based on their knowledge and experience. Purposive sampling is appropriate for key informants because it targets individuals with specific expertise or insights that are not randomly distributed within the population.

3.6 Data processing, analysis and presentation

3.6.1 Data Processing

Once data collection was complete, the next phase involves data processing, which includes organizing, cleaning, and coding the collected information. For quantitative data obtained through surveys, responses were entered into Excel software for

analysis. Data cleaning was involved checking for completeness, consistency, and accuracy to eliminate errors and ensure reliability. Each questionnaire was assigned as a unique identification number to maintain traceability and confidentiality.

3.6.2 Data Analysis

The analysis of data was guided by the specific research objectives. For Objective 1 (to explore types of plant species grown in the study area), descriptive statistics such as frequencies, percentages, and cross-tabulations was used to summarize the availability, functionality, and condition of invasive species. For Objective 2 (to examine socio-economic implications of invasive species on communities' households' livelihoods), both quantitative and qualitative data were analysed. This approach involves identifying recurring themes, patterns, and narratives that reflect the lived experiences and perceptions of the participants. For Objective 3 (to examine strategies that local communities participate in managing invasive species for better household's livelihood outcomes), descriptive statistics may be used while qualitative insights were used to explain the underlying institutional, financial, and social barriers. The integration of both quantitative and qualitative findings was provided by comprehensive understanding of the research problem.

3.6.3 Data Presentation

In terms of data presentation, the results were displayed using a combination of tables, graphs, pie charts, and narrative summaries. Tables was be used to present numerical data in a structured format, while graphs and charts was enhancing visual interpretation of trends and comparisons. Qualitative findings were presented in narrative form,

supported by direct quotes from participants to illustrate key themes. This multi-format presentation ensures clarity, accessibility, and engagement for both academic and non-academic audiences. This vigorous approach to data processing, analysis, and presentation was to ensure that the study findings are accurate, meaningful, and actionable, ultimately contributing to evidence-based decision-making.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This section presents the findings obtained from the field. The first part of the section provides social and demographic characteristics of the respondents. The second part focuses on the education level. Thirdly, there is the focus on the extent Primary Occupation. The fourth part is about Types and Uses of Invasive Species. The fifth section presents Socio-economic Implications in relation to support they get from government. Lastly there is the investigation on whether Management Strategies of the government strategies on invasive species.

4.1 Demographic Profile of Respondents

4.1.1 Age and Sex Distribution

Table 4 shows age distribution of respondents shows a majority between 20-39 years, indicating a predominantly young population engaged in household livelihoods. reflecting a relatively young to middle-aged demographic. This indicates that working-age individuals form the bulk of the surveyed households. This shows that the population is largely within the productive working age, with implications for both labour availability and adaptive capacity in managing invasive species. The age distribution aligns with Tanzania's national demographic profile, which is characterized by a youthful population (NBS, 2016). The community is not resource-poor in terms of human capital. This presents a significant opportunity for educational interventions and participatory research.

Table 4: Demographic Characteristics of the Respondents.

Age Group	Male	Female	Total	Percentage
20-29	12	11	23	33
30-39	7	8	15	22
40-49	9	10	19	28
50-59	5	3	8	12
60-69	3	0	3	4
70-79	1	0	1	1
Total	**37**	**32**	**69**	**100**

Source: Field survey (2025)

4.1.2 Education Level

A significant proportion of respondents which were 30% had college/university education, followed by secondary school 28% of the respondents and vocational training respondents were 23%. Msuya *et al*., (2010) in their study on knowledge transfer in rural Tanzania, higher educational attainment in peri-urban areas like Mafinga Town Council is a key factor influencing the adoption of new agricultural technologies and information. This suggests the community has the demographic and educational capacity to engage in sophisticated management practices if properly trained. This relatively high education level can facilitate awareness campaigns and adoption of sustainable management practices. Which suggests that literacy and learning potential are not major barriers to awareness campaigns. The education level of respondents indicates a significant number with secondary education and above, which may influence their awareness and management strategies regarding invasive species. Table 5 shows the education level of respondents indicates a significant

number with secondary education and above, which may influence their awareness and management strategies regarding invasive species.

Key Informant Opinion*: Government agricultural officers consistently highlighted a significant "knowledge gap" at the community level. One officer stated, "Our communities know these plants by their local names and uses, not as 'invaders.' They see a plant that provides good firewood or timber and encourage it. The concept that this same plant can choke rivers or make cattle sick is foreign to them."*

Table 5: Education level of respondents

Education Level	Percentage
No formal education	9
Primary school	10
Secondary school	28
Vocational training	23
College/University	30
Total	**100**

Source: Field survey (2025)

4.1.3 The main source of income.

Figure 3 show the Crop farming respondents were about 38% and small business 29% of the respondents dominated, showing a dual reliance on agriculture and trade. Livestock keeping 14% and wage employment 12% also play a role. Crop farming were 38%, small business 29%, livestock keeping 14%, forest product harvesting 7%, wage employment 2% which indicates diverse livelihood portfolios with a strong dependence on agriculture and informal economy. Further underscores this gap between local experience and scientific understanding, a common issue in rural

settings as noted by Novoa *et al.*, (2018). The data reveals substantial economic benefits of household's respondents using invasive species for income generation and those who uses as food sources.

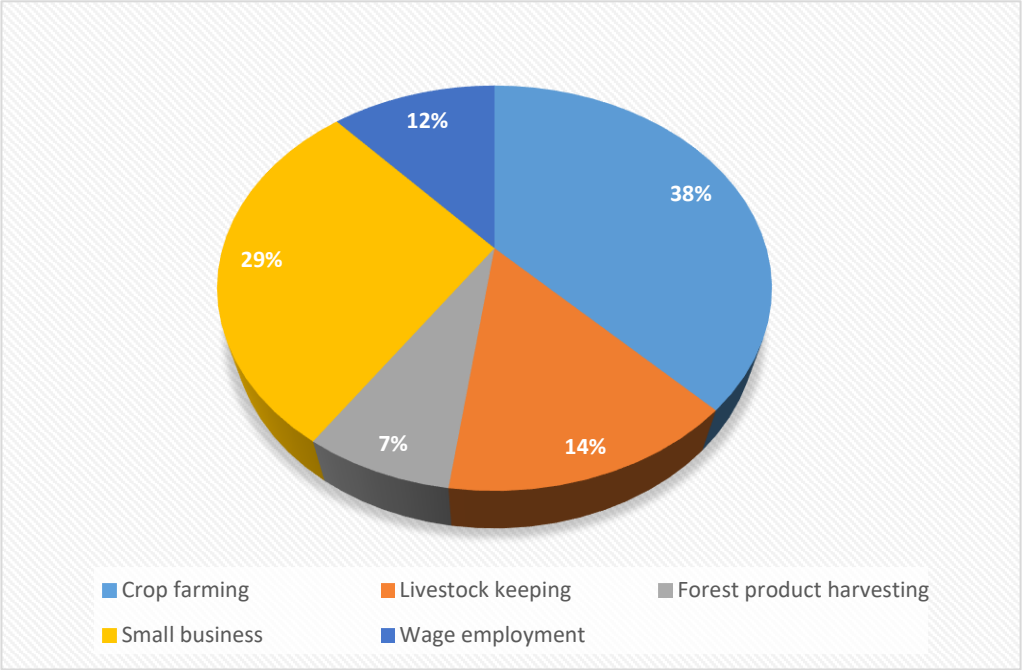

Figure 3: Primary occupation of Respondents

Source: Field survey (2025)

4.2 Types of Plant or Invasive Species Grown in Boma Ward.

4.2.1 Types of Invasive Plants Grown/Used

Lantana camara (Lantana**):** Often cited as one of the world's worst invasive species, Lantana is known for forming dense, impenetrable thickets that outcompete native flora Shackleton *et al.*, (2017). Its presence in Boma Ward is significant. While it is a major ecological threat, communities often harvest it for fuelwood and occasionally for medicinal uses, though its value is typically low compared to native species.

Eucalyptus spp. (Eucalyptus) and Pine Tree (Pinus spp.). Plate 1shows these species are often intentionally introduced for commercial forestry, soil stabilization, and as a source of timber and poles. Their listing as "invasive" in this context is crucial, it highlights the dual nature of such species they are economically beneficial for building materials 12% of uses and income generation, but their high-water consumption can deplete local water tables and alter soil nutrients, negatively impacting adjacent agricultural land (Dye and Jarmain, 2004). Their economic utility likely explains their tolerance and even promotion in some areas. Chromolaena odorata (Siam Weed). This plant is a classic example of an invasive species with mixed impacts. It can severely reduce biodiversity and pasture productivity. However, it is also widely used as a green manure to improve soil 2% of uses and has applications in traditional medicine (Witt, 2017). Its rapid growth makes it a readily available, though ecologically damaging, resource. Tithonia diversifolia (Mexican Sunflower), Similar to Chromolaena, Tithonia is prized in agroforestry for its ability to be used as green manure and botanical pesticide. Its promotion for soil improvement can create a dependency on an invasive species, presenting a complex management dilemma Jama *et al.*, (2000). Prosopis juliflora (Mesquite). This thorny shrub is highly invasive in arid and semi-arid regions like Iringa. It encroaches on grazing land, harming livestock with its thorns. However, its pods are a valuable source of fodder 2% of uses, especially during dry seasons, and its wood is excellent for fuelwood and charcoal (Shackleton *et al.*, 2014) as shown in figure 4. This creates a strong trade-off between its negative ecological impacts and its direct livelihood benefits. Parthenium hysterophorus (Feverfew). This is one of the most hazardous invasive, as it can cause severe allergic reactions in humans and health problems in livestock. It’s very low reported use in the

data aligns with its known toxicity. Its presence is almost purely detrimental, and its management is a significant challenge (Bajwa *et al.*, 2016).

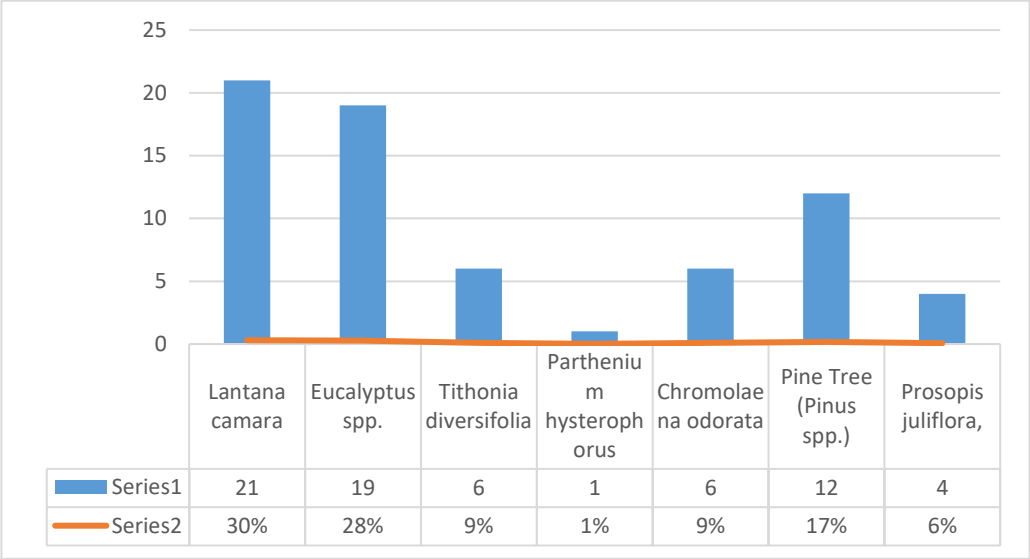

Figure 4: Types of Invasive Plants Grown/Used

Source: Field survey (2025)

Plate 1: Types of Invasive Plants Grown/Used

Sources: Field survey (2025)

4.2.2 Sources of Invasive Species

Most species were intentionally planted 41% with significant cases of unknown origins 35%, highlighting the challenge of tracking spread as shown in figure 5. This implies that some invasions are directly linked to livelihood practices. Global Spread Pathways: Intentional Introduction: For ornament (Lantana, Tithonia), forestry (Eucalyptus, Pine), or agriculture (fodder, green manure). Accidental Introduction as contaminants in crop seed (Parthenium), attached to machinery, or via ship ballast water. Spread within Tanzania and into Boma Ward human transportation, the main highway through Mafinga is a major corridor. Seeds of Parthenium and Chromolaena are carried on vehicles and trucks. Livestock Movement. Animals eat fruits (e.g., Lantana berries) and disperse the seeds through their dung over long distances. Natural Dispersal wind (Parthenium seeds), water (along rivers), and birds (which eat and disperse Lantana and Chromolaena seeds). Agricultural Exchange: The movement of planting material, tools, and livestock between farmers inadvertently spreads weeds like Parthenium.

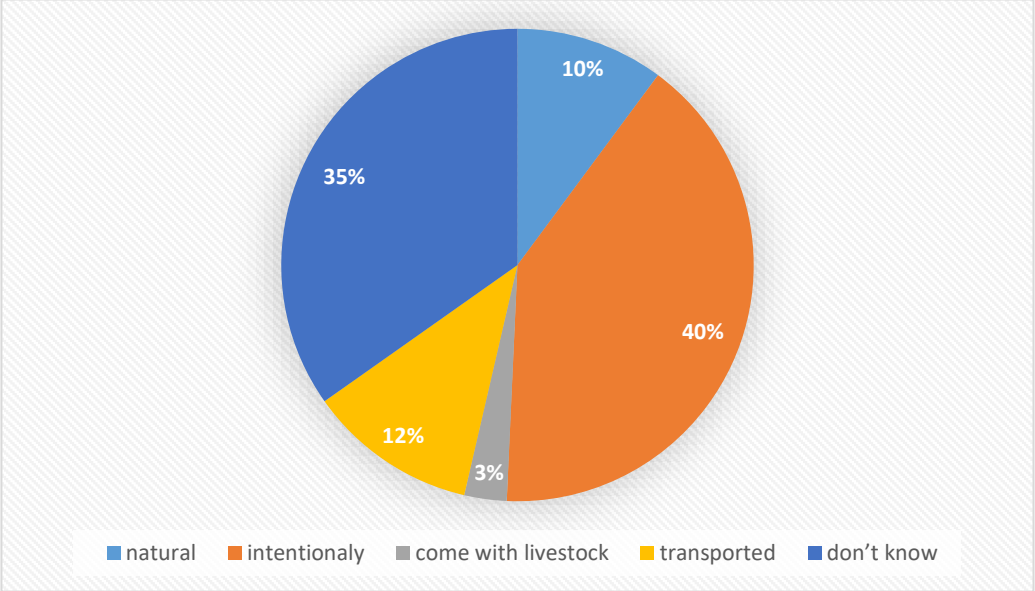

Figure 5: Sources of invasive species

Source: Field survey (2025)

4.3.1 Awareness of Invasive Species

Findings in figure 6 shows that about 57% majority of household respondents were not aware of the concept of "invasive species." respondents reported being aware of invasive species, revealing a significant knowledge gap. This finding is consistent with a global review by Shackleton *et al.*, (2007), who found that local communities often perceive plants based on their utility rather than their origin or ecological impact. In a Tanzanian context, Binggeli (2001) argued that the lack of awareness is a primary constraint to managing invasive species, as communities do not recognize slow, long-term environmental degradation caused by these plants, focusing instead on immediate benefits. This imply that fundamental concepts of invasion biology have not been effectively communicated to the local level. This knowledge gap is the root cause of many management challenges.

Key Informant Opinion: *Government agricultural officers consistently highlighted a significant "knowledge gap" at the community level. One officer stated, "Our communities know these plants by their local names and uses, not as 'invaders.' They see a plant that provides good firewood or timber and encourage it. The concept that this same plant can choke rivers or make cattle sick is foreign to them."*

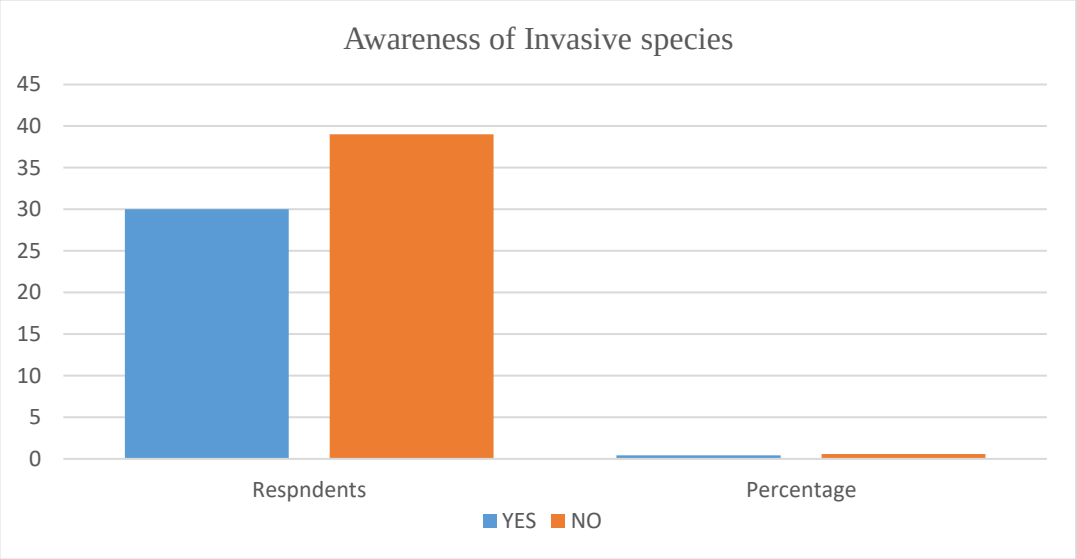

Figure 6: Awareness of Invasive Species

Source: Field survey

4.3 Socio-Economic Implications of Invasive Species on Communities' Livelihoods.

4.3.1 Purpose of Use of Invasive Species.

The data on the purpose of use of invasive species reveals that the primary roles of these species are income generation 38% and as a food source 35%, as shown in figure 7 and table 6 and followed by building materials 12%. This directly supports the research title, demonstrating that households are not just coping with these species but are actively integrating them into their economic strategies. As noted by Shackleton *et*

al., (2007) extensively documented how invasive species form a critical "safety-net" for rural livelihoods across Southern Africa, providing essential goods and cash income. The significant economic reliance on invasive species is a well-documented paradox. Whereby the main uses were income generation with about 38% and food 35%, underscoring the economic and nutritional role of these species. Income generation and food are the main uses, indicating strong economic and subsistence value. Shackleton *et al.*, (2007), invasive are often utilized because they are abundant and freely available, reducing the costs of alternative resources. The primary use of invasive species is for income generation and food source, which are critical for household sustainability. Underscoring the economic and nutritional role of these species. Income generation and food are the main uses, indicating strong economic and subsistence value.

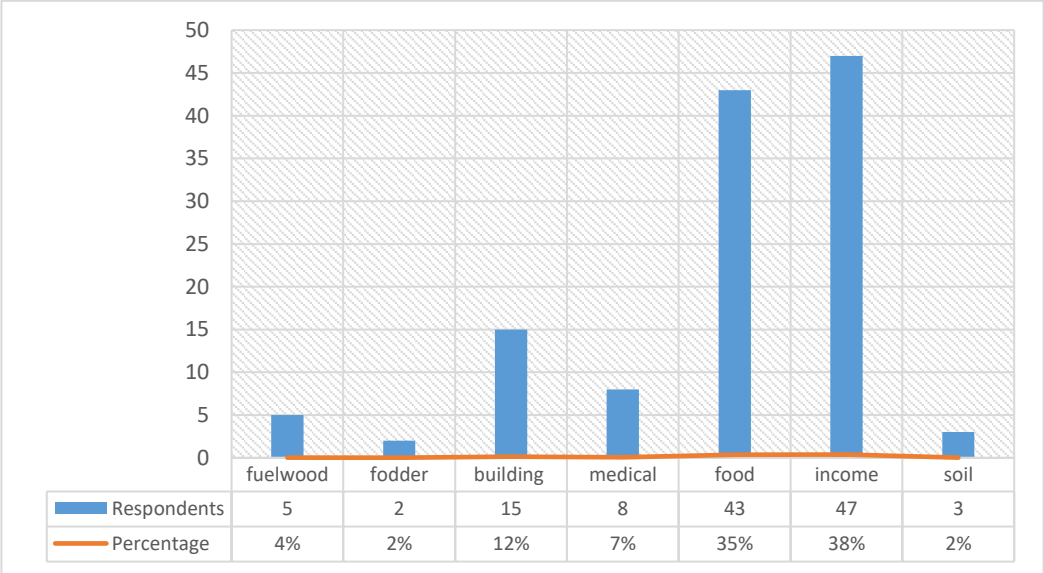

Figure 7: Purpose of Use of Invasive Species

Source: Field survey (2025)

Table 6: Purpose of Use of Invasive Species

Category	Invasive Species	Purpose of Use
Timber Species	Eucalyptus spp.	Building materials, poles, timber, fuelwood
	PineTree (*Pinus* spp.)	Building materials, timber, fuelwood
Medicinal Species	Lantana camara	Treating wounds, rheumatism, skin ailments
	Chromolaena odorata	(stopping bleeding), wound healing, treating skin infections
	Tithonia diversifolia	Treating malaria, liver pains, as an antifungal
Fodder Species	Prosopis juliflora	Fodder for livestock (pods), fuelwood (charcoal)
Multiple Uses	Tithonia diversifolia	Soil improvement (green manure), medicinal uses
	Chromolaena odorata	Soil improvement, medicinal uses

Source: Field survey (2025)

4.3.2 Income Generation from Invasive Species.

Annual Income from Invasive Species (in Tanzanian Shillings - TZS) shows the economic Benefits. The income generation data is striking a significant 46% of respondents engaged in selling products from invasive species earned between TZS 300,000-350,000. This income is substantial, potentially contributing a crucial secondary or even primary income stream for households. This finding is supported by global studies; for instance, a review by Shackleton (2021) found that "invasive species can provide significant financial benefits at the household level, particularly for the poor and marginalized who have limited access to other assets." The sale of timber from Eucalyptus/Pine, charcoal from Prosopis, or perhaps food products from other species is a vital livelihood strategy. A study by Kamanga *et al.*, (2009) on rural income in Malawi showed that similar amounts constituted a significant portion of annual household cash income, underscoring the economic importance of these resources and creating a strong disincentive for their control. The income levels reported in Boma Ward are substantial. So, this implies that the economic benefits derived from these species create a significant barrier to eradication. Management must therefore focus on sustainable use and replacement with beneficial non-invasive alternatives to avoid impoverishing communities. This perspective validates the survey finding that 38% of use is for income generation and that nearly half of the respondents earn a significant portion of their cash income from these species. The Key informant confirm that this economic reality is the biggest barrier to management.

***Key informant Opinion**: A ward executive explained the economic dilemma: "You cannot simply tell a family to cut down a tree that they sell for 300,000 TSH. That are*

school fees. That is a hospital bill. The benefits are real and immediate; the harms, like soil degradation, are slow and invisible to them."

Table 7 and figure 8 shows that almost 60% of respondents (those earning TZS 300,000 and above), they are engaged in selling different product from invasive species such as timber and medicine which are a crucial economic resource, providing what can be considered a primary or major secondary income stream. This underscores their vital role in supporting livelihoods in Boma Ward.

Table 7: Annual Income from Invasive Species (in Tanzanian Shillings - TZS)

Income Range (TZS)	**Respondents**	**Percentage**	**Analysis**
20,000 - 50,000	5	7	Low, supplemental income. Likely from occasional sale of fuelwood or fodder.
100,000 - 150,000	11	16	Supplementary income. Could be from more regular sales of poles or charcoal.
200,000 - 250,000	9	13	Significant supplementary income.
300,000 - 350,000	32	46	This is the mode (most common income bracket). This represents a major source of household income, likely from the sustained sale of high-value products like timber from Eucalyptus or Pine.

Income Range (TZS)	Respondents	Percentage	Analysis
400,000 - 450,000	9	13	Very significant income, potentially a primary income source for these households.
500,000 - 1,000,000	3	5	Major primary income. Likely from large-scale trade in timber or charcoal.

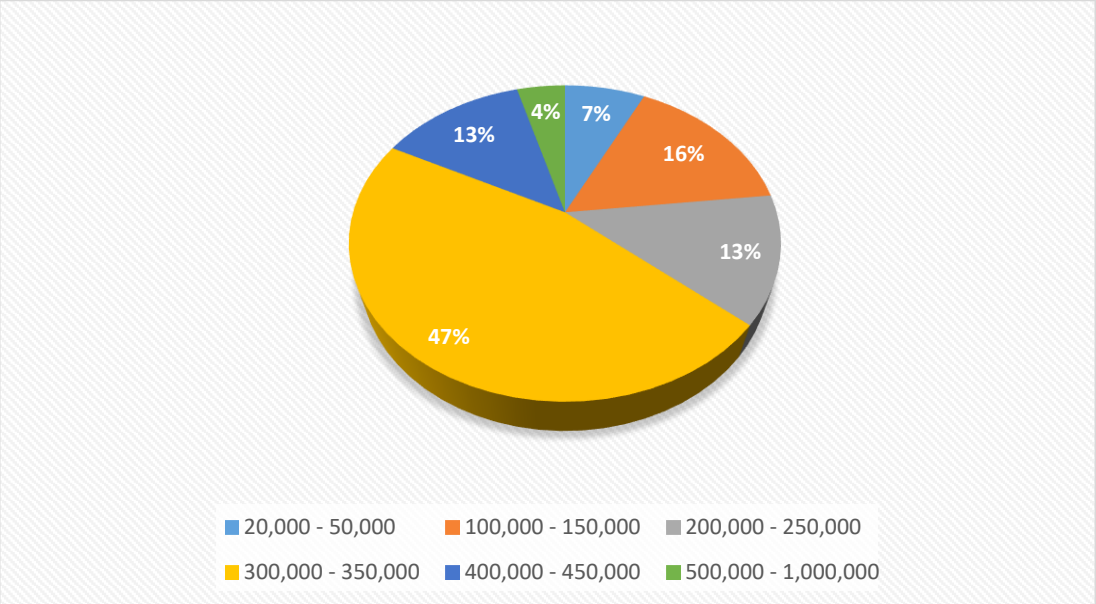

Figure 8: Income Generation from Invasive Species.

Source: Field survey (2025)

4.3.3 Impact of Invasive Species on Agriculture

A majority of respondents reported no effect on crop production 59% or livestock 58% as shown in figure 8. However, a notable minority reported increased crop production

26% and improved livestock 25%, likely due to species used for soil improvement (Tithonia, Chromolaena) and fodder (Prosopis). Soil Improvement**:** Species like Tithonia diversifolia and Chromolaena odorata are used as green manure. They are cut and incorporated into the soil to add nutrients, improving fertility and crop yields for the 26% who reported increased production. Those reporting negative impacts (14% decreased crops, 16% reduced livestock) are likely dealing with the encroachment and allelopathic effects of species like Lantana and Parthenium. This split in perception underscores that the impact is highly species-specific and context-dependent. The net effect on a household depends on which species are present on their land and their knowledge of how to utilize or manage them (Nuñez and Simberloff, 2005). While some households reported increased crop yields, others noted declines due to competition for resources. This reflects the "double-edged sword" described by Kull *et al.,* (2011), where the benefits of invasive species coexist with potential harm to native biodiversity and agricultural productivity. Trade-offs and Ecological Risks.This perceived neutrality or benefit contrasts with the scientific consensus on the negative impacts of many invasive species. This positive perception contradicts most agricultural literature. The Food and Agriculture Organization (FAO) frequently cites invasive species as a major cause of crop yield loss and livestock poisoning. The community's perception can be explained, species they are utilizing such as Eucalyptus for building materials may not be the most aggressive agricultural pests. Furthermore, some species like *Chromolaena odorata* can initially improve soil fertility before becoming dominant, which might explain the positive perceptions (Witt, 2010). This implies that the mismatch between local perception and scientific evidence risks leaving communities vulnerable to unperceived long-term

risks, such as soil degradation and water scarcity. They also reduced production Competition. Lantana camara, Parthenium hysterophorus, and Prosopis juliflora form dense thickets that compete fiercely with crops for water, sunlight, and nutrients, leading to reduced yields for the 14% reporting decreased production. Allelopathy: Some species (e.g., Eucalyptus, Parthenium) release chemicals into the soil that inhibit the germination and growth of nearby plants**.**

Key Informant Opinions: *An agricultural extension officer provided a technical explanation for the community's perception of "no effect": "Some species, like certain Eucalyptus, are deep-rooted and may not directly compete with annual food crops in the short term. So, a farmer sees no yield change in his maize and concludes the tree is harmless. He doesn't see the falling water table or the loss of soil fertility beneath the tree canopy over years."*

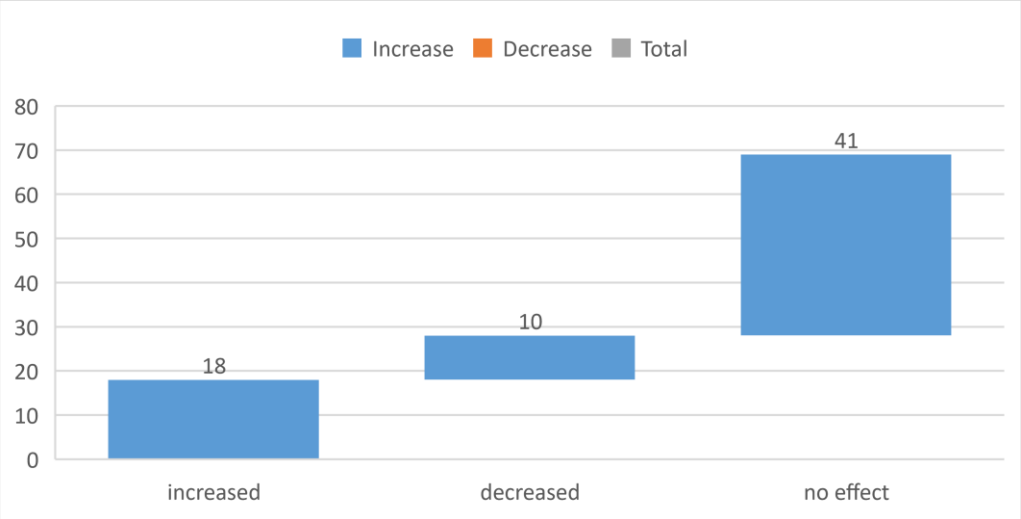

Figure 9: Impact of Invasive Species on Agriculture

Source: Field survey (2025)

4.3.4 Impact of Invasive Species on Livestock

The majority of respondents also indicated that invasive species had no effect on livestock, suggesting potential benefits in certain contexts. The perceived "no effect" on livestock contradicts findings by Gebrehiwot *et al.,* (2002), who reported livestock poisoning from Parthenium hysterophorus in Ethiopia. Fodder: The pods of Prosopis juliflora are a highly nutritious food source for goats, cattle, and camels, especially during dry seasons when other fodder is scarce. This improves livestock health and weight gain for the 25% who reported improved livestock. Windbreaks/Shelter: Plantations of Eucalyptus or Pine can act as windbreaks, protecting crops from strong winds and reducing soil erosion.

This suggests that either the most toxic species are not prevalent in Boma Ward or that their effects are not correctly attributed by farmers. About 25% reported improvement, 16% a reduction, and 58% no effect as shown in figure 10. However, McNeely (2001) explains that perceptions are context-dependent. For instance, Eucalyptus spp. (identified by 20% of respondents) is often valued for timber but is also known to deplete water resources and soil nutrients. The perceived "no effect" on livestock contradicts findings by Gebrehiwot *et al.,* (2002), who reported livestock poisoning from Parthenium hysterophorus in Ethiopia. Land Encroachment: Invasive shrubs make land inaccessible for grazing and cultivation, reducing the available land for the 16% who reported reduced livestock. This suggests that either the most toxic species are not prevalent in Boma Ward or that their effects are not correctly attributed by farmers. A critical finding is the low awareness 43% of the concept of "invasive species" despite their widespread use. This indicates that communities view these plants simply as available resources rather than as problematic aliens. This lack of ecological awareness is a major barrier to effective management, as communities may not prioritize controlling a plant they find useful (Estévez *et al.,* 2015).

Direct Toxicity: Parthenium hysterophorus is highly toxic. Its pollen can cause severe respiratory allergies (asthma) and skin dermatitis (itching, rash) in humans and livestock upon contact. This is the most likely cause for the 1% reporting health

problems. Physical Injury: The thick, sharp thorns of Prosopis juliflora can cause injuries to the mouths, legs, and hooves of animals, leading to infections and reduced mobility. Livestock Poisoning: Lantana camara is toxic to livestock if ingested, causing photosensitization, liver damage, and even death.

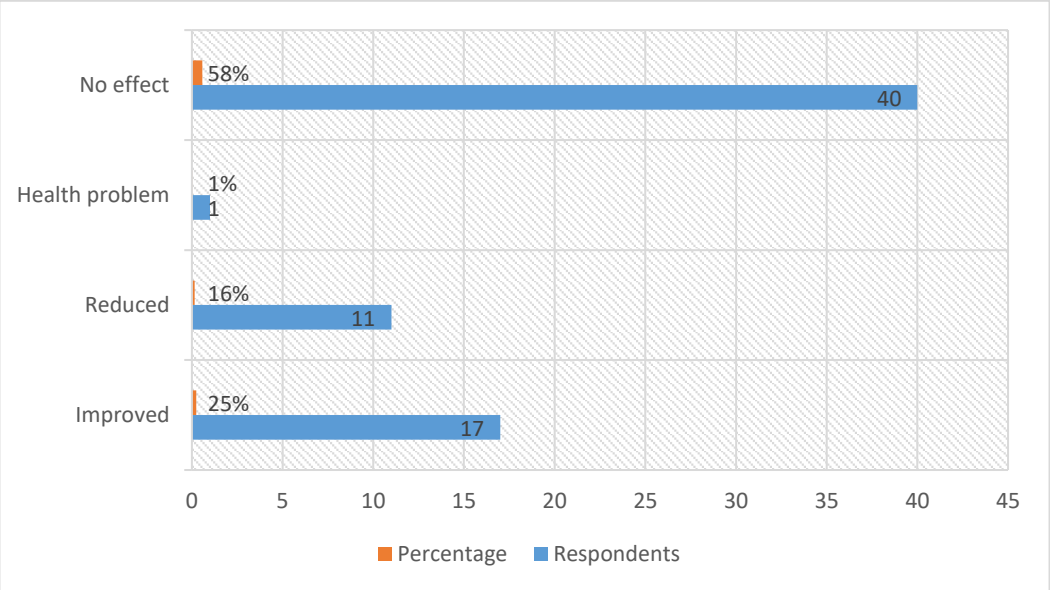

Figure 10: Impact of Invasive Species on Livestock

Source: Field survey (2025)

4.3.5 Invasive Species as A Livelihood Security

This measures the net perceived effect of invasive species on overall livelihood security. The data suggests that a significant portion of respondents feel them livelihood security has deteriorated, while a smaller but substantial portion feels it has improved. This is the ultimate summary. The net effect on livelihood security is not universally positive or negative. Scoones, I. (1998). For some, the income generated outweighs the agricultural losses (improved). For others, particularly those who cannot engage in the invasive species business or whose farms are severely affected, the overall impact is negative (deteriorated). This indicates that the role of invasive species is complex and creates winners and losers within the community. Figure 11 shows the

high frequency of daily use about 57% respondents and large proportion of respondents reporting improved livelihoods of about 59% respondents align with findings from Shackleton *et al.,* (2007), who observed similar benefits in rural South Africa where invasive provided fuelwood, building materials, and income. In Boma Ward, Eucalyptus spp. appear to play particularly important roles, similar to Prosopis multiflora in Kenyan communities (Mwangi and Swallow, 2008).

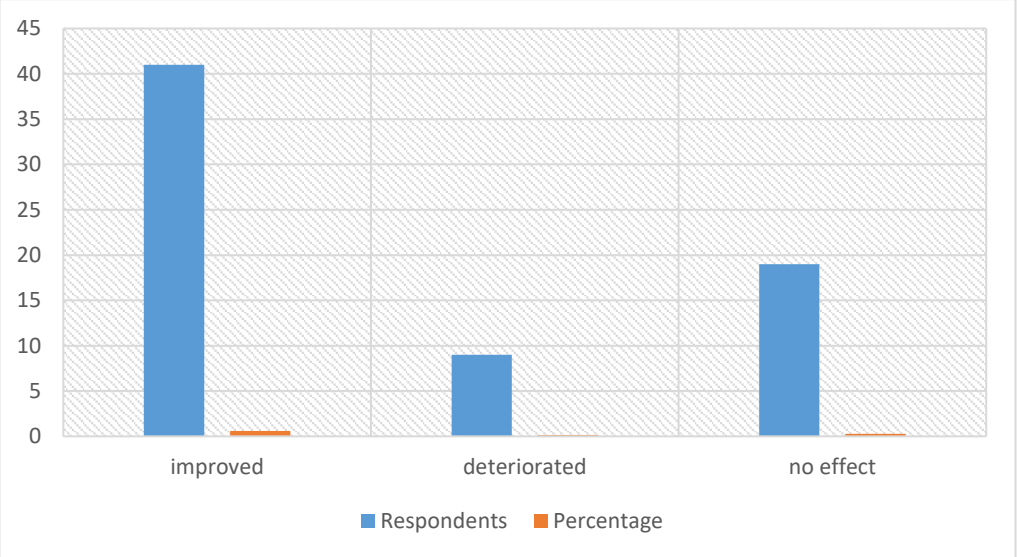

Figure 11: livelihood security indicator

Source: Field survey (2025)

4.3.6 Business Opportunities from Invasive Species

A significant majority 80% of the household's respondents reported net income opportunities from invasive species, primarily from selling timber, fruit, and medicinal products mainly in trade of products from invasive species and only 41% of the respondents had received formal training, underscoring the need for capacity building (Table 8). This overwhelming positive response directly supports the title's claim that

invasive species play a role in supporting livelihoods. Instead of viewing these species purely as a problem to be eradicated, most residents view them as an economic resource. This represents a pragmatic adaptation strategy where communities are deriving benefit from a negative environmental phenomenon.

Key informants' opinion*: Provide examples of these businesses. Common ventures might include: Harvesting and selling invasive plants for charcoal, firewood, timber, handicrafts (e.g., from Lantana camara, Prosopis juliflora). Making and selling charcoal from invasive trees. Producing and selling honey from beehives placed in areas dominated by invasive flowering plants. Creating fodder for livestock from certain invasive species.*

Table 8: Business opportunities from invasive species

Business opportunity	Respondents	Percentage
YES	55	80
NO	14	20
Total	**69**	**100**

Source: Field survey (2025)

4.4 Local Strategies in Managing Invasive Species for Better Livelihood Outcomes.

4.4.1 Management Strategies of Invasive Species

Control Methods such as burning 39% of response and chemical control 25% of response are the most common methods as shown in table 9. Burning is cheap and

immediate but non-selective and can promote fire-adapted invaders like Chromolaena. Chemical control is effective but expensive and poses environmental and health risks. The fact that 14% of respondents do not control at all is consistent with the high percentage finding uses for these species why control a useful plant? (Kull *et al.*, 2011). The identified challenge of "lack of knowledge" is consistent with global studies. The Global Invasive Species Programme (GISP) consistently identifies capacity building and awareness as the cornerstone of effective management. This implies that Current control methods may be worsening the problem. There is a clear, expressed need for training and education on Integrated Pest Management (IPM) strategies that are effective, safe, and sustainable. Wilson *et al*., (2013) note that fire can often stimulate seed germination and spread of many fire-adapted invasive plants. Households employ various control methods, with burning being the most common technique, burning 39% and chemical control 25% are the most common methods. Reliance on burning and chemicals is common but often ineffective and environmentally damaging. Burning can stimulate seed germination of some invasive, and chemicals pose health and pollution risks. This implies that Current control methods may be inadvertently exacerbating the invasion. The expressed need for knowledge provides a clear entry point for intervention. The effectiveness of each control method is analyzed below based on ecological principles and the provided data on community adoption.

Key Informant Opinion: *A key informant from the environmental sector criticized common practices: "Burning is our biggest enemy. It is the default tool for land clearance, but for plants like Lantana, it's like giving them fertilizer. It clears the*

competition and stimulates their seeds to germinate. We are fighting a losing battle with the very method people use to control the problem."

Table 9: Analysis of Methods of Control of Invasive Species Effectiveness

Method of Control	Respondents	Percentage	Effectiveness Rating
Burning	32	39	Ineffective
Chemical Control	21	25	Very Effective
Physical Removal	8	10	Effective
Biological Control	10	12	Neutral to Effective
Do Not Control	12	14	Ineffective

Source: Field survey (2025)

4.2 Access to resources

Financial support is the scarcest, with 74% of respondents accessing it "rarely" and 0% of households are accessing it daily. Training/Education is also largely unavailable, with 50% accessing it rarely. The tools for management are accessed more frequently than others, but still, 46% of the households rarely get them. The severe lack of resources is a critical finding. It suggests that households are engaging with invasive species (e.g., harvesting them for income) largely through informal, self-taught means without institutional support. This lack of training, tools, and capital limits the efficiency, scale, and safety of their ventures and potentially increases their

vulnerability. It highlights a significant gap where local government (Mafinga Council) or NGOs could intervene to formalize and strengthen this livelihood strategy. Inference, key information has explained in Table 10 below.

***Key Informants**: Key informants have explained that resource allocation is constrained by budget limitations, lack of expertise on invasive species management, or that invasive species are not yet a high-priority issue compared to other developmental challenges. They might also note that existing support is channeled towards conventional agriculture, not towards innovative uses of invasive.*

Table 10: Access to resources

Access to resources	daily	weekly	monthly	rarely	Total	Percentage
Tools for management	17	9	11	31	68	33
Training/education	1	6	26	33	66	32
Financial support	0	4	14	52	70	34
Total	**18**	**19**	**51**	**116**	**204**	**100**

Source: Field survey (2025)

4.3 Labour and Management Challenges

The main challenge as presented in figure 12 below shows lack of knowledge 52%, followed by limited resources 20% The significant additional labor required mirrors findings from Ethiopian studies on Parthenium hysterophorus (Tamado and Milberg, 2000), where manual removal was labor-intensive. The reliance on burning as a control method suggests limited access to sustainable management options. The main challenge was lack of knowledge 52%, followed by limited resources 20% of households. The significant additional labor required mirrors findings from Ethiopian

studies on Parthenium hysterophorus (Tamado and Milberg, 2000), where manual removal was labor-intensive. The reliance on burning as a control method suggests limited access to sustainable management options. Wilson *et al.,* (2013) note that fire can often stimulate seed germination and spread of many fire-adapted invasive plants. The high percentage citing "lack of knowledge" as a challenge directly supports the findings and echoes calls by the Global Invasive Species Programme (2005) for massive investment in awareness and capacity building as the first step in any management strategy. The "limited resources" challenge 20% is also a common theme in the literature, as effective management is often costly and requires sustained investment (Van Wilgen and De Lange, 2011). This implies that Current control methods may be inadvertently exacerbating the invasion. The expressed need for knowledge provides a clear entry point for intervention.

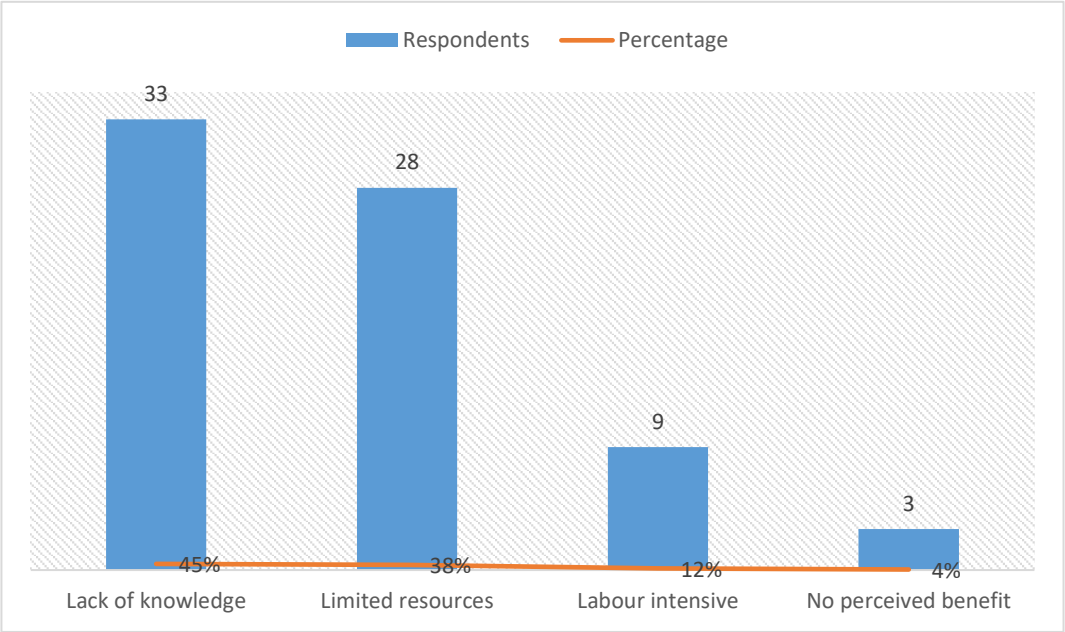

Figure 12: Challenges in managing invasive species

Source: Field survey (2025)

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study identified several key invasive species in Boma Ward, with Eucalyptus spp. and Lantana camara being the most prevalent and significant. A critical finding was the major knowledge gap, as 57% of respondents were unaware of the concept of "invasive species," instead viewing these plants through their utility. These species were primarily sourced through intentional planting or unknown origins with uses heavily geared towards income generation and as a food source This indicates that communities have pragmatically integrated these species into their livelihood systems based on immediate benefit rather than ecological understanding. This study set out to examine and reveals the complex and multifaceted dual role of invasive species in supporting household livelihoods in Boma ward in Mafinga Town Council, Iringa Tanzania. The findings reveal a profound paradox: these invasive species are not merely ecological threats but are deeply embedded provide significant socio-economic fabric of the community, serving as indispensable sources of food, income and raw materials. They prevent ecological challenges that require careful management. However, findings demonstrate that invasive species are deeply integrated into local livelihoods strategies, while simultaneously posing significant management challenges, hidden costs, and potential long-term risks to agricultural sustainability and ecosystem health. In the study six predominant invasive plant species such as maize and avocado being the most common, followed by Eucalyptus spp. The

distribution pattern aligns with Shckleton *et al.,* (2017) findings in similar context, where agriculturally valuable species often dominate local invasive flora due to their economic utility.

Socio-Economic Implications: The research revealed a profound paradox. Economically, invasive species serve as a crucial pillar of livelihood security, with 80% of respondents recognizing them as a business opportunity. Further underscores this gap between local experience and scientific understanding, a common issue in rural settings as noted by Novoa *et al.,* (2018). The data reveals substantial economic benefits of household's respondents using invasive species for income generation and those who uses as food sources A significant of engaged households earned between TZS 300,000–350,000 annually from selling products like timber and charcoal. However, this benefit coexists with negative impacts, as a notable minority reported decreased crop production and reduced livestock conditions This duality underscores the complex role of invasive species as both an asset providing essential income and a liability posing challenges to agricultural productivity. The socio-economic implications are profoundly significant and multifaceted as invasive species are substantial economic pillar. Research showing that impoverished communities often depend on invasive species for economic survival. However negative impacts were also evicted with decreased crop production and noting reduced livestock conditions. This impact pattern supports Vaz *et al.,* (2017) ecosystem services disservice paradigm, whereby invasive species provide both benefits and costs to local communities.

Community management strategies are predominant rudimentary, short-term and reactive where burning and chemical control are the most common methods, chosen for their immediacy and low technical barrier, despite of their negative consequences for soil health and biodiversity (FAO, 2020). Assessment of invasive species management in developing context, where limited resources and knowledge constrain effective control. The significant proportion of household respondents who do not control is a major concern, directly linked to the paramount challenge and about a half % of the respondent's lack knowledge. This is compounded by limited resources and the minimal use of sustainable methods like biological control indicates a significant gap in access to and knowledge of integrated management strategies promoted by agencies like the Tanzania Agricultural Research Institute (TARI). The very low rate is receiving training thus confirms that communities are left to cope with minimal external support, a finding consistent with key informant interviews that cited a lack of extension services.

5.2 Recommendation

Conduct Participatory Botanical Surveys and Awareness Programs: Through participatory species mapping and awareness campaigns, Local government authorities in collaboration with environmental NGOs, the study identified a mix of species known to be invasive globally (e.g., Lantana camara, Chromolaena odorata, Parthenium hysterophorus) and species whose invasive status is more context-specific, such as Eucalyptus spp. This Aligns with studies by Shackleton *et al*., (2017), Who found that local communities often define invasive species based on their impacts on livelihood assets and daily activities, rather than scientific definitions. Indicates a

significant gap in ecological knowledge, which is a common finding in rural contexts where immediate utilitarian benefits often overshadow long-term environmental considerations (Novoa *et al.,* 2018). The Mafinga Town Council, under Extension officer and forest resource management officer in collaboration with the Tanzania Forest Research institute (TAFORI), WWF Tanzania and The Sokoine University of Agriculture (SUA), Should conduct detailed surveys in order to accurately map the invasive species. This should be followed by awareness campaign that differentiate between high destructive invasive such as Parthenium and economically valuable but aggressively spreading species, such as avocado crops. This were help farmers and communities to make informed land -use decisions.

Capacity Building in Integrated Pest management (IPM): Build capacity in integrated and sustainable management through massive investment in farmer training is required. Extension services should be revitalized and strengthened to train farmers on Integrated Pest Management techniques, combining safe chemical use, physical control and promoting approved biological control agents for specific weeds and safe targeted use of chemical to minimize environmental damage. Training should prioritize methods and address the core challenges of lack of knowledge, less labor-intensive methods and more effective than burning. Enhance Extension Services with Integrated Pest Management (IPM): Extension systems should be strengthened to integrate invasive species management. Government and NGO initiatives must provide training on effective, safe, and sustainable IPM strategies that move beyond burning and chemical use. This includes promoting biological control agents and less

labor-intensive physical control methods, directly addressing the community's expressed need for knowledge and better tools.

Mainstream Invasive Species into Local Environmental Action Plans: The Mafinga Town Council and district Agricultural department and officers should formally integrate invasive species management into its district development plans and budgets and in its broader environmental and agricultural development plans. This would ensure dedicated resources and a strategic, long-term approach to the issue, moving beyond individual households' efforts to promote a coordinated community-wide response rather than piecemeal approach, and aligns with national goal like the Tanzania National Strategy for Managing Invasive Species. This policy shift should focus on formalizing the beneficial use of non-destructive invasive while controlling their spread, thereby safeguarding both ecosystem health and household livelihood resilience. Through Development partners such as UNDP Tanzania and FAO, Tanzania Forest Services Agency (TFS)should work instead of outright eradication which may harm livelihoods, so local cooperative should promote programs that helps communities sustainably harvest and add value to invasive species with economic potential. For example, programs could train communities to craft furniture or (handcraft)from Lantana camara or productive essential oils and charcoal, transforming a problem into a sustainable enterprise as recommended in World Bank (2018) reports on green livelihoods also this approach is recommended in FAO reports (2020), turns a problem into an economic opportunity while controlling its spread.

5.2.1 Areas for Further Research

A long-term Cost-Benefit Analysis of different Management Approaches: Research to quantify the long-term economic costs of invasion and long-term ecological impact assessment of predominant invasive species, (such as soil degradation, water loss, reduced crop yields) versus the short-term benefits derived from these species.

Ecological Impact Studies: An in-depth research on the impact of the ecological and the most prevalent species (such as, Eucalyptus spp, on water tables and Maize on soil nutrients) on local soil health and water resources, to inform evidence-based policy whereby climate change also contributes to the interactions with invasive species spread.

Ethnobotanical Studies: Research to documents and evaluates traditional or informal knowledge, gender-differentiated impacts and management strategies. Research into effectiveness and scalability practices of community-based biological control programs for specific weeds like Parthenium hysterophorus related to these species that may offer effective, community-owned solutions.

By adopting a nuanced, evidence-based approach that recognizes both the utility and the threat of invasive species, policymakers and communities in Boma Ward can develop resilient strategies that simultaneously safeguard both ecosystem health and secure household livelihoods resilience.

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APPENDICES

Appendix 1: Questionnaires for respondents

Please kindly circle the statement/phrase that answers the question best. Thanks in advance.

Dear

I am Linda C Kabwa, a student pursuing a Bachelor Degree in Environmental Planning and Management at IRDP, Dodoma. I am conducting a research study on the role of invasive species in supporting households' livelihoods: a case of BOMA ward in Mafinga town council. The purpose of this questionnaire is to collect information to assess the current status, and the support provided by the invasive species on household's livelihoods.

Your responses were be kept strictly confidential and used solely for academic purposes. Kindly answer the questions honestly. Your participation is voluntary, and you may withdraw at any time.

Thank you for your cooperation.

Questionnaire for households

Section 1: Respondent Characteristics

a. Age

What is your age in years? _____

b. Gender

What is your gender?

[ ] Male

[ ] Female

Education Level

c. What is the highest level of education you have completed?

[ ] No formal education

[ ] Primary school

[ ] Secondary school

[ ] Vocational training

[ ] College/University

[ ] Other (specify) _____

Primary Occupation

d. What is your main source of income?

[ ] Crop farming

[ ] Livestock keeping

[ ] Forest product harvesting

[ ] Small business/trading

[ ] Wage employment

[ ] Other (specify) _____

Section 2: Types and Uses of Invasive Species

Awareness on Invasive Species

Are you aware of any plant species in your area that spread aggressively and may cause problems?

[ ] Yes

[ ] No

If yes, please name them: _____

Types of Invasive Plants Grown/Used

Which of these plants do you have on your land or use regularly?

[ ] Lantana camara

[ ] Eucalyptus spp.

[ ] Tithonia diversifolia

[ ] Parthenium hysterophorus

[ ] Chromolaena odorata

[ ], Pine Tree (Pinus spp.)

[ ] Prosopis juliflora,

Other (specify) _____

Sources of Invasive Species

How did these plants first appear in your area?

[ ] Natural spread

[ ] Intentionally planted

[ ] Came with livestock

[ ] Transported accidentally

[ ] Don't know

Purposes of Use

For what purposes do you use these plants? (Check all that apply)

[ ] Fuelwood

[ ] Fodder for livestock

[ ] Building materials

[ ] Medicinal uses

[ ] Food source

[ ] Income generation

[ ] Soil improvement

[ ] Other (specify) _____

Frequency of Use

How often do you use products from these plants?

[ ] Daily

[ ] Weekly

[ ] Monthly

[ ] Seasonally

[ ] Rarely

Section 3: Socio-Economic Implications

Income Generation

Do you earn any income from these plant species?

[ ] Yes

[ ] No

If yes, approximately how much per month? _____ TZS

What products do you sell? _____

How much income do you generate from invasive species annually?

How do you spend income generated from those invasive species? _____

Impact on Agriculture

Have these plants affected your crop production?

[ ] Increased yields

[ ] Decreased yields

[ ] No effect

Impact on Livestock

Have these plants affected your livestock?

[ ] Improved grazing

[ ] Reduced grazing

[ ] Caused health problems

[ ] No effect

Labor Requirements

How much additional time do you spend managing these plants compared to native species?

[ ] Much more time

[ ] Somewhat more

[ ] About the same

[ ] Less time

Livelihood Security Indicators

How has the presence of invasive species affected your livelihood?

[ ] Improved

[ ] Deteriorated

[ ] No effect

Business Opportunities

Have invasive species created any business opportunities?

Section 4: Management Strategies

Control Methods

What methods do you use to control these plants?

[ ] Physical removal

[ ] Burning

[ ] Chemical control

[ ] Biological control

[ ] Do not control

[ ] Other (specify) _____

Community Participation

How is your community involved in managing these plants?

What activities do you conduct? _____

Access to Resources

Do you have access to:-

	Daily	Weekly	Monthly	Rarely
Tools for management				
Training/education				
Financial support				

Early Detection

How do you typically first notice new invasive plants?

[ ] Personal observation

[ ] Neighbor reports

[ ] Government alerts

[ ] NGO programs

[ ] Other (specify) _____

What are the main challenges in managing these plants?

[ ] Lack of knowledge

[ ] Limited resources

[ ] Labour intensive

[ ] No perceived benefit

[ ] Other (specify) _____

Have you received any training and workshops on managing invasive species?

Appendix 2: Key Informant Interview Guideline.

Section 1: Respondent Background

1. What is your current position and area of responsibility?

……

2. How long have you worked in this field/community?

……

3. What training or qualifications do you have related to environmental management?

……

Section 2: Invasive Species Overview

4. Which invasive plant species are most prevalent in this area?

……

5. How have these species spread geographically over time?

……

6. What are the primary pathways of introduction for new invasive species?

……

Section 3: Socio-Economic Impacts

7. What positive economic benefits do communities derive from invasive species?

……

8. What are the main negative economic impacts observed?

……

9. How do invasive species affect different groups (gender, age, wealth levels) differently?

……

10. What changes in livelihood strategies have you observed due to invasive species?

……

Section 4: Management Approaches

11. What formal management programs or policies exist for invasive species?

……

12. How effective have these programs been, and what are their limitations?

……

13. What traditional or local knowledge approaches are used for management?

……

14. How are community members involved in decision-making about invasive species?

……

Section 5: Future Recommendations

15. What policy changes would improve invasive species management?

……

16. What capacity building is needed at community level?

……

17. How could monitoring and early warning systems be improved?

……

18. What research gaps need to be addressed?

……

Section 6: Final Thoughts

19. Is there anything else important about invasive species and livelihoods we haven't discussed?

……

20. Who else should we talk to about this issue?

……