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Assessment of the Invasive Alien Plant Species *Lantana Camara* in Nile River Millennium Park, Bahir Dar, Ethiopia

By Taye Birhanu Belay & Ashenafi Ayenew Hailu

Ethiopian Biodiversity Institute

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Abstract- *Lantana camara* is the major invasive alien species in Nile River Millennium Park and it is introduced for ornamental purpose to the park intentionally. It reproduces by seed, root and vegetative multiplication, and disseminated by animals particularly birds and human intentional gardening are the major spreading mechanisms. Local communities are highly frustrated by the negative impacts of *Lantana camara* which includes competing animal feed, biodiversity loss, closing roads, and hiding harmful wild animals like rodents, snakes, mongoose, etc. According to the present study *Lantana camara* rate and scale of invasion has been increasing at an alarming rate affecting socio-economic status of the community and adverse effect to the biodiversity at large since its introduction. This is because *Lantana* spreading mechanisms are in multiple ways such as local human activity, by animals particularly birds, wind and its prolific seed production and easy dispersal, and multiplication nature. This, therefore, needs for an integrated, coordinated and multi-stakeholder and multiple level actions that the community, government and development partners shall participate in the eradication of the invasive plant *Lantana camara*. This would require the restriction of further spread of *Lantana camara* into non invaded areas, restriction use of *Lantana* in gardens and strategically controlling infestations by mechanical mechanism.

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1. INTRODUCTION

Invasive Alien Species' (IAS) are defined by the CBD (Convention on Biological Diversity) as species, subspecies or lower taxa, (including any part, gametes, seeds, eggs, or propagules of such species), introduced outside their natural past or present distribution and threaten biological diversity. Invasive alien species seriously affect many sectors of the economy; especially they are noted for being an important cause of global biodiversity loss. The impacts of alien invasive species on biodiversity have been described as "immense, insidious and usually irreversible [5].

Invasive alien species are increasingly becoming a serious environmental and development challenge in Ethiopia. Although, there is no complete account of the cost of IAS, rural communities have to endure tremendous economic and social hardships due to IAS. Many communities have lost productive assets through degradation of the natural resource base including pasture land, arable lands, plant species of medicinal, food and feed values, while many other have suffered from physical displacement and crowding into ever shrinking land area resulting in loss of ecosystem services. Invasive Alien Species has been colonizing many ecosystems of the country. Consequently, the biodiversity of Ethiopia is under increasing threat from IAS (IAS policy and strategy). The main invasion routes are: introduction by chance (unintentionally) and introduction by hand (intentional introduction of horticultural, medicinal, silvi cultural or agricultural plants for economic purpose) [3, 8].

Lantana section *Camara* is native only to the Americas, with members occurring from Florida and Texas in the north to northern Argentina and Uruguay in the south. While it is recognized that the weedy taxa of *lantana* naturalized in the Old World are of hybrid origin, and so do not have a 'native' range *per se*, the hybrids are almost certainly derived from various species within the section *Camara* that originated in the Americas [2].

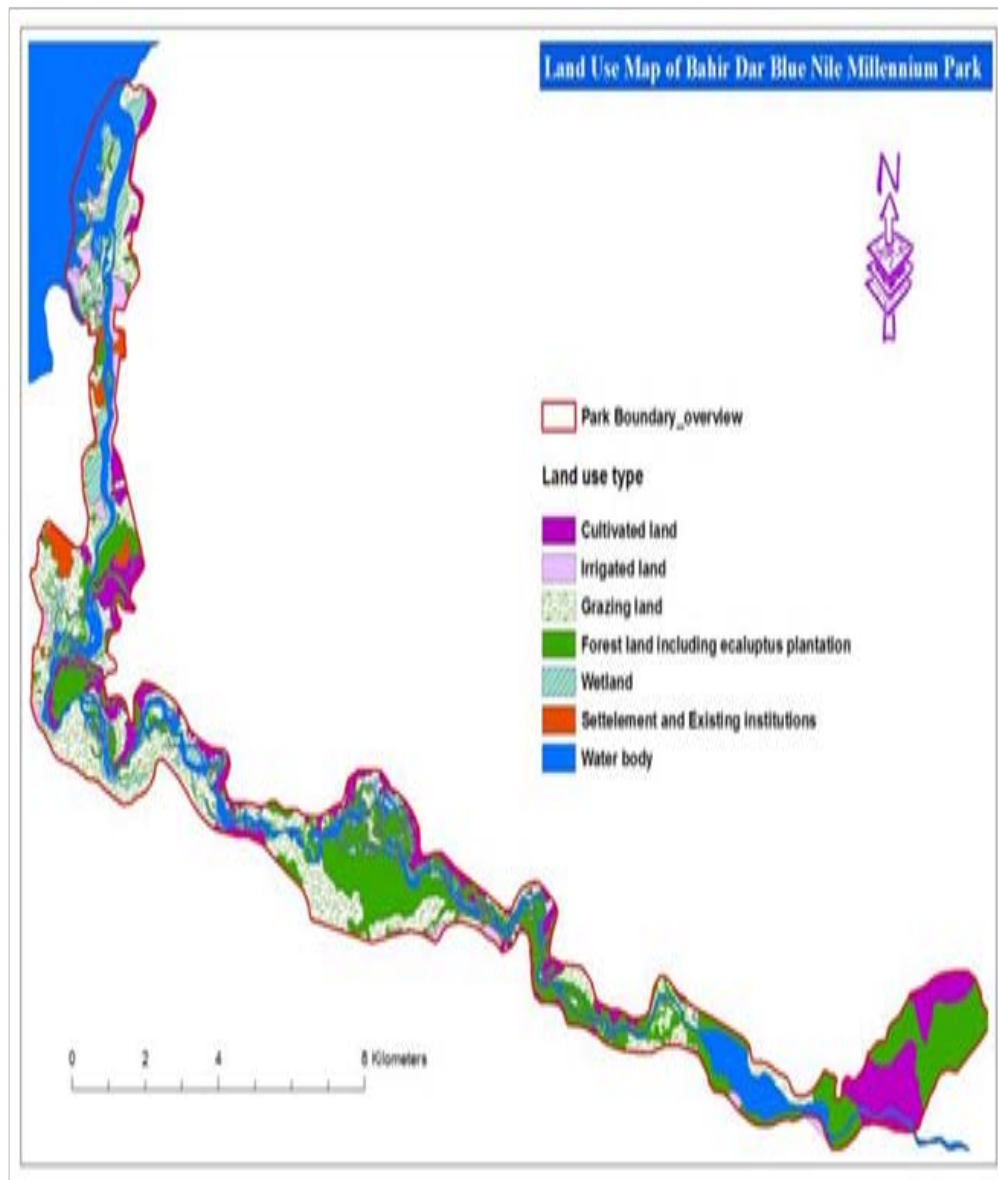
L. camara is considered a problem weed in many of the countries to which it has been introduced. It flowers prolifically and the seeds are dispersed by birds [10]. The plants can grow in individual clumps or as dense thickets, crowding out more desirable species. In disturbed native forests, it can become the dominant understorey species, disrupting succession and decreasing biodiversity. Its allelopathic qualities can reduce vigour of plant species nearby and reduce productivity in orchards [4]. It can affect agriculture by outcompeting native pastures by interfering with the mustering of cattle, and by causing death of stock by poisoning [10]. However, no adequate recent information exists about the impacts, distribution pattern, trend, status and controlling mechanisms of this species in the study area. Therefore, this research aims at assessing the impacts, distribution pattern, trend, management practices and statuses of *L. camara* in Bahir Dar Nile River Millennium Park.

Author 1: Genetic Resources Access and Benefit Sharing Directorate, Ethiopian Biodiversity Institute (EBI), Addis Ababa, Ethiopia.
e-mail: Tayebirhanu@ibc.gov.et

Author 2: Genetic Resources Access and Benefit Sharing Directorate, Ethiopian Biodiversity Institute (EBI), Addis Ababa, Ethiopia.

II. MATERIALS AND METHODS

a) Description of the study area



Source: Nile River Millennium Park office

Fig. 1: Land use map of Nile River Millennium Park

The geographic location of Abay riverside park (Nile River Millennium Park) is 11°29'40.2"N to 11°37'27.9" N latitudes and 37°24'37.2" E to 37°36'34.0" E longitudes starting at the source of Blue Nile out late from Lake Tana to the famous river fall of Tis Abay Fountain.

b) Method of Data Collection

Field study on the impacts, trends, mode of entry, spread, status, distribution and management practices of *Lantana camara* in Nile River Millennium Park, Bahir Dar, Amhara region was conducted. The study area was selected purposively on the basis of the level of *L. camara* invasion with the help of information

obtained from Environment and Forest office of Amhara region.

Based on the above selection criteria, 20 households from nearby kebeles of the Nile River Millennium Park were randomly selected. Accordingly, Hidar 11, Wereb kola tsion and Park Communities were selected to conduct this research.

Data was collected from primary sources and it has been collected through Rapid Ethno botanical Appraisal (REA) to obtained needed information quickly and inexpensively in a very short period of time. The primary data was collected using semi-structured interviews, discussions and direct field observations.

Secondary source of data was obtained from the agricultural, and Environment and forest office of the region, from different books and journals.

c) Method of Data Analysis

The collected data was analyzed by using SPSS (statistical package for social sciences). A descriptive statistical method was employed to analyze and summarize the data and to calculate percentages and frequency.

III. RESULTS AND DISCUSSIONS

a) Invasive alien species and level of *Lantana camara* in the study area

All the respondents with no variation (100%) indicated *L. camara* is the only invasive plant species in

their locality and they also indicated that *L. camara* infestation has been increasing at an alarming rate since its introduction (Figure. 2). Based on our field observation, the respondents view is quite genuine that *L. camara* makes dense and abundant thickets in Nile River Millennium Park. Not only is the geographic range of lantana still expanding in many areas, but the density of infestations within its range is increasing and it grows impenetrable thickets that can suppress the growth of native species. Similar report indicates that due to its prolific nature of flowering and dispersal, the species tends to alter the structure of the terrestrial ecosystem by gregarious presence. The species forms dense thickets and tends to eliminate the native species [7].

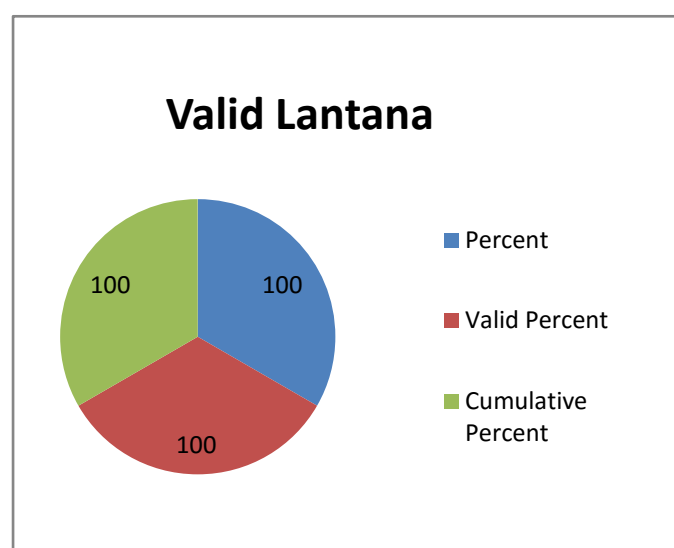


Fig. 2: List of Invasive Alien Species in the study area

b) Modes of Introduction of *Lantana camara*

The invasive plant *L. camara* is introduced intentionally. The majority of respondents (70%) indicated *L. camara* has been planted in the Bezawit palace intentionally for ornamental purpose in 1985. Bezawit palace is Emperor Hailesilassies palace where it is located inside of the Nile River Millennium Park. According to the respondents, Lantana was brought from Awash Melkasa palace by Mr. Alebel Kassa, the local administrator of Bezawit Palace, who he planted as one of the ornamental species in and around the palace. He had been an employee of Awash Melkasa palace, and he brought his garden plant, *Lantana camara* to his new work place. Some of the respondents (25%) say it is introduced by birds, others (5%) say they don't know how *L. camara* has been introduced [Fig 3]. Similar report by [1, 9] on *L. camara* reported that it is introduced intentionally to Ethiopia for ornamental purpose and also it is introduced intentionally and has covered all the park area, highly spreading and destroying the native biodiversity, converting the

beautiful attractive riverine park into homogenous and less attractive sight.

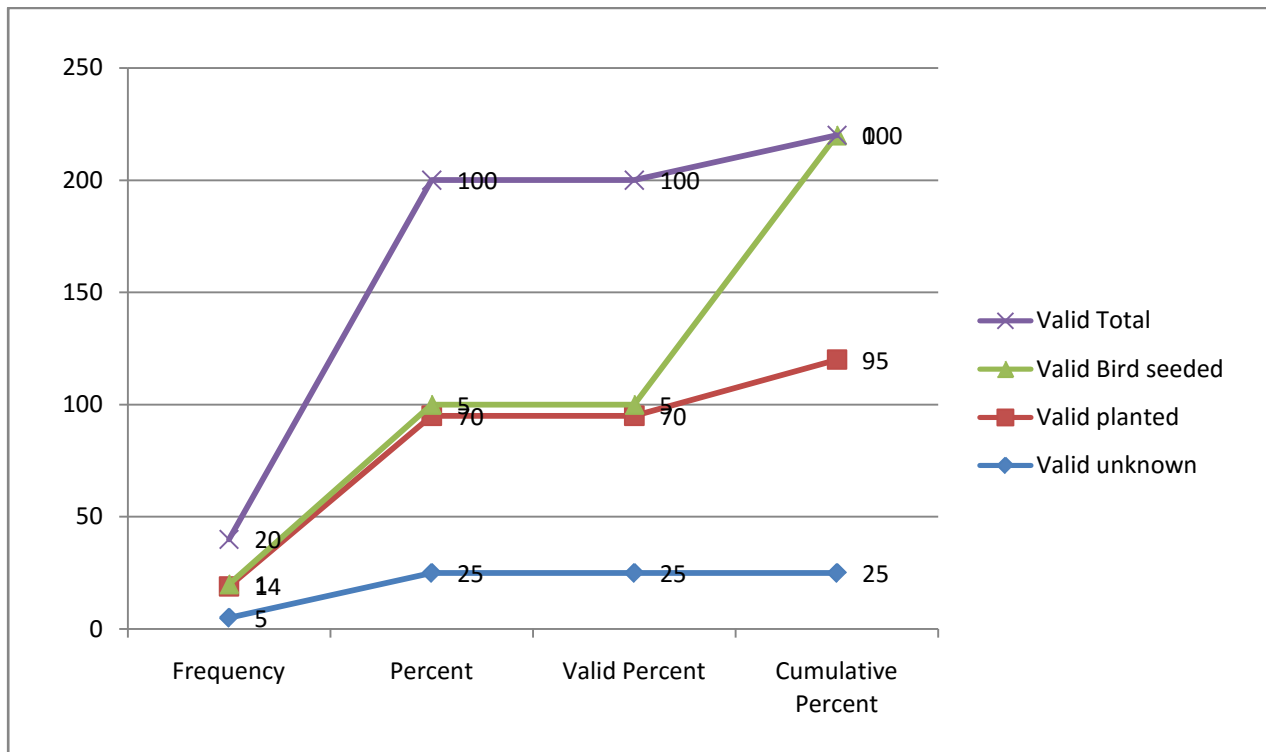


Fig. 3: Modes of introduction to the park

c) *The Modes of Dispersal of Lantana camara*

The majority of respondents (55%) indicated modes of dispersal of the invasive plant *L. camara* is by means of animals particularly birds and 15% of respondents say prolific seed production, easy dispersal, and layering are the mechanism for its high dispersal. Some (10%) say both birds and human intentional planting are the root mechanism of fast and wide dispersal. According to the respondents birds pass the seed in their droppings, potentially spreading it over

quite large distances. Others (5%) say human intentional planting is the root cause of its dispersal [Table 1]. Similar report by [2] indicates that Seeds are widely dispersed, predominantly by birds, but also by kangaroos, bearded dragons, sheep, goats, cattle, foxes, jackals, monkeys and possibly rodents. Fruit dispersal is through frugivorous birds, fox and rodents. Germination rate of fresh seed is generally low, but the germinability gets improved when the seed passes through the digestive system of birds and animals [11].

Table 1: Modes of dispersal for *Lantana camara*

	Frequency	Percent	Valid Percent	Cumulative Percent
animals(birds)	11	55.0	55.0	55.0
human	1	5.0	5.0	60.0
Valid seed multiplication	3	15.0	15.0	75.0
bird and human	3	15.0	15.0	90.0
bird and wind	2	10.0	10.0	100.0
Total	20	100.0	100.0	

d) *Highly Invaded areas in the study area*

L. camara is invading all land use. The Lion share of respondents (55%) say in their locality, the highly invaded area is grazing land while 35% of respondents informed protected area of Nile River Millennium Park is highly invaded area. The remaining 5% of respondents say *lantana camara* is invading the agricultural land. Others (5%) say *lantana camara* is invading grazing land, agricultural land and the adjacent areas of Nile River Millennium Park [Fig 4].

This is in agreement with our observation that all the areas were highly invaded by *L. camara* and in agreement with the report by [9, 11,] which states the relative abundance and invasion pattern of *L. camara* is very high in grass land followed by in the cultivated land and natural forest respectively.

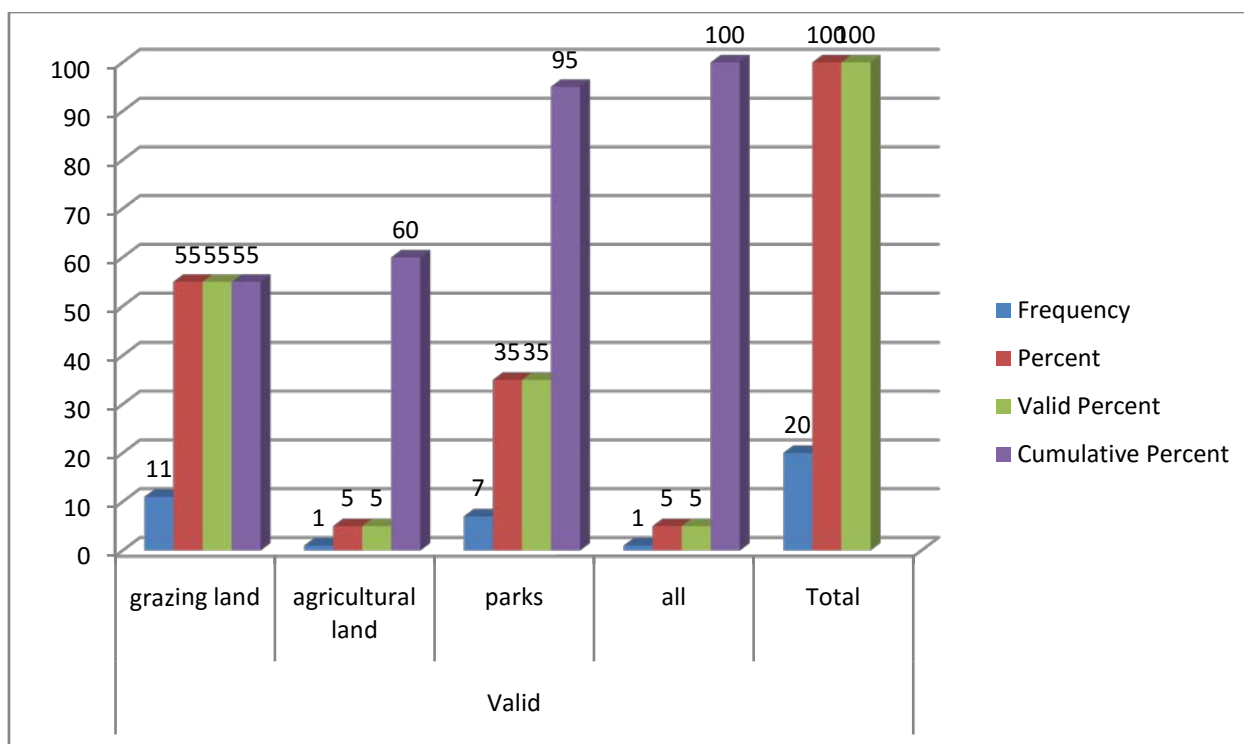


Fig. 4: Highly invaded areas in the study area

e) Negative Impact of *Lantana camara*

The effects of IAS on biodiversity have been described as “immense, insidious and usually irreversible [5]”. All informants confirmed that *Lantana* posed a very serious problem to their livelihood. They stated numerous negative effects of *L. camara* [Fig 5]. According to the majority respondents (50%), the invasive alien plant *L. camara* has a negative impact on

biodiversity in general and particularly affects animal forages, closes roads and hide harmful wild animals like snake, rodents, Egyptian mongoose [Fig 5]. Similar report by [2] indicates that once established in pastures, *lantana* forms large, impenetrable thickets, outcompeting valuable pasture species, blocking the movement of domestic stock to waterholes, poisoning stock and interfering with mustering.

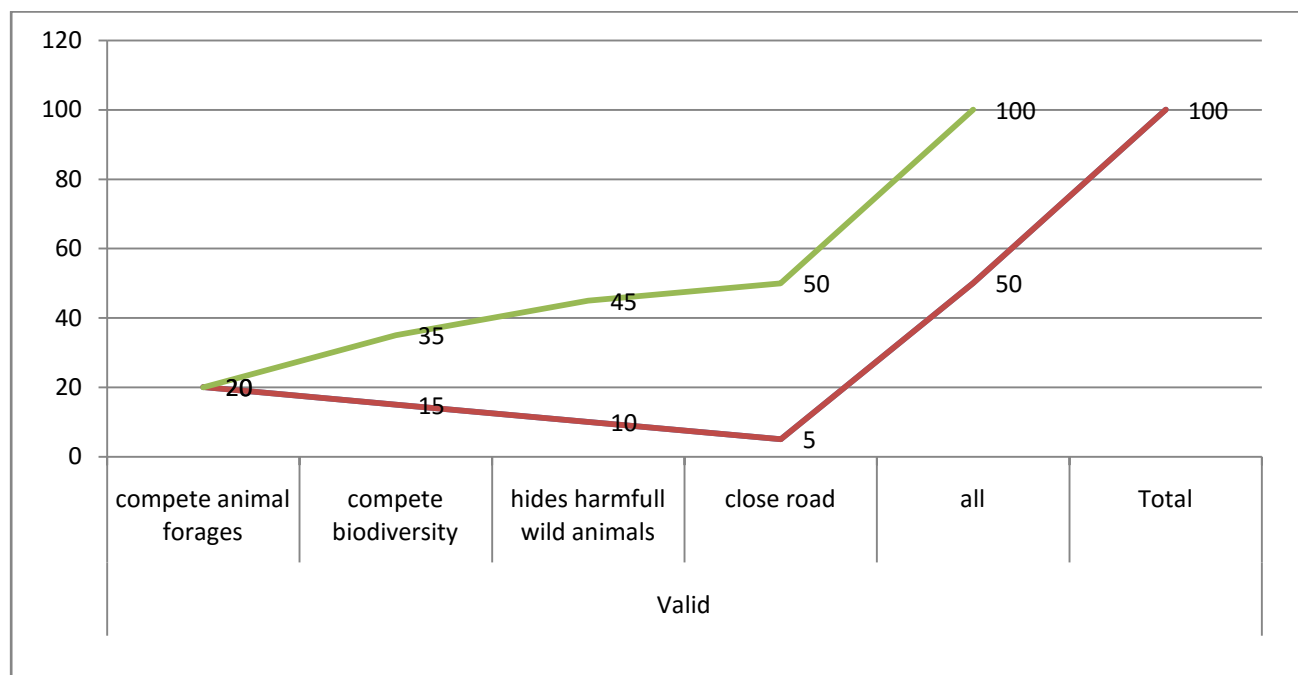


Fig. 5: Negative Impacts of *Lantana camara*

f) Control and/or Eradication Methods Introduced

L. camara is causing huge economic damage and biodiversity loss in Nile River Millennium Park. While having vast horizons of both ecological and environmental significance in the park, concerted control efforts are still very limited that majority of respondents (45%) indicated no management efforts have been made so far in the park. Some (35%) say mass cutting of *L. camara* was practiced and others (15) say both cutting and hand pulling was used to eradicate *L. camara* while the remaining (5%) say hand pulling was

practiced to manage *L. camara* [Fig 6]. If coordinated controlling mechanism had been used, it would have been effective that similar study indicated manual removal of plants minimizes disturbance to nearby vegetation and is effective in killing the plants, especially those in small, isolated clumps growing along fence lines or in public parks. Manual uprooting of *lantana* plants is labor intensive and costly but is often the only method available to farmers in developing countries [11].

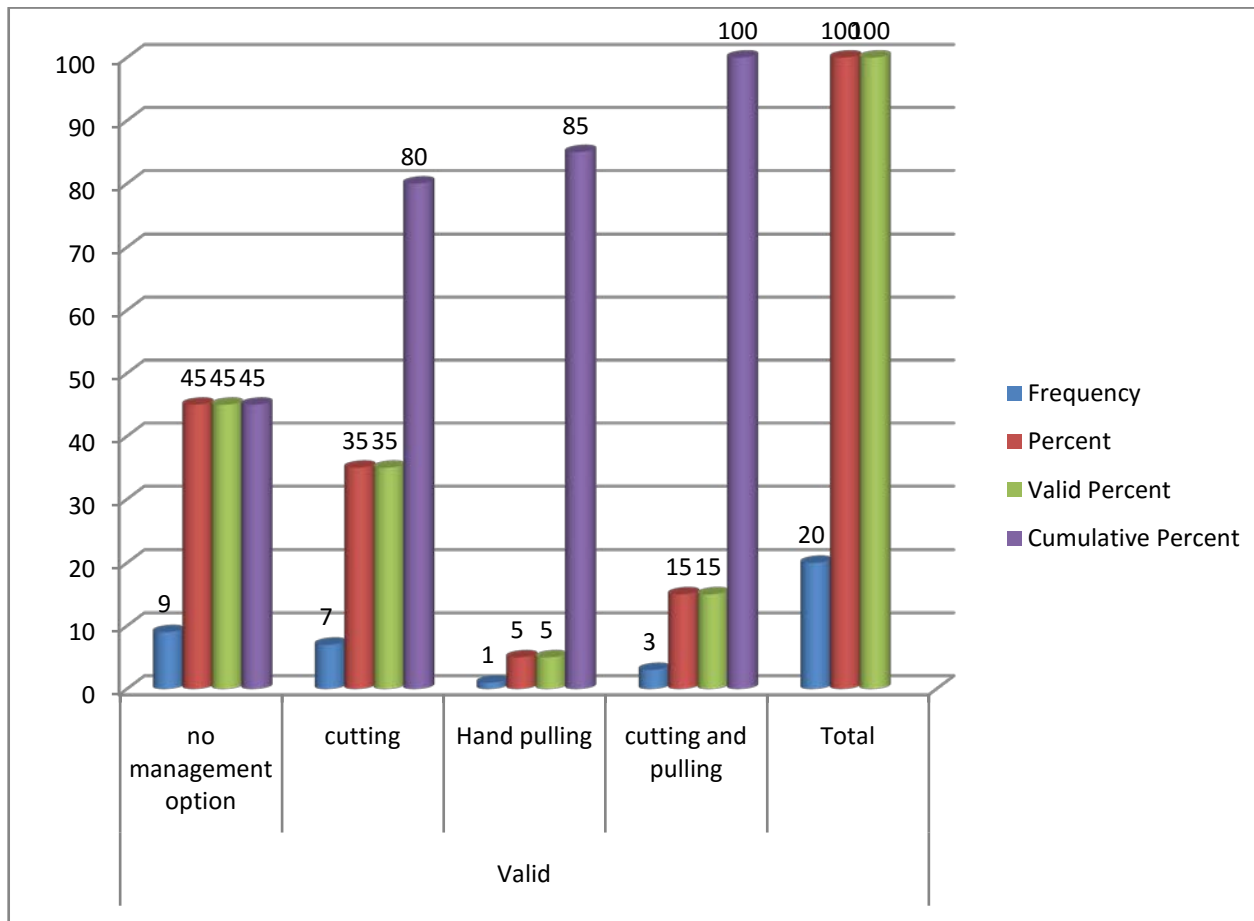


Fig. 6: Control and/or Eradication Methods Introduced

g) Suggested future actions

The majority of respondents (45%) suggested that hand pulling and burning is effective management option while 35% of respondents view is the use of chemical is the best option to manage *L. camara*. Some (15%) say combination of biological chemical and physical methods is effective management options. Others (5%) say biological control mechanism is effective technique to manage the dense *L. camara* in the study area [Fig 7].

The informants' perception is real that mechanical removal, using either modified bulldozers or ploughing, removes standing plants. Clearing by tractor or stick-raking is considered superior to burning when dealing with mature *lantana* plants [2]. Manual removal

of plants minimizes disturbance to nearby vegetation and is effective in killing the plants, especially those in small, isolated clumps growing along fence lines or in public parks. Mechanical clearing and hand pulling are suitable for small areas and fire can be used over large areas [2, 12].

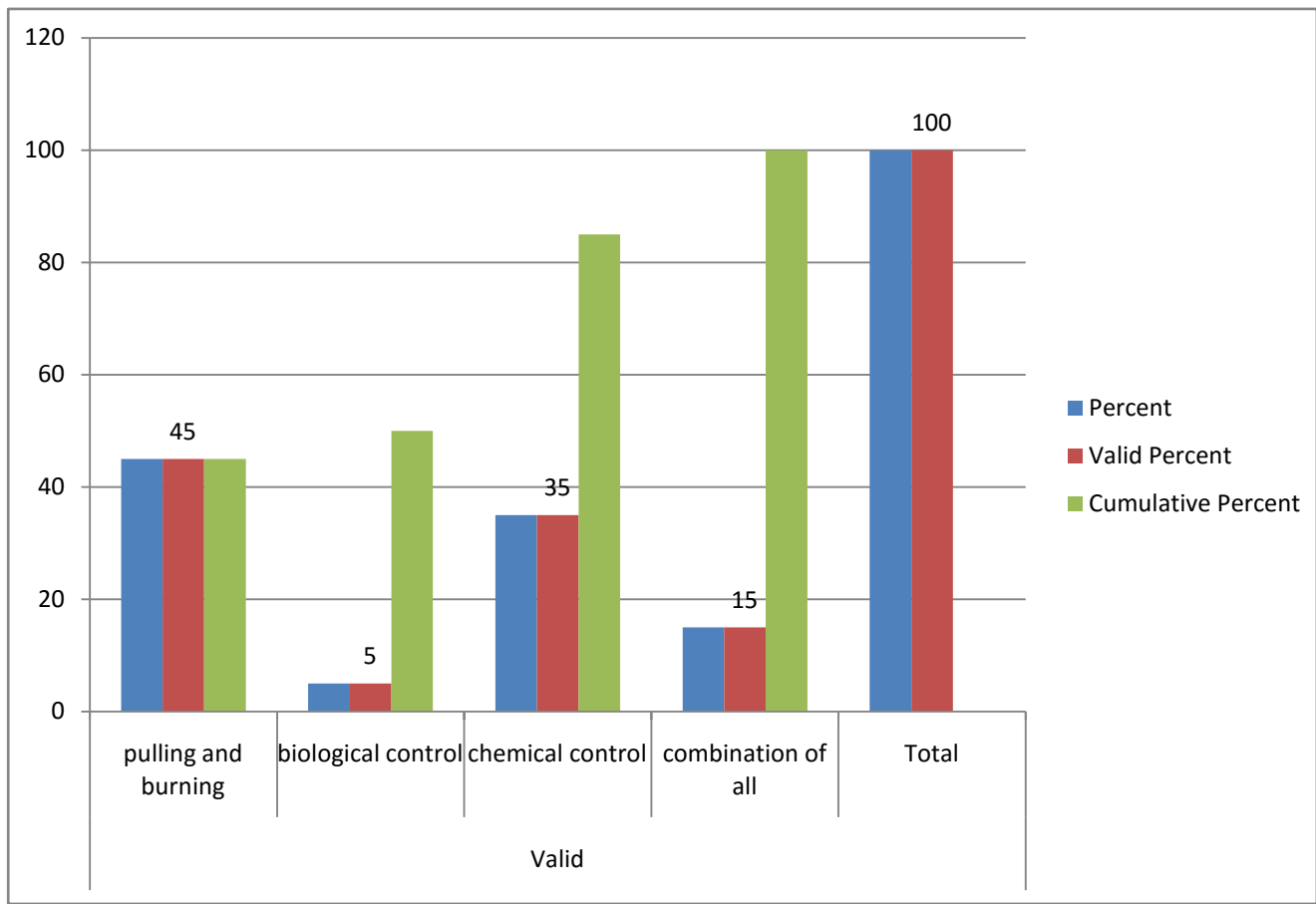


Fig. 7: Suggested future actions

h) Trends in the spread of *Lantana camara* and Major role player

According to the respondents (100%), the level of infestation in the study area has been increasing extremely and the management effort made so far were ineffective, irregular and poor. All the respondents (100%) calls for an integrated, coordinated and multi-stakeholder and multiple level actions that the community, government and development partners shall

participate in the eradication of the invasive plant *L. camara*.

Similar report by [13] describe that the major players, in management of Invasive Alien Species are the community, government and development partners. Thus it needs the coordinated measures to address invasive alien species and protect and conserve the country's biological diversity and agricultural production as well as the health of wildlife and humans, is essential.



Fig. 8

IV. CONCLUSION AND RECOMMENDATION

L. camara is the major invasive Alien species in Nile River Millennium Park and it was introduced for ornamental purpose to the park intentionally. While, Nile River Millennium Park has biodiversity conservation, water and soil conservation significance, and the ecological balance of the surrounding area of the river where the Nile River emanates from Lake Tana up to the surrounding area of Tis Abay Fountain is mostly invaded in dense stands of Lantana, the capacity of the soil to absorb rain is lower than under good grass cover. This could potentially increase the invasion impact to serious loss of biodiversity, increase the amount of run-off and the subsequent risk of soil erosion, affects animal forages, affect many sectors of the economy of local communities; especially it hide harmful wild animals like snake, rodents, Egyptian mongoose and closes roads.

The means of spread of *L. camara* are multiple, including animals particularly birds, prolific seed production and easy dispersal, layering and human intentional planting is the root mechanism of fast and wide dispersal. This, therefore, it needs for an integrated, coordinated and multi-stakeholder and multiple level actions that that the community, government and development partners shall participate in the eradication of the invasive plant *L. camara*. This would require the restriction of further spread of *L. camara* into non invaded areas, restriction use of Lantana in gardens and strategically controlling infestations by mechanical mechanism such as hand pulling and burning, Stickraking, bulldozing, ploughing, grubbing, Hand cutting using brush cutters, and maintenance control involves use of techniques in a coordinated manner on a continuous basis in order to maintain *Lantana* populations at the lowest acceptable level.

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