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Assessment on the invasive alien plant species *Cirsium vulgare* in selected districts of East Gojam Zone, Ethiopia

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Abstract

Invasive Aliens Species (IAS) has been introduced to Ethiopia intentionally and unintentionally and posing particular problems on biodiversity of the country. *Cirsium vulgare* was one of the IAS affecting the ecosystems. In Ethiopia, it has a high distribution status, but little is known about its distribution, impact, traditional management and mechanisms of invasion. Therefore, this study aimed at assessing the impact, distribution pattern, trend status, management practices and controlling mechanisms of *Cirsium vulgare* in selected district of East Gojam Zone. The data were collected through structured questionnaires using interview and field observation. All respondents were aware about the invasiveness of *Cirsium vulgare*. Among these (88.4%) agreed that the spread level of *Cirsium vulgare* invasion have been increased time to time as compared to the past invasion. Respondents (90%, 78.3% & 68.3%) informed farm land, communal land and road side were the main infested area on *Cirsium vulgare*. Moreover, they described the negative impact level of *Cirsium vulgare* on biodiversity were increased slightly (45.8%), increased sharply (35%) and decreased slightly (12.5%). 95% of the respondents reacted dig out this weed at young stage and burn it, repeated tillage and eradicating through campaign at young stage before fruiting were the appropriate controlling methods. This assessment shown *Cirsium vulgare* invasion was increased time to time in the study areas. Therefore, communities, governmental and nongovernmental organizations should work together and find a mechanism to eliminate this invasive plant and save the farm and grazing lands before becoming uncontrolled.

Keywords: *Cirsium vulgare, distribution, impact, invasive aliens species, management*

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1. Introduction

Biological invasion is a form of biological pollution that is probably more disastrous than the chemical pollution which is considered as the second greatest global threat to biodiversity after habitat destruction (Reddy, 2008). It is high on both scientific and political agendas (Hulme *et al.*, 2009; Fleishman *et al.*, 2011; Sutherland *et al.*, 2013; Genovesi *et al.*, 2015). Yet as only a rather small portion of alien species causes negative impacts, most ecologists do not oppose alien species per se (Simberloff *et al.*, 2011; Russell, 2012). Even widespread alien species may have negligible effects (Hulme, 2012). Moreover, some alien species may also benefit native species (Schlaepfer *et al.,* 2011) or underpin ecosystem services (Riley et al., 2018). Accordingly, relevant legislation such as EU Regulation 1143/2014 focusses on IAS, i.e. alien species that threaten or adversely impact biodiversity and related ecosystem services (Tollington *et al.,* 2015).

These invasions undergo rapid increase in the century due to interaction with other changes such as increasing travel and tourism. Thus, plant invasion in the new areas alter indigenous community composition, deplete species diversity, affect ecosystem process, and thus cause huge economic and ecological imbalance (Sumit *et al*., 2014). The key challenges in invasion biology are therefore to figure out which alien species will naturalize and spread ('invasive' sensu Richardson *et al.,* 2000) or which alien species will adversely impact biodiversity or other resources ('invasive' sensu Mack *et al.,* 2000; Tollington et al., 2015). To respond to the latter challenge, an array of assessment approaches has been developed over the past 25 years, starting with Panetta (1993) and Tucker and Richardson (1995). All approaches share the same major aim, i.e. to support decisions regarding the introduction or management of IAS, but differ in the underlying purposes, criteria, methods, legal status and target area. There are already some reviews on invasion-related assessment approaches (e.g. Fox & Gordon, 2009; Verbrugge et al., 2010; Essl et al., 2011; Leung *et al.,* 2012, Kumschick & Richardson, 2013; Dana et al., 2014; Buerger et al., 2016; Roy et al., 2018).

As in many other countries in the tropics, hundreds of IAS had been introduced to Ethiopia, intentionally and unintentionally and posing particular problems on biodiversity of the country particularly on agricultural lands, rangelands, national parks, water ways, lakes, rivers, power dams, roadsides and urban green spaces with great economic and ecological consequences (Abdulahi *et al*., 2017). Among these *Parthenium hystrophorus, Prosopis*

juliflora, *Eichhornia crassipes*, *Euphorbia stricta*, *Mimosa diplotricha*, *Xanthium strumarium*, *Cirsium vulgare* and *Lantana camara* was described (Demissew et al., 2018).

Cirsium vulgare ("Bull thistle" in English, "Qoree Harree" in *Afaan Oromo*, "Dender" in *Amharic*) is the member of Asteraceae family, native to Europe, Western Asia, Northern Africa, Pakistan and China. The plant has been included in the Global Invasive Species Database in 2010. The plant was reproduced solely by seed and is prolific seed producers. The seed remains viable in the soil for many years. At maturity, these spiny weeds have basal rosettes, purplish disk flowers, and flowering stems that are highly branched (Sullivan, 2004). The seed has a large plume that allows it to drift in the air and travel long distances before it plummets back to the ground or into the waterways to start a new infestation. Thistle seed is easily dispersed by wind, water, birds, and other animals. Seed can be carried long distances by adhering to surfaces and undercarriages of road vehicles and road maintenance equipment. Thistles may also be introduced to new areas via seed in hay that is not certified to be weeding free (Hassler, 2015).

Cirsium vulgare reproduces solely by seed and is prolific seed producers. The seed remains viable in the soil for many years. Seed production can vary from 100 to 300 seeds per flower and one to over 400 flowers per plant, and may average over 4,000 seeds per plant. Its seeds are readily dispersed by water, wind, animals, human activities, and contaminated hay. Most seeds fall close the parent plant. They may germinate throughout the growing season depending on soil moisture. Most seeds germinate or die within the first year, but may remain viable for up to 3 years or more if buried deeply (Jones, 2014). At maturity, these spiny weeds have basal rosettes, purplish disk flowers, and flowering stems that are highly branched (Sullivan, 2004). The seed has a large plume that allows it to drift in the air and travel long distances before it plummets back to the ground or into the waterways to start a new infestation. Thistle seed is easily dispersed by wind, water, birds, and other animals. Seed can be carried long distances by adhering to surfaces and undercarriages of road vehicles and road maintenance equipment. Thistles may also be introduced to new areas via seed in hay that is not certified to be weeding free (Good Oak Ecological Services, n.d.). Bull thistle rapidly colonizes disturbed areas and prospers in pastures that are heavily grazed and receive nitrogen fertilization. Once established, bull thistle successfully out competes native plant species, depriving them of water and nutrients. Bull thistle's sharp spines deter livestock and wildlife from grazing them and nearby plants.

Cirsium vulgare is invasive in parts of Kenya and has been introduced to Tanzania and Uganda. It has been included in the Global Invasive Species Database (Witt *et al*., 2018) and listed as a noxious weed in South Africa (prohibited plants that must be controlled). They serve no economic purpose and possess characteristics that are harmful to humans, animals or the environment. This thistle is very competitive as it can grow in areas of stiff competition. Its rosettes can grow to a diameter of 24 inches and can choke out the beneficial plants (Cardina *et al.*, 2010). It is the most widespread of the pasture and rangeland thistles. Plants are found in disturbed areas such as roadsides, fence rows, overgrazed pastures and rangeland, eroded gullies, ditch banks, and vacant lots. Bull thistle grows best on soils that are rich in nitrogen, have a neutral pH, and retain moderate soil (Hultén, 1968).

Although bull thistle is a problem predominantly in disturbed areas, it can also be found in natural areas. Once established, bull thistle out-competes native plant species for space, water, and nutrients, considered a nuisance weed in pastures, rangeland and newly logged sites, in the short term it competes with desirable forbs and grasses (Shiferaw *et al.*, 2018). Thistles are highly competitive and persistent plants. A high density of thistles reduces availability of quality forage and the diversity of flora and fauna species. Most thistles have taproots that do not stabilize the soil as well as the fibrous roots of native grass species; therefore, high densities of thistles can contribute to soil erosion and stream sedimentation (Witt *et al*., 2018). On the other hand, excessive grazing favors thistle growth over grasses since livestock do not prefer to graze these weeds. Moreover, some thistles have allelopathic properties that slow or prevent growth of desirable plant species, thereby allowing thistles to thrive (Whitson *et al*., 2010).

In Ethiopia, it has showed that a high distribution status, but little is known about its distribution, impact traditional management and mechanisms of invasion (Witt *et al*., 2018). The Ethiopian ecosystems which are highly affected by *Cirsium vulgare* include: cultivated landmass, roadside, grazing areas, non-cultivated landmass, rangeland, rural villages and urban area (Shiferaw *et al.*, 2018). However, no adequate recent information exists about the distribution pattern, status, controlling mechanisms and the impact of *Cirsium vulgare*. Therefore, this research aimed at assessing the impact, distribution pattern, trend status, management practices and controlling mechanisms of *Cirsium vulgare* in selected district of East Gojam Zone, Amhara Regional State, Ethiopia.

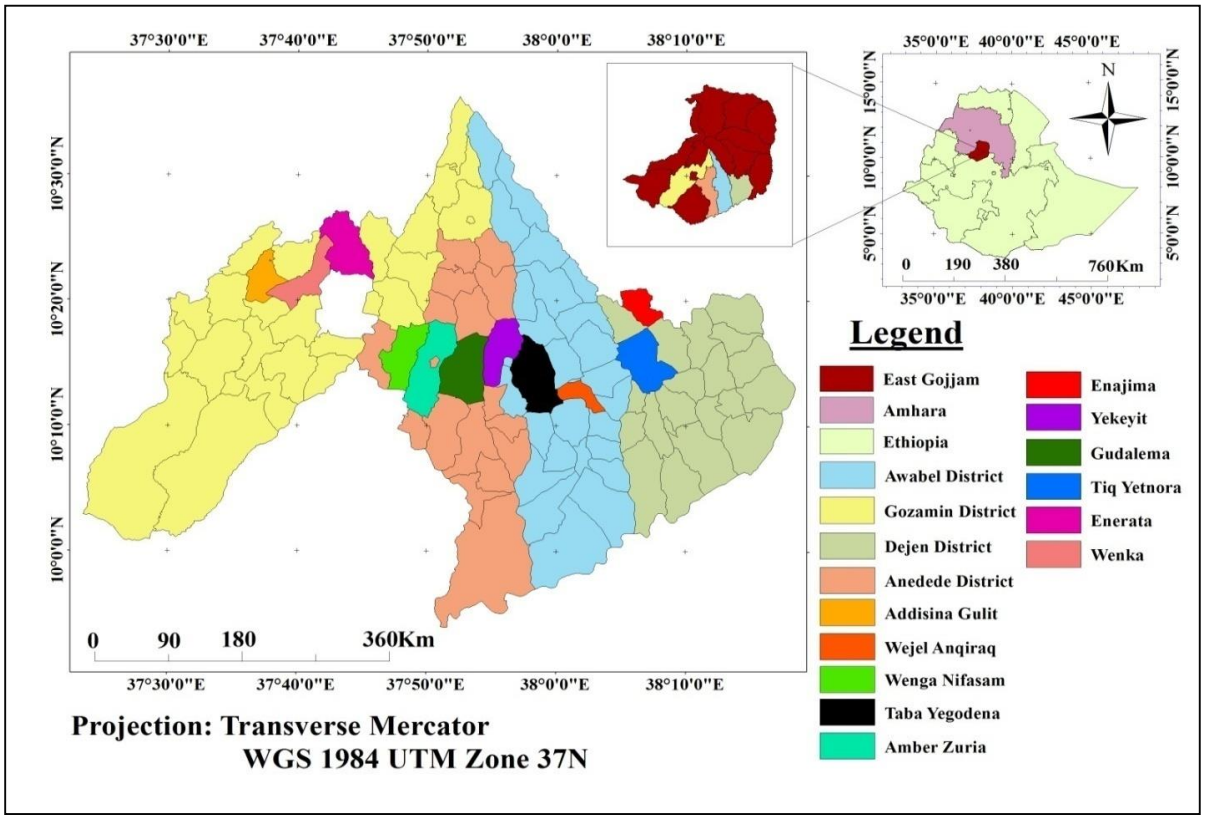
2. Materials and Methods

2.1. Description of the Study Area

East Gojam is a Zone in the Amhara Region of Ethiopia. Misraq Gojjam is named after the former province of Gojjam. It is bordered in the south by the Oromia Region, in the west by Mirab Gojjam, in the north by Debub Gondar, and in the east by Debub Wollo; the bend of the Abay River defines the Zone's northern, eastern and southern boundaries. The Zone has 17 districts namely Bibugn, Hulet Ej Enese, Goncha Siso Enese, Enebse Sar Midir, Enarj Enawga, Enemay Debay Tilatgen, Debre Elias, Machakel, Gozamin, Baso Liben, Awabel, Dejen, Shebel Berenta, Debre Markos town, Sinan and Aneded (CSA, 2013). Its highest point is Mount Choqa (also known as Mount Birhan). Towns and cities in Misraq Gojjam include Bichena, Debre Marqos, Debre Werq and Mota.

Figure 1

Map of the study area



2.2. Method of Data Collection

This study was conducted between April and May 2023 in East Gojam Zone, Amhara regional State. The study districts (Gozamin, Aneded, Awabel and Dejen) were selected purposively on the basis of the level of *Cirsium vulgare* invasion with the help of information obtained from zonal Agricultural office. Three representative kebeles from each district and a total of 12 kebeles from the entire study districts were selected. Hence, 10 households from each kebele with a total number of 120 respondents were sampled to assess the status, trend, distribution pattern and management practices of *Cirsium vulgare*. The respondents were selected based on experiences on agricultural practice. Data was collected from primary and secondary sources. The primary data was collected through structured questionnaire using interview and field observation. Secondary data was obtained from zonal and district agricultural offices, books and research articles.

Table 1

Total number of selected districts, Kebeles and respondents for the study

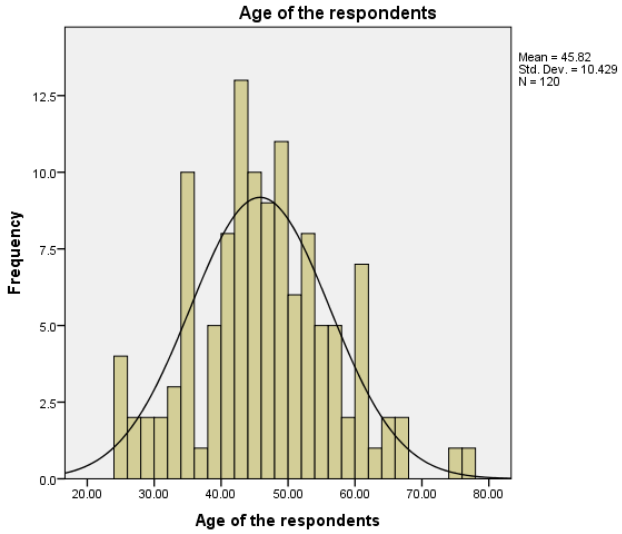
No.	Selected Districts for the study	Selected Kebele from each district	Total number of respondents in each kebele	Total No. of respondents in each district
1.	Gozamin	Enerata	10	30
		Adis ena Gulit	10	
		Wenqa	10	
2.	Aneded	Aber zuri	10	30
		Shafo gudalema	10	
		Wegan nifasam	10	
3.	Dejen	Enajima	10	30
		Tiqi	10	
		Yetnora	10	
4.	Awebal	Taba Yegodena	10	30
		Yekeyt	10	
		Wejel anqiraq	10	
		TOTAL		**120**

A total of 120 respondents, 111 (92.5%) males and 9 (7.5%) females, were interviewed from April to May 2018. The age of respondents varied between 25 years old (the minimum age) and 76 years old (the maximum age) with mean age of 45.82±10.43 years, range 51 years and mode 48 years old (figure 2). Majority of the respondents 116 (96.7%) were married, 1

(8%) of them were divorce and 3 (2.5%) were widowed. Regarding education status, 45.0% of the respondents were informally educated, 40.0% attended primary school education, 4.2% had attended secondary school education, 1.7% attended Priesthood education while the rest, 9.2%, were uneducated. The average years of respondents living in the study area were 44.73±11.07. Moreover, 79.2% of respondents grouped themselves under medium level income, 12.5% grouped under lower-level income and the rest, 8.3%, grouped themselves under higher level income.

Figure 2

Age of the respondents



2.3. 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, frequency and mean.

3. Results and Discussions

3.1. Level and Status of Cirsium vulgare Invasion

All respondents (100%) agreed that they were aware about the invasiveness of *Cirsium vulgare*. This is also confirmed by field observation of researchers during the study period. Of the total respondents, 73.3% agreed that the level of infestation of *Cirsium vulgare* is either high (45%) or very high (28.3%) in the study area and 24.2% claimed that the level of

infestation is medium and insignificant number of the respondents (2.5%) reported that the level is low in their local area (table 2).

Figure 2

Status of Cirsium vulgare invasion in the study areas

Table 2

Respondents' statements about the current level of Cirsium vulgare in study areas

		Frequency	Percent	Cumulative Percent
Valid	Low	3	2.5	2.5
	Medium	29	24.2	26.7
	High	54	45.0	71.7
	Very high	34	28.3	100.0
	Total	**120**	**100.0**	

Majority of the respondents (88.4%) agreed that the spread level of *Cirsium vulgare* invasion have been increased time to time as compared to the past invasion. This may be due to the lack of regular assessment and awareness raising on IAS. Moreover, 10.8% of the respondents described the level of *Cirsium vulgare* invasion was decreased as compared to the past and a respondent stated the level of *Cirsium vulgare* invasion has no differences as of the previous time.

Table 3

Respondents' statement about the previous and current spread of Cirsium vulgare in the study area

		Frequency	Percent	Cumulative Percent
Valid	Increases	80	66.7	66.7
	Decreases	13	10.8	77.5
	No differences	1	.8	78.3
	Highly increases	26	21.7	100.0
	Total	**120**	**100.0**	

3.2. Method of Introduction and Spread of Cirsium vulgare

Concerning the main means of introduction of *Cirsium vulgare* in the study districts, majority of the respondents (65.8%) had no information about how *Cirsium vulgare* was introduced in their local area. A few respondents argued that it was introduced either by animals (2.5%) or it instantly occurred (6.7%); besides, 24.2% of the respondents claimed that it was introduced either by wind (11.7%), flood (6.7%) or with dumping soil during road construction (5.8%). Insignificant number of respondents (0.8%) replied that, *Cirsium vulgare* was introduced with food.

Majority of the respondents (99.2%) had no information from where *Cirsium vulgare* was introduced to their local area. Insignificant number of the respondents (0.8%) reported that *Cirsium vulgare* was introduced with flood from highland areas (through river). Regarding the mechanisms of spread, a little above half of the respondents (55.8%) agreed that *Cirsium vulgare* easily dispersed by flood, animals (20.8%) and wind (35%) in view of the fact that it has many and light winged seeds. On the other hand, 5.8% of the respondents replied that it was easily dispersed by plough plow and vehicles, 1.7% of them replied as the change of climate also had its own contribution, 9.1% of them reported as lack of awareness to control its spread and 10.8% of them by wind and flood. The remaining respondents (16.7%) had no information about the mechanism of spreads.

Almost all of the respondents (99.2%) informed that farm land, communal land, abuttal areas, rangeland (range), backyard, flooding areas, around fence and road side were the main habitats which were mostly invaded by *Cirsium vulgare*. Of this, 61.7% informed that *Cirsium vulgare* is mainly found on road side, abuttal areas, farm and communal land, the remaining respondents (37.5%) informed that it was found on flooding areas, around fence, road side,

abuttal areas, farm and communal land. Insignificant number of the respondents (0.8%) reported that Cirsium *vulgare* is found only on the road side and communal land.

3.3. Impact of Cirsium vulgare

Most of the respondents (60%) reported that *Circium vulgare* has been causing several negative impacts on animals and plants. Some of these damages were prick animals, minimize the growth of plants, compete agricultural, communal land, invade road side and abuttal areas. On the other hand, 23.3% of the respondents reported that the plant has been affecting their environment negatively by competing with agricultural crops and destroy communal land. Moreover, 3.3% of respondents replied that the weed has been negatively affecting their environment by minimizing the growth of plants and compete agricultural, communal land, invade road side, and limit working areas. Insignificant number of the respondents (3.3%) replied that *Circium vulgare* has been affecting the community by competing with agricultural crops; destroy communal land, limit work, its thorn prick on human and livestock and by invading road sides and abuttal (boundary) areas.

Regarding the benefits of *Cirsium vulgare*, majority of the respondents (99.2%) reported that it had no benefits in the study areas. Insignificant number of respondents (0.8%) reported that *Cirsium vulgare* used for fence and as feed for Donkey. On the other hand, with regards to the organisms that are highly harmed by *Cirsium vulgare*, the majority of the respondents (61.7%) replied that all crops, grasses and other small plants were specifically affected by *Cirsium vulgare* in the study area. Meanwhile, 15% of the respondents replied that *Cirsium vulgare* was harming *Eragrostis tef*, Lathyrus *sativus*, *Cicer arietinum*, *Triticum aestivum*, Buckthorn and Ox, of these 11.7% replied as *Cirsium vulgare* was harming *Eragrostis tef*, Lathyrus *sativus*, *Cicer arietinum*, *Triticum aestivum* and 3.3% replied that *Cirsium vulgare* was harming *Lathyrus sativus*, Buckthorn and Ox. Moreover, 12.5% of the respondents replied as *Cirsium vulgare* was harming all animals except donkey and all crops and grasses, 6.7% of the respondents reported as bovine animals and *Eragrostis tef* are highly impacted by this invader. Insignificant number of the respondents (4.2%) had no information about the organisms that are highly harmed by *Cirsium vulgare.*

Regarding the level of negative impact of *Cirsium vulgare* on biodiversity, majority of the respondents (80.8%) reported that the negative impact of *Cirsium vulgare* on biodiversity increase slightly and sharply (45.8% of the respondents increased slightly and 35% of the

respondents increased sharply) and 12.5% of the respondents stated as decreased slightly whereas insignificant number of the respondents (6.7%) indicated as remained constant.

Table 4

Level of the negative impact of Cirsium vulgare on the biodiversity in the past

		Frequency	Percent	Cumulative Percent
Valid	Decrease slightly	15	12.5	12.5
	Remain constant	8	6.7	19.2
	Increase slightly	55	45.8	65.0
	Increase sharply	42	35.0	100.0
	Total	**120**	**100.0**	

On the coverage of the negative impact of *Cirsium vulgare*, almost half of the respondents (49.2%) reported that the coverage of the negative impact of *Cirsium vulgare* in the past was scattered, 13.3% of them reported as widespread and 25% of them replied as localized coverage. The remaining 12.5 % of the respondents confirmed that the coverage of the negative impact of *Cirsium vulgare* in the past was throughout (table 5).

Table 5

The coverage of the negative impact of Cirsium vulgare on biodiversity in the past

		Frequency	Percent	Cumulative Percent
Valid	Localized	30	25.0	25.0
	Scattered	59	49.2	74.2
	Widespread	16	13.3	87.5
	Throughout	15	12.5	100.0
	Total	**120**	**100.0**	

With regards to the negative impact of *Cirsium vulgare* on biodiversity in the future, almost half of the respondents (50.8%) reported that its impact will be very high and 35% of them reported as high impact, whereas the remaining 9.2% and 5% of the respondents reported that its impact will be moderate and mild, respectively (table 6).

Table 6

The negative impact of Cirsium vulgare on biodiversity in the future

		Frequency	Percent	Cumulative Percent
Valid	Mild	6	5.0	5.0
	Moderate	11	9.2	14.2
	High	42	35.0	49.2
	Very high	61	50.8	100.0
	Total	**120**	**100.0**	

Whether *Cirsium vulgare* gets out of control or not in the study areas, majority of the respondents (71.7%) reported that *Cirsium vulgare* gets out of control whereas the remaining number of respondents (28.3%) replied that the species was not out of our control (table 7).

Table 7

Respondents statements whether Cirsium vulgare get out of control or not in the study areas

		Frequency	Percent	Cumulative Percent
Valid	Yes	86	71.7	71.7
	No	34	28.3	100.0
	Total	**120**	**100.0**	

3.4. Traditional Management Practices of Cirsium vulgare in the study Areas

Several management techniques were employed by the respondents in the study areas to control the spread of *Cirsium vulgare*. A little below half of the respondents (45.0%) reported that dig out the plant at young stage and burn it, was appropriate controlling methods, whereas half of the respondents (50 %) reported that cutting of the plant at young stage and burn it and repeated tillage was appropriate controlling methods. The remaining insignificant number of the respondents (5%) reported as creating awareness about *Cirsium vulgare* was appropriate controlling method.

On the best technique or practice applied by the local community for the effective controlling of the spread of *Cirsium vulgare* in the study area, 44.2% of the respondents believed that there was no effective controlling method for it. In contrary to this, 27.5% of the respondents agreed that digging out the plant at young stage and burning it was the best option for preventing its spread. Other group of respondents (20.8%) believed that cutting before

flowering and ploughing was the best option for preventing its spread. Insignificant number of the respondents (7.5%) reported that eradicating through campaign at young stage before fruiting (5.0%) and repeated tillage and cutting and burning at young stage (2.5%) were the best options.

Based on the information obtained from the respondents on the possible best practices that will be applied by the communities, government and non-governmental organization to control the spread of *Cirsium vulgare* in the future, 46.97% of respondents reported that the government should conduct detailed research, select the best herbicide and also make community awareness creation programs and NGOs prepare herbicide and spray equipment's and community dig out and burn before flowering (at young stage). On the other hand, 16.7% of respondents reported as the best possible practice is eradicating through campaign at young stage, before fruiting by the local communities and 12.5% of the respondents replied as the government must develop strategies to eradicate and the community must clear and burn before flowering stage. Moreover, 11.7% of respondents reported that it needs further investigations by the government and non-governmental organization and it is better if the government and non-governmental organizations find and provide chemical that completely eradicate the weed from their community.

On the organization that has been working in the control of *Cirsium vulgare*, majority of the respondents (65.0%) informed that there was no organization that has been working in the control of *Cirsium vulgare*. The remaining respondents (35%) reported that there was an organization (Agricultural Office) that has been working in the control *of Cirsium vulgare*

Table 8

Respondents' statements about an organization that has been working in the control of Cirsium vulgare

		Frequency	Percent	Cumulative Percent
Valid	Yes	42	35.0	35.0
	No	78	65.0	100.0
	Total	120	100.0	

As to the modes controlling of *Cirsium vulgare* with the help the organization/Agricultural Office, 27% of the respondents replied that the controlling mechanisms were mechanical and/or physical, 7.5% by awareness creation program and majority of the respondents (65%) had no information about the mode of controlling of *Cirsium*

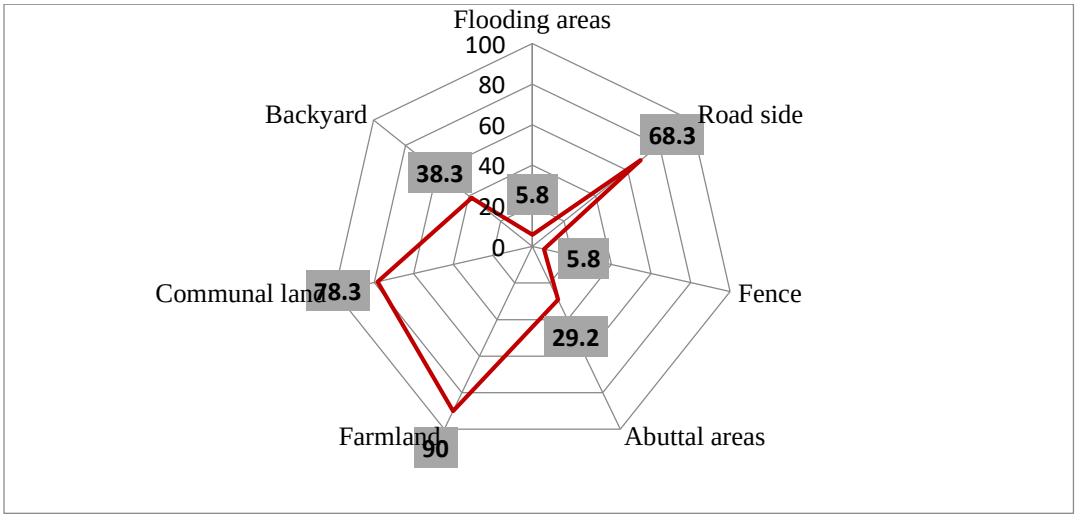
vulgare by the Organization/Agricultural Office. Regarding the effective techniques applied by Organization/Agricultural Office to control *Cirsium vulgare,* majority of the respondents (75%) agreed that there was no effective technique and the remaining respondents (25%) eradicating through campaign at young stage/before fruiting was the effective techniques applied by Organization/Agricultural Office to control the spread of *Cirsium vulgare.* On the other hand, the organization that will be involved in the control of *Cirsium vulgare,* majority of the respondents (95%) believed that in the control of *Cirsium vulgare,* the societies, the government and non-governmental organization should be better to work together. The remaining insignificant number of the respondents (5 %) believed that the government and the communities should be better to design strategies in the control and regulation of *Cirsium vulgare*.

3.5. Distribution Habitats of Cirsium vulgare in the Study area

90% of the respondents informed farm land was the main infested area on *Cirsium vulgare,* followed by communal land (78.3%), road side (68.3%). However, a small number of respondents (5.8%) reported that *Cirsium vulgare* was found only on the flooding areas and around the fence. Thistle establishes readily on disturbed or neglected sites, especially along roadsides, railways, ditch banks, and waste areas USDA (2014) and disturbed areas including rangeland, pastures, forest clearcuts, roadsides, waste areas foothills, dry meadows and riparian areas are also the main habitats (Ditomso, 2013).

Figure 3

Distribution of Cirsium vulgare in percent on different land use



3.6. Impact of Cirsium vulgare on Agriculture and Biodiversity

The general impact of *Circium vulgare* (99.2% of the respondents) was reported as reducing the size of the grazing land, its thorn punctures livestock and human, competing the growth of plants and crops and limiting the movement of farmers on their boundaries. Weeds can reduce the quality and value of livestock products. For example, seed heads from *Critesion spp*. and thistles such as Cirsium vulgare can reduce the value of wool by contaminating it (Dowling *et al*., 2000). Regarding the benefits, almost all of the respondents (99.2%) reported *Cirsium vulgare* had no benefits in the study areas. However, insignificant number of the respondents (0.8%) stated *Cirsium vulgare* was used for fence and as feed for animals.

Most of the respondents (71.7%) replied *Cirsium vulgare* harmed all crops, plants, grasses and animals except donkey. As Forcella and Randall (1994) noted, *Cirsium vulgare* achenes can contaminate crop seeds and flowering plants may contaminate hay, which serve as accidental pathways for the introduction of this weed to new locations. *Cirsium vulgare* has detrimental competitive effects on forage growth and quality (Whitson *et al.*, 2010). On the other hand, 24.1% of the respondents replied that *Cirsium vulgare* highly harmed *Eragrostis tef*, *Lathyrus sativus*, *Cicer arietinum* and *Triticum aestivum*. However, a small number of respondents (4.2%) had no information about its impact.

Respondents (45.8%) described that the negative impact level of *Cirsium vulgare* on biodiversity increased slightly, increased sharply (35%) and decreased slightly (12.5%). However, a few numbers of respondents (6.7%) stated as *Cirsium vulgare* impact level remained constant (figure 4). The seeds of this plant are readily dispersed by animals, wind, and water. As Holm *et al*. (1997) observed, *Cirsium vulgare* seeds can be transported by wind and water, carried by vehicles and farm machinery, embedded in mud on the fur and feathers of animals, or spread through animal manure.

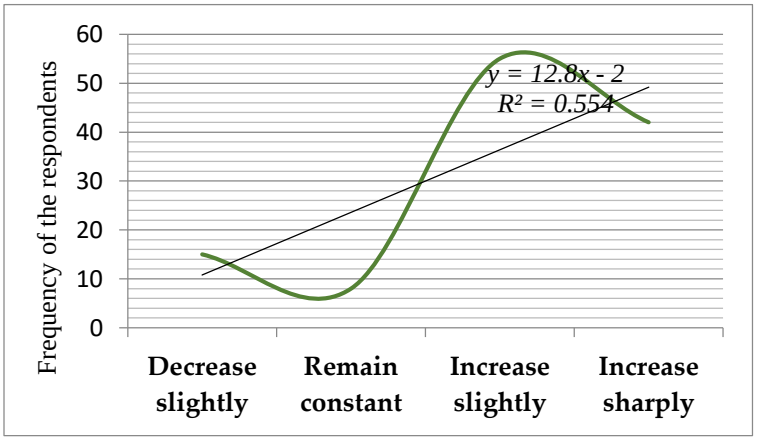


Figure 4

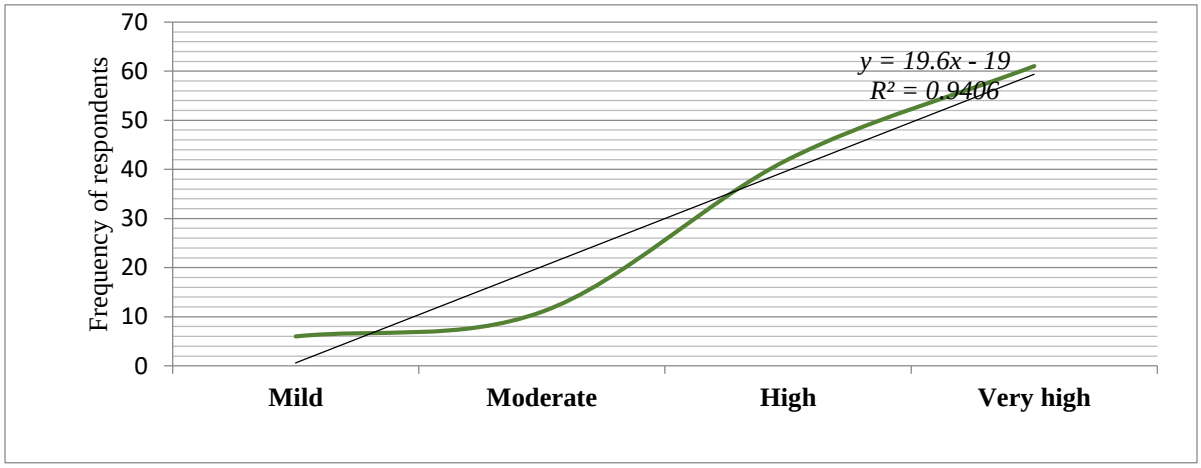
Level of the negative impact of Cirsium vulgare on biodiversity

3.7. Cirsium vulgare Coverage on Biodiversity

As respondents described that *Cirsium vulgare* past coverage on biodiversity was scattered, widespread, localized and throughout (49.2%, 13.3%, 25%, and 12.5%), respectively. They also forecast its future negative impact as very high (50.8%), high impact (35 %), moderate (9.2%) and mild impacts (5%) (figure 5). Moreover, they (71.7%) designated *Cirsium vulgare* was out of control at present; this is because of the seed production and viability of the weed. As AKEPIC (2005) noted, thistle average fruit production is nearly 4,000 per plant and seed viability is high (up to 90% may germinate within a year). Whereas, the remaining (28.3%) reacted, the species was not out of control.

Figure 5

Future negative impact of Cirsium vulgare on biodiversity coverage



3.8. Traditional Management and controlling Practices of Cirsium vulgare

Several traditional management techniques were employed to control the spread of *Cirsium vulgare* in the study areas. Among these, 95% of the respondents stated to dig out this weed at young stage and burn it, repeated tillage and eradicating through campaign at young stage before fruiting were appropriate controlling methods. This is the same as USDA (2014) field guide which are hand pulling, hoeing, grubbing, or cutting may be done any time of year; but these methods are most effective if done before development of flower heads occurs. However, the remaining (5%) stated no effective controlling method rather than creating awareness about the negative impact of *Cirsium vulgare*. Regarding the traditional controlling

practices of *Cirsium vulgare*, 92.5% and 7.5% of the respondents replied mechanical and awareness creation as the most effective controlling practices of the study area.

4. Conclusion and Recommendation

Biological invasions are attracting far reaching attention from ecologists because of their significant ecological impacts and economic costs worldwide. They are more and more recognized as a key problem of conservation of biological diversity. Many invasive alien plant species are introduced intentionally or unintentionally for various purposes. *Cirsium vulgare* is one of invasive alien plant species that invaded many areas in Ethiopia, which disturb ecosystem structure, function and reduce native biodiversity. Currently, it is invading the flooding areas, road side, around fence and abuttal areas, on farm land, on rangeland, communal land, backyard and disturbed land of East Gojam Zone (Gozamen, Aneded, Dejen and Awebal districts), Amhara regional State, Ethiopia. This assessment study indicates the severity of the invasion in these areas. Therefore, the communities, governmental, and nongovernmental organizations should find a mechanism to eliminate this invasive plant and save the farm and grazing lands before becoming uncontrolled.

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