

Full Length Research Paper

Distribution and abundance of emerging invasive weeds in central Western part of Ethiopia

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Invasive alien weed species; are non-indigenous species that have adverse economic, environment and ecological effects on habitats where they have been introduced, either accidentally or deliberately, outside their normal past or present distribution. The objective of this study was to determine the distribution and abundance of emerging invasive weeds in West Shewa and East Wollega Zones of Western Oromia. The biophysical survey was conducted by stopping along main and sub-roads accessible for, vehicle at 8 to 10 km interval. At each stop a 20m by 20m area was used to determine distribution and abundance of the invasive weeds. Five major emerging invasive weeds i.e *Senna occidentalis*, *Senna didymobotrya*, *Xanthium spinosum* and *Carduus* spp, *Cirsium* spp were identified as, important emerging invader species in the study area. Infestation of these weeds was mostly observed on roadsides, around human habitations, in pasture and waste lands and even crop fields. The extent of distribution varied among habitat and locations surveyed, ranging from none to abundant infestation of the alien weed species.

Key words: Ethiopia, emerging weeds, invasive weeds, weed abundance, weed distributions, weeds.

INTRODUCTION

Invasive alien species are species that are commenced as a consequence of human activities to new geographic areas, where they become established and then flourish and extend, to harm human interests and natural systems, outside their normal past or present distribution (Masters and Norgrove, 2010). These problematic non-native species are known to have negative impacts not only on biodiversity and ecosystem functioning but also on an array of other natural processes and human

activities (Luizza et al., 2016).

The spread of invasive plant species is now recognized as one of the greatest threats to the ecological and well being of the planet. While the problem is global, the nature of severity of the impacts on society, economic life, health and natural heritages are distributed unevenly across nations and regions. Ethiopia's natural ecosystems, like those in most part of the world, are under threat from invasive plant species. Many invaders

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Table 1. Abundance scale and coverage estimates used in invasive alien plant species assessment.

Abundances	Scale	Descriptions
Absent	0	No invasive alien weeds is found
Present	1	Individuals plentiful, but coverage small
Rare	2	Individuals very numerous; covering at least 5% of the area
Occasional	3	Individuals few or many; collectively covering 6-25% of the area
Frequent	4	Individuals few or many; collectively covering 26-50% of the area
Abundant	5	Weeds cover 51-75 % of the area
Very abundant	6	Weeds cover 76-100% of the area

that is, *Parthenium hysterophorus*, *Prosopis juliflora*, *Lantana camara*, *Argemone ochroleuca* and *Opuntia stricta* are already well established, while scores of invasive alien plant species except *Parthenium hysterophorus* and *Prosopis juliflora* are at early stages of invasion (Berhanu et al., 2015).

Emerging invasive plant species are a special problem, whose management requires long-term planning. The identification of invasive plant species and delineation of their geographical distribution and locations of infestations are ultimately aimed to, prioritizing species and/or locations which focus on management and identify species that require further study and/or close monitoring (Berhanu et al., 2015).

There are available technologies and techniques that have been employed in monitoring and curbing spread of emerging invasive weeds, of which Geographic Information System (GIS) is the most widely used. Mapping is useful for identifying the infested areas and the spatial distribution of these weeds. However, there is inadequate information available with regard to their distribution and abundance in Ethiopia. This study addresses the distribution and abundance of emerging invasive weeds in Central Western part of Ethiopia with the objective of, determining their distribution and abundance in West Shewa and East Wellega Zones of Western Oromia.

MATERIALS AND METHODS

Descriptions of Study Sites

The study was conducted in West Shewa and East Wellega Zones of Western Oromia. The area is located between 9°5'17"N&9°8'22.128"N latitude and 36°33'E&37°51'0.576"E longitude in East Wellega and West Shewa Zones, respectively. The altitude of the area ranges from 1000 to 3500 meters above sea level while the mean annual temperature ranges from 14.1° to 25°C. Rainfall is bi-modal with a short rainy season, during the months of April and May and long rainy season, during the months of June to August in which the vast area which was covered under the study receive mean annual rain fall of 1244 to 1700 mm.

Soils in most of the areas where study was conducted are vertisols which are potentially suitable for farming. The pre-dominate agro-ecological zone is mid-highland, which is conducive for the production of cereals, pulses, vegetables and oilseeds. Mixed

farming is a common practice prevailing in the zones as a result of the livelihood of the rural people, which is dependent on both crop farming and livestock rearing. The land use pattern varies from year to year in the case of crop land allocation activities, due to change in population number. The major crops grown in the zones include cereals, pulse and root crops where maize, wheat, teff, barley and sorghum are the dominant cereals, and faba beans, chickpeas, and field peas the pre-dominate (Amare and Taye, 2013).

Distribution of emerging invasive weeds

Biophysical survey was conducted during 2009/10 cropping season by stopping at 8 to 10 km interval, along main and sub-roads, accessible to vehicles. At each stop, a 20m by 20m sampling area was used to determine the presence and abundance of emerging invasive weeds.

The locations' latitude and longitude coordinates of the emerging invasive aliens weeds were recorded using a handheld GPS. Presence/absence (prevalence) and abundance (quantitative estimate) were observed simultaneously and noted on data collection sheet based on the scale indicated in Table 1. In addition, infested habitat, landform, and places were also recorded. The estimation of numbers is provided using the abundance scales after modification of the methods used by Martin (2002) and estimate scale based on Wittenberg et al. (2004) and Shashie (2007). The records were site specific and have provided a general indication of infestations throughout the area of study.

Data analysis

All data was collected using handheld GPS and manual records down loaded into computer Microsoft Excel program. Data collected was used to update and draw accurate map, using GIS (Arc GIS Desktop 9.1) software which show the distribution of emerging invasive weeds, indicating their presence/absence and the extent of occurrence at each stopping point in the area of study.

RESULT AND DISCUSSION

Distribution of emerging invasive weeds

Five potential emerging invasive weeds were recorded from the study areas. They were observed frequently in different habitats that is, roadsides, crop fields, pasture lands, wastelands, urban areas and other human habitations. Most of the emerging invasive weeds found

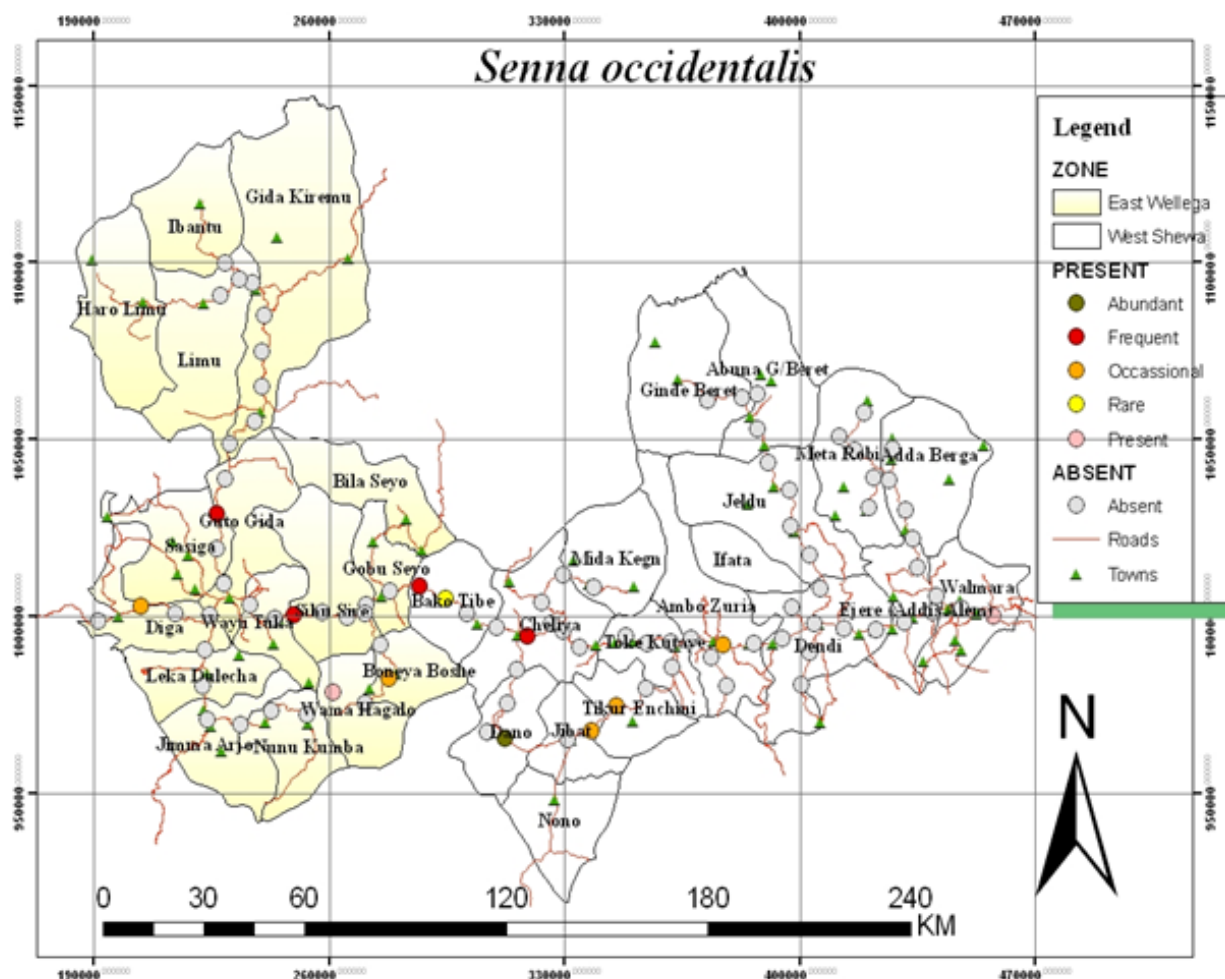


Figure 1. Distribution and abundance of *S. occidentalis* in West Shewa and East Wollega Zones of Western Oromia, 2009/10.

were perennials belong to the families asteraceae followed by fabaceae. *Senna occidentalis*, *Senna didymobotrya*, *Xanthium spinosum*, *Carduus* spp, *Cirsium* spp were considered as potential emerging species invading local environment quickly and widely.

Senna occidentalis

The biophysical survey revealed that, *S. occidentalis* was observed at varying level of infestation in different locations in the study area. It was registered on 13 sampling points out of 95 total sampling points (Figure 1).

The occurrence of the species is with varying abundance scale that ranges from its presence up to abundant scale of infestation. The districts where *S. occidentalis* was recorded as Diga, Guto Gida, Wayu Tuka, Sibu Sire, Wama Hagalo, Boneya Boshe, Gobu Seyo, Bako Tibe, Cheliya and Dano (Figure 1). In the study area, *S. occidentalis* grows on roadsides and

pasturelands but rarely in crop fields. It was distributed and spread following main roads at different level of infestation. It occurred frequently but occasionally along the sampling points. Thus there is an indicator that, a weed may be spread to different adjacent districts of the study area. The extent of its occurrence varied from district to district. Its infestation was abundant in Gobu Seyo, rare in Boneya Boshe and Sibu Sire and present in Guto Gida, Diga, Wayu Tuka, Wama Hagalo, Bako Tibe, Cheliya and Dano. Its distribution pattern is also an indicator for the potential to be spread to other adjacent districts.

Senna didymobotrya

S. didymobotrya was widely distributed in twelve districts of the study area, that is, Abune Gindeberet, Welmera, Dendi, Ambo, Cheliya, Bako Tibe, Boneya Boshe, Sibu Sire, Nunu Kumba, Wayu Tuka, Guto Gida and Diga.

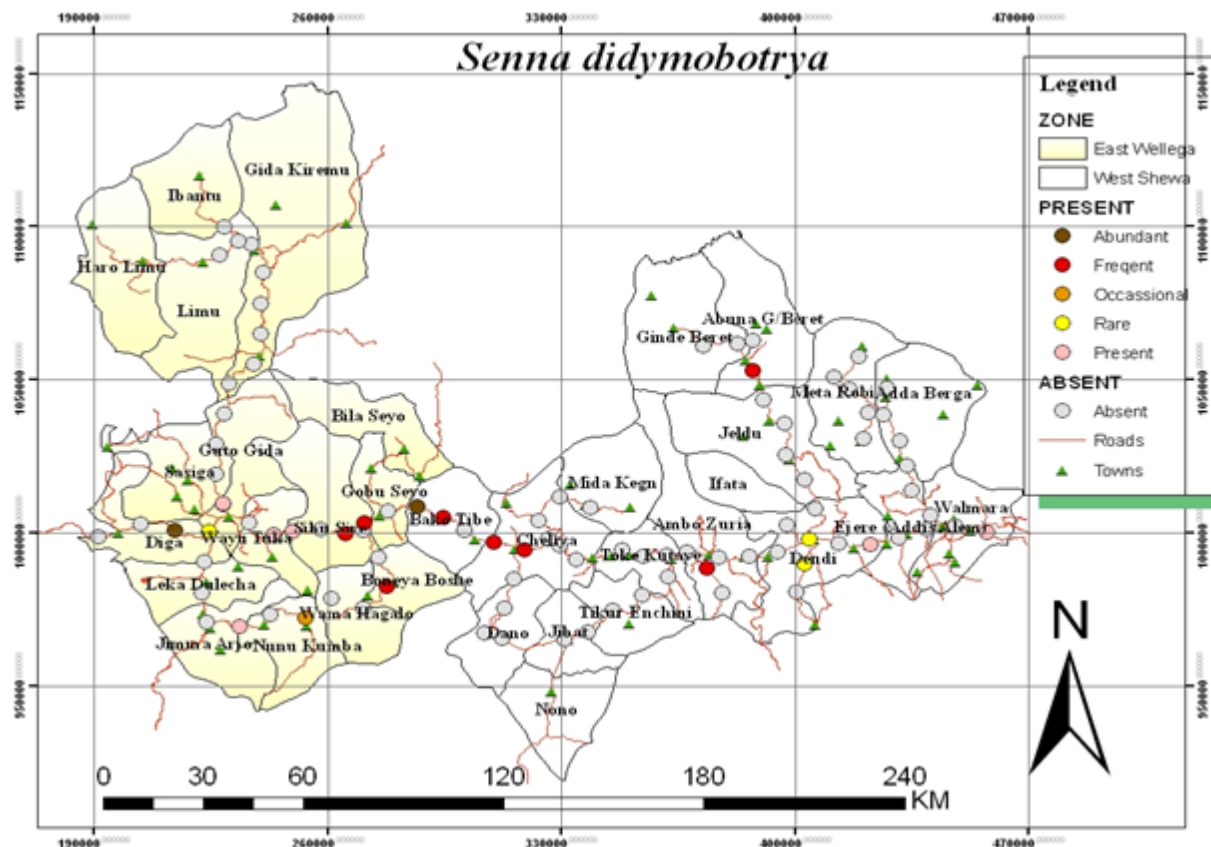


Figure 2. Distribution and abundance of *S. didymobotrya* in West Shewa and East Wollega Zones of Western Oromia, 2009/10.

Out of the total sampling points, the weed occurred in 19 areas with varying level of abundance in different habitats. It was observed to grow on roadsides, towns and near habitation. Few individuals of the weed were collectively observed in some districts; which was abundantly observed in others. As showed in Figure 2, it was frequently occurred around the border of the two zones. This indicated that, it is a potential invader and has the chance to spread in either direction.

The local community assumed that, this weed was introduced intentionally for fence and fuel wood. Because of this, many people were not aware of its weedy nature. Furthermore, the study presented that invasiveness of the weed in the study area was not known among the community. This showed that there will be potentials for its spread and distribution because of lack of awareness to control.

Xanthium spinosum

The distribution and spread of *X. spinosum* was low in East Wollega Zone. It was found only in two districts, that is, Leka Dulecha and Jimma Arjo. The weed was

distributed widely in districts of West Shewa with varying level of abundance and habitats. It was observed in 13 sampling points from which three in East Wollega Zone and ten in West Shewa Zone (Figure 3). The weed grows along roads, meadows and disturbed areas. It was sometimes common around waterholes and along floodplains, canals, ditches, creek flats, river terraces, and other moist places.

Results of the biophysical survey revealed that the distribution of *X. spinosum* is localized to few places but its spread was in progress. It was believed that the weed was distributed from one corner to the next corner (districts) of west shewa zone following the main road of Addis Ababa to Nekemte. From this, it is realized that the weed is spreading following vehicle roads and has a potential to colonize large area of the zones.

Carduus spp

Cardus spp is the dominant weed in West Shewa, it was not observed in East Wollega across all the sampling points. *Carduus* spp was found at 37 stopping, with varied level of infestation (Figure 4). It was densely

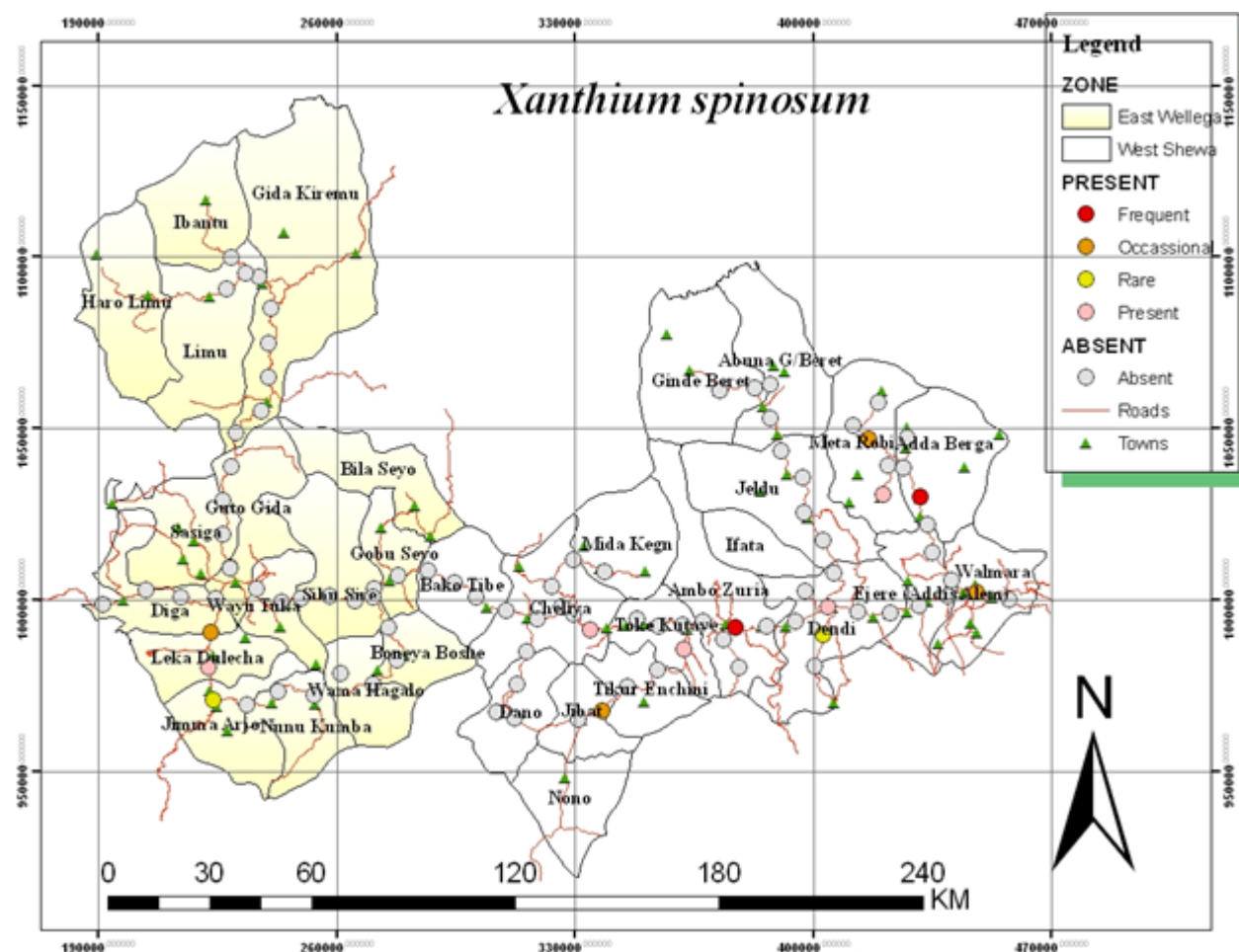


Figure 3. Distribution and abundance of *X. spinosum* in West Shewa and East Wollega Zones of Western Oromia, 2009/10.

infesting and distributing along the main road of Addis Ababa to Nekemte, following the main roadsides in both directions.

Besides, it was widely distributed from localized infestation along main road to the adjacent districts of west shewa, following weather roads. Cheliya, Toke Kutaye, Ambo, Dendi, Ejere, and welmera were the infested districts on the way of Addis, whereas it was found also on sub-roads of Jeldu, Abune Gindeberet, Meta, Adea Berga, Mida Kegn, Jibat and Tikur Inchin. The weed spread from one waypoint to the next progressively. However, the community awareness about the adverse effect of the weed was very low.

Cirsium spp

The finding showed that the weed was observed at 16 consecutive sampling points with different level of abundance; which was limited to few districts: Ambo, Dendi, Jeldu, Abune Gideberet, Meta, Adea Berga,

Welmera and Ejere (Figure 5). It was observed on roadsides, disturbed soil due to construction, waste and pasture land with moderately spread from one sampling point to the next. This indicated that, the weed had the capacity to spread and distribute to the adjacent areas or habitats whenever, the conducive conditions are created.

The distribution of the weed from Holeta to Adea Berga had a progressive abundant. Similarly, it was distributed with varying level of abundance from Dendi to Gindeberet following roads at each sampling point.

Conclusion

Distribution and abundance of emerging invasive weeds in West Shewa and East Wollega Zones were identified. The map which indicate the distribution and extent of occurrence of emerging invasive weeds were developed. A total of twelve major invasive weeds were recorded; in which five of them were potential emerging invaders.

Weeds were spread from one sampling point to the

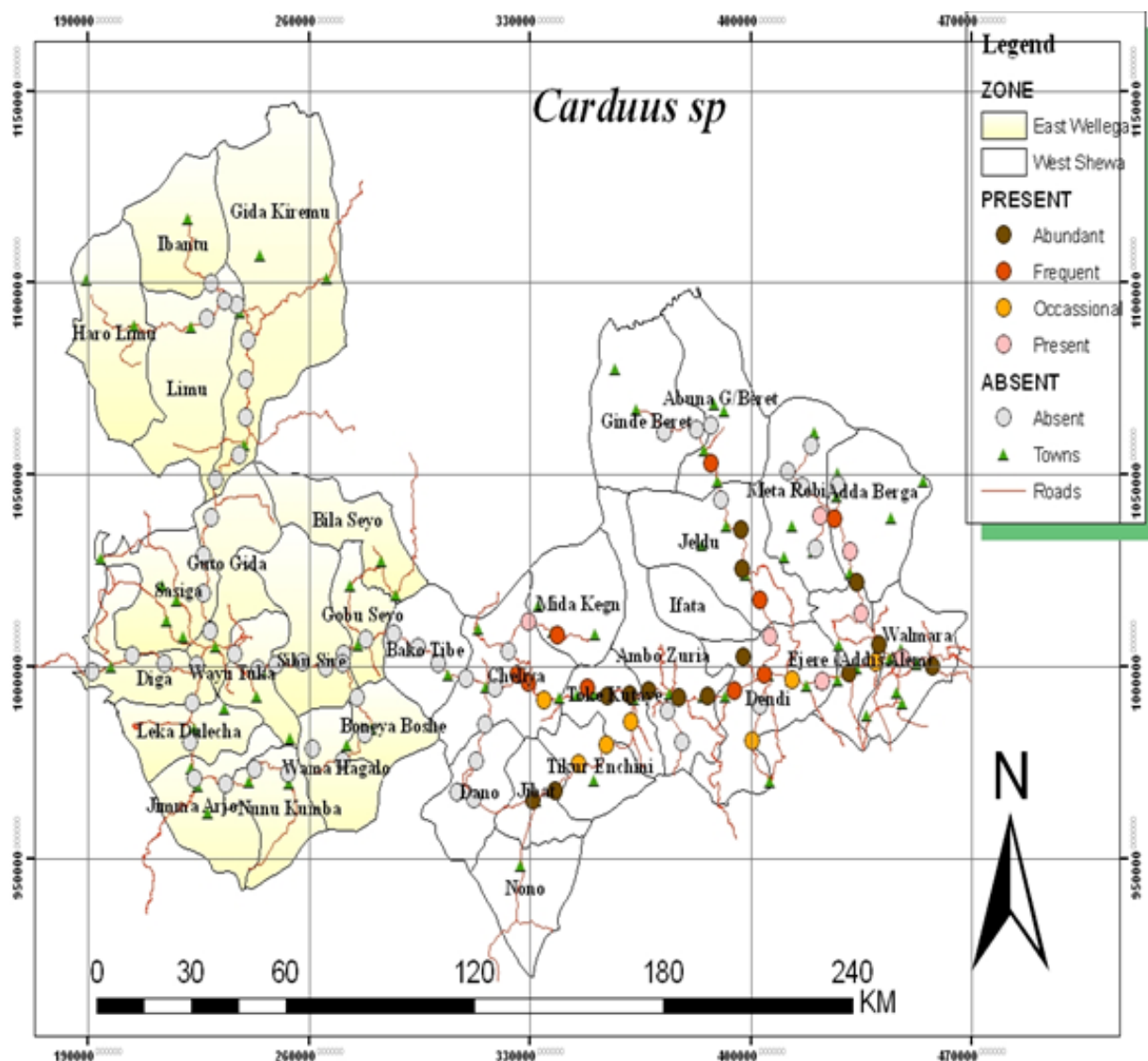


Figure 4. Distribution and abundance of *Carduus* spp in West Shewa and East Wollega Zones of Western Oromia, 2009/10.

next progressively. Furthermore, they were distributed on roadsides, disturbed soil due to construction, around human habitations, in pasture and waste lands and even crop fields ranging from none to abundant infestation of the alien weed species. This indicated that, the weeds had the capacity to spread and distribute to the adjacent areas or habitats whenever, the conducive conditions are created.

However, the biophysical survey was limited to roadsides; the community awareness about the adverse effect of the weeds were, very low. Therefore, further investigation should be made on the abundance and distribution of emerging invasive alien weeds, at Kebele level. Further research will target on management of invasive weeds including biological control, putting

invasive weeds policy and regulations in place, training and awareness creation on invasive weeds issues and capacity building in terms of facility and management, which are important.

CONFLICT OF INTERESTS

The authors did not declare any conflict of interest.

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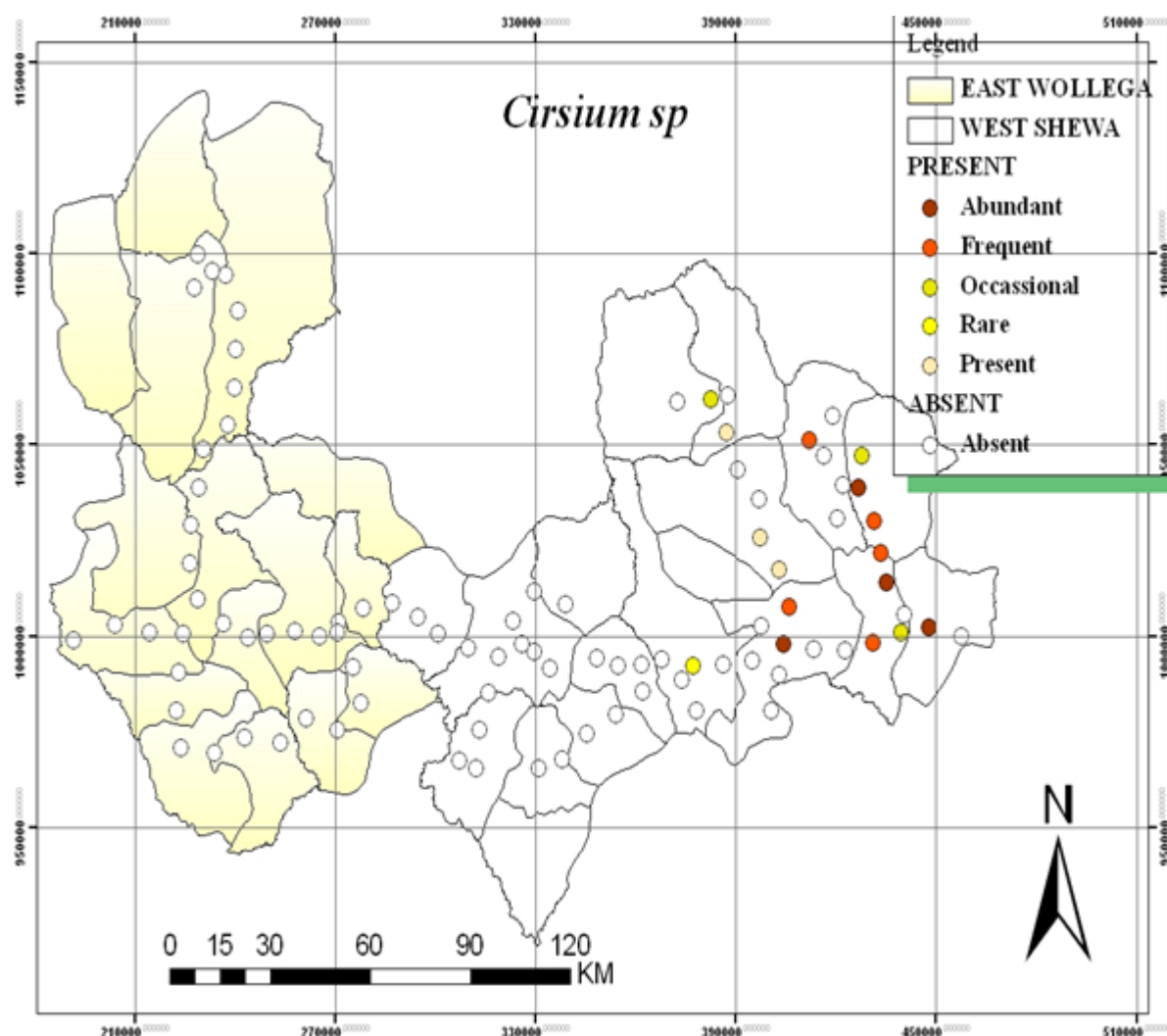


Figure 5. Distribution and abundance of *Cirsium sp* in West Shewa and East Wollega Zones of Western Oromia, 2009/10.

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