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Status of Invasive Alien Plant species in Dhankuta Municipality

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Abstract

Invasive alien species are plants, animals, pathogens and other organisms that are non-native to an ecosystem, and which may cause economic or environmental harm or adversely affect human health. At least 179 species of alien plant species are naturalized in Nepal and 26 of them have become invasive with negative impacts on environment and economy. Out of 26 invasive alien species four species are among the 100 of the world's worst invasive alien species. The present study intended to investigate the invasive alien plant species found in Dhankuta Municipality, which has not been explored previously. Present study reported 30 species of invasive alien plant species belong to 13 families of 28 genera. Agro-ecosystems accounted for 40% of the 30 species' IAPS, followed by grasslands and residential areas (31% each), and forests and shrub-land (27% each).

Keywords: IAPS, Asteraceae, agro-ecosystem, grassland, residential area

Introduction

Invasive alien species are plants, animals, pathogens and other organisms that are non-native to an ecosystem, and which may cause economic or environmental harm or adversely affect human health. In particular, they impact adversely upon biodiversity, including decline or elimination of native species through competition, predation or transmission of pathogens and the disruption of local ecosystems and ecosystem functions (CBD, 2009). Invasive species often coexist with native species for an extended time and then grows larger and denser and it adapts to its new location in absence of their natural predators. With increasing globalization of trade and human movement, the number of alien species has been increasing in all continents and climatic regions without any sign of saturation (Seebens et al., 2017), including in high mountains and polar regions (Pauchard et al., 2016). Lodge *et al.* (2006) concluded that IAPS endanger the environment, economy and human welfare. They also reduce the population of native species or replace them altogether, thus increase the agricultural activities (Ricchardi *et al*., 2008). The IAPS impacts the wide range of sectors including agriculture, forestry, aquaculture, trade and recreation (CBD, 2002).

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The CBD has set global priorities and action plan on collecting information and on coordinating international activities on invasive alien species. Nepal, being a signatory of the Convention on Biological Diversity (CBD), is required to prevent the introduction of IAPS and to control or eradicate those IAPS that threaten ecosystem, habitats and species (Baral *et al*., 2017).

The enrolment and diversification of IAPS are increasing rapidly and especially on different land uses, in the changing environment. The problem of invasion is quite high in farmland and forests compared to other ecosystem (IUCN, 2004). At least 13,168 species of plants have become naturalized elsewhere in the world outside their native distribution range (Van Kleunen *et al*., 2015). At least 179 species of alien plant species are naturalized in Nepal and 26 of them have become invasive with negative impacts on environment and economy. Out of 26 invasive alien species four species viz., *Lantana camara, Mikania micrantha, Chromolaena odorata* and *Eichhornia crassipes* are among the 100 of the world's worst invasive alien species. The number of invasive alien plant species decline from east to west and from lowland to high mountains. Most of the land use types in Tarai, Siwalik and Middle Mountain regions are being invaded by some invasive alien plant (Shrestha B. B., 2017). The first study of the IAPS of Nepal was carried out nearly five decades ago (Banerji, 1958), focusing on impacts and management of IAPS at species ecosystem and socio-economic levels through eco-friendly approaches (Baral *et al.,* 2017). Shrestha and Siwakoti (2017) admit further research on the IAPS on different aspects. Present research was carried out to appraise the diversity of IAPS in Dhankuta municipality and its impact on the agro-ecosystem as well as natural and wild habitat of the plant and animals.

Methods and Materials

Study area

The study was carried out in Dhankuta municipality area which is situated in between 26^0 59' to 27^0 02' north latitude and 87^0 17' to 87^0 23' east longitude. The elevation ranges from 300 meters to 2100 meter and occupy the 48.3 sq. km of total area of Dhankuta district. Being located in the middle mountains region, the climate of Dhankuta municipality is essentially warm temperate, sub-tropical. The temperatures range from 2^0 c to 34^0 c. The vegetation zones in the district range from sub-tropical Sal forest along the Tamor and Arun rivers, and cooler temperate forests on some of the high ridges that mark the watershed between the two catchments. The majority of the population is involved in agriculture and crops include maize, rice and millet. (https://en.wikipedia.org/wiki/Dhankuta).

Data Collection

The exploration were carried out almost all land covering are of Dhankuta municipality, mostly from agricultural land, forest and other vegetation sides. Plant specimens were collected, photographed, numbered, its life span and it impacts were noted with the help of questionnaire with local people (Thakur and Rajbhandary, 2018). The specimens have been identified with the help of relevant taxonomic literature and standard floras (Polunin and Stainton, 1984; Stainton, 1988; Grierson and Lang, 1983- 2001, Shrestha, 2016; Shrestha and Shrestha, 2021) and from expert.

Result and Discussion

Present study reported total 30 species of invasive alien plant species belong to 13 families of 28 genera. Asteraceae is the most dominant family and comprise 12 species followed by Fabaceae, Euphorbiaceae and Amaranthaceae, which contains four, three and two species respectively. Remaining nine families contains one species each.

Table 1

List of Invasive alien plant species reported from Dhankuta Municipality

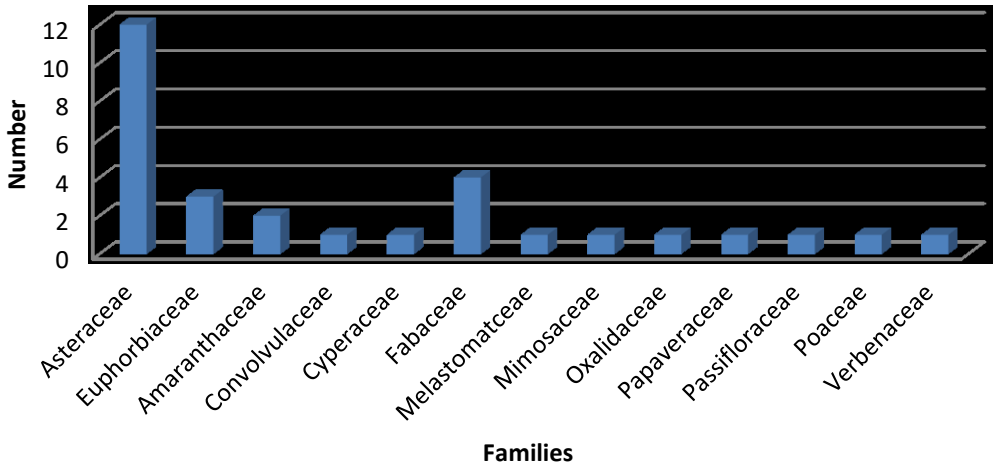
Plant name	Local name	Family	Habitat
Ageratina adenophora (Spreng.) King and H. Rob	Kalo banmara	Asteraceae	Agroecosystem
Ageratum conyzoides L.	Gandhe	Asteraceae	Agroecosystem
Ageratum houstonianum Mill	Nilo gandhe	Asteraceae	Agroecosystem
Alternanthera philoxeroides (Mart.) Griseb	Jalajambhu	Amaranthaceae	Agroecosystem
Amaranthus spinosus L.	Kunde lude	Amaranthaceae	Grassland and residential area
Argemone mexicana L	Thakal	Papaveraceae	Agroecosystem
Bidens pilosa L.	Kalo kuro	Asteraceae	Grassland and residential area
Chromolaena odorata (Spreng.) King and Robinson	Seto Banmara	Asteraceae	Forest and Shrubland
Clidemia hirda (L.) D.Don		Melastomataceae	Forest and Shrubland
Crassocephalum crepidioides (Benth.) S. Moore	Anikale jhar	Asteraceae	Forest and shrubland
Crotalaria pallid Aiton	Chinchine	Fabaceae	Forest and Shrubland
Cyperus odoratus L.	Mothe	Cyperaceae	Agroecosystem
Erigeron karvinskianus DC.	Phule jhar	Asteraceae	Agroecosystem
Euphorbia heterophylla L.	Dhudhe jhar	Euphorbiaceae	Forest and Shrubland
Galinsoga quardiradiata Ruiz & PV.	Jhuse chitlange	Asteraceae	Agroecosystem
Imperata cylindrica L.	Siudi phool	Poaceae	Agroecosystem
Ipomoea indica (Burn.F.) Meer.	Siudi	Convolvulaceae	Forest and shrubland

Jatropha curcas L.	Sajiyon	Euphrbiaceae	Grassland and shrubland
Lantana camara L.	Sutkeri kada	Verbenaceae	Forest and shrubland
Leucaena leucocephala (Linn.) Dewit.		Leguminosae	Agroecosystem
Mikania micrantha Kunth.	Lahare banmara	Asteraceae	Forest and shrubland
Mimosa pudica L.	Lajjawati	Mimosaceae	Agroecosystem
Oxalis latifolia Kunth.	Chariamilo	Oxalidaceae	Agroecosystem
Parthenium hysterophorus L.	Pati jhar	Asteraceae	Grassland and residential area
Passiflora edulis Sim.	Ghadi phool	Passifloraceae	Grassland and residential area
Ricinus communis L.	Aderi	Euphorbiaceae	Grassland and residential area
Senna occidentalis (L.) Linn	Tapre	Fabaceae	Grassland and residential area
Senna tora (L.) Roxb.	Panwar	Fabaceae	Grassland and residential area
Xanthium strumarium L.	Bhende kuro	Asteraceae	Grassland and residential area
Tithonia diversifolia (Hemsley) A. Grey	Suryamukhi	Asteraceae	Grassland and residential area

Distribution of species based on families

On the basis of families Asteraceae is the largest family containing 11 genera and 12 species, followed by Fabaceae containing 3 genera and 4 species, Euphorbiaceae with 3 genera and 3 species, Amaranthaceae with 2 genera and 2 species and Convolvulaceae, Cyperaceae, Melastomataceae, Mimosaceae, Oxalidaceae, Papaveraceae, Passifloraceaea and Verbenaceae are monotypic having one genus and one species.

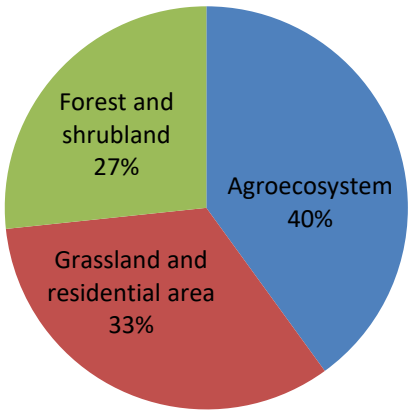
Figure 1
Distribution of species based on families



Land use by IAPS

During observation it was found that among total 30 species of IAPS reported from Dhankuta municipality, 12 species (40%) are inhabit the agroecosystem viz., *Ageratina adenophora, Ageratum conyzoides, Ageratum houstonianum, Argemone maxicana, Alternanthera philoxeroides, Cyperus odoratus, Erigeron karvinskianus, Galinsoga quardiradiata, Imperata cylindrical, Leucaena leucocephala, Mimosa pudica* and *Oxalis latifolia*; 10 species (33%) inhabit the grassland and residential area viz., *Amaranthus spinosus*, and *Bidens pilosa*, *Jatropha curcus, Parthenium hysterophorus, Passiflora edulis, Ricinus communis, Senna occidentalis, Senna tora, Tithonia diversifolia* and *Xanthium stumarium*; and 8 species (28%) inhabit the forest and shrubland.

Figure 2
Land use by IAPS



Impact of IAPS in biodiversity and agriculture

Invasive species is the second largest reason for biodiversity loss after habitat defragmentation (Gaertner *et al*., 2009). Invasive species threaten biodiversity by causing disease, acting as predators or parasites, acting as competitors, altering habitat or hybridizing with local species. Besides replacing the native species, invasive plants also change the ecology of a given habitat by changing the nutrient cycle and soil pH (Drenovsky *et al*., 2007). IAPS also affect the wild life habitat, degrade the soil profile which result the loss of productivity and adversely affect the human health by degrading the natural ecosystem.

Invasive plants can have a wide range of impacts on agriculture. They may act as new or additional hosts for new or existing crop diseases and pests, may cause crop yield reductions and may require increased use of pesticides to control them (Shah *et al*., 2020). These activities of invasive plants increase the cost value of farmers and also reduce the total productivity and land value. Invasive plants have ability to grow faster, produce more seed and have gregarious spreading capacity than native plants. So they are very harmful to forestland, agro-ecosystem, grassland and residential area, which adversely affect not only our ecosystem but also in biological life of wild animal, domestic animals and human beings also. The invasion of *Ageratum conyzoides*, *A. adenophora* and *Chromolaena odorata* had reduced the production of cereal corps and grasses in Kaski district (Bhusal, 2009).

Management and control of IAPS

Invasive alien plant species are perceived to be one of the major challenges for the earth's natural habitats and after deforestation, is seen as a second biggest danger to the survival of biodiversity (Tiwari *et al*., 2005). Due to open border and less effective quarantine in Nepal, many exotic species of our neighboring countries can spread into Nepal. According to Rejmanek (2005), effective management of biological invasion should follow three main steps from prevention, early detection and eradication and control backed up by integrated management.

Conclusion

Observations revealed that there are 30 invasive alien plant species, which are divided into 13 families and 28 genera. With 12 species, the Asteraceae family has the most members and is followed by the Fabaceae, Euphorbiaceae, and Amaranthaceae. Agro-ecosystems accounted for 40% of the 30 species' IAPS, followed by grasslands and residential areas (31% each), and forests and shrub-land (27% each). Several new varieties of alien species are able to enter Nepal with ease because of the open border and lack of adequate quarantine checkpoints. Agriculture production and biodiversity are threatened by the introduction of such species. For the prevention of the introduction and management of invasive alien plant species in Nepal, there is no specific law or regulation. In order to avoid such, the Quarantine Department should be active.

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