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Research Article

DOCUMENTATION OF INVASIVE ALIEN PLANTS SPECIES OF RUPANDEHI DISTRICT, WESTERN NEPAL

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Abstract

Invasive species are non-native to the locality. They have been introduced in any area both accidentally and intentionally. Their introduction undoubtedly modifies the structure and functions of the ecosystem supply and alters the rate of nutrient cycling. Invasive alien species compete with the crop mainly for water, light, and nutrients. During study we have collected fifty-five species which are invasive and alien. They directly affect the productivity of food crop like rice, wheat, maize etc.

Key Words: Invasive; alien; ecosystem; productivity; nutrient cycle, Rupandehi.

Introduction

Invasive Alien Species (IAS) is non-native or exotic to ecosystems which are introduced to a new geographic area from their known historic range. IAS may include plants, animals, and microbes that have been transferred accidentally or with intent of economic benefits (Holmes et al., 2009). Sometime their history of origin and distribution might not be clear but their global expansion and distribution is accelerated due to global trade and human mobility (Meyerson & Mooney, 2007). Invasive weeds are more successfully colonizing in any natural habitats due to their faster rate of growth, biomass production, efficient dispersal of seeds and propagules, rapid colonization and establishment in comparison to native species. Their introduction undoubtedly modifies the structure and functions of the natural ecosystem, which ultimately creates a change in the supply of ecosystem services (Wilcove et al., 1998; Millennium Ecosystem Assessment, 2005). Various invasive plants are known to decrease local plant species diversity (Vila et al., 2006; Gaertner et al., 2009; Powell et al., 2011) increase ecosystem productivity and alter the rate of nutrient cycling (Liao et al., 2008; Ehrenfeld, 2010). The recent Ecologists identify invasive plant species as one of the greatest threats to native forest ecosystem and species richness (Wilcove et al., 1998; Moore, 2000; D'Antonio, and Kark, 2000).

Nepal lies at junction of the Palearctic and oriental realms of the earth and at the crossroad of six floristic provinces of Asia that occupies about 0.1 percent land surface area but globally recognized for its rich biodiversity. It has great variation in geographical and climatic conditions that favours the introduction and growth of several alien plant species. Nepal has 5856 flowering plants (NBS, 2002) of which 246 plants are endemic (Shrestha and Joshi 1996). The protected areas of Nepal have 140 endemic plant species, while remaining 106 (out of 246) occur outside of protected areas (Shrestha, 1999). The ancient practice on cultivation of imported varieties of crops (maize, potato, tomato, and sweet potato), fruits (papaya, guava), ornamental (marigold, *Mirabilis*, *Bougainvillea*) (Tiwari et al., 2005), timbers (*Tectona*, *Albizia*, *and Eucalyptus*) and other pet animals has introduced many exotic species. Mostly the IAS in Nepal is of neo-tropical origin introduced through India due to open trade and geographical continuance in contrast of natural barriers in North**.** Some major IAS of Nepal is *Ageratina adenophora*, *Chromolaena odorata*, *Lantana camara*, *Mikania micrantha*, *Eichhornia crassipes*, *Parthenium histerophorus* (Tiwari et al., 2005, Kunwar 2003, Rai and Scarborough 2013). Native biodiversity of Nepal has been under excessive pressure due to growing population's demand, overdependence on natural resources, unplanned urbanization and land use practices. In past 2-3 decades many exotic species have been rapidly colonizing in natural habitats posing great threat on natural ecosystems and economic loss (Rai and Scarborough 2013). It is, therefore, important to control the spread and effects of such species at an early stage during their establishment process. Any further passivity and lack of initiatives may have a serious impact on native biodiversity.

Knowledge on alien species in Nepal is rather meager and limited. Any comprehensive study has yet to document and determine the status of AIS in Nepal in order to understand and address the problems created by them. There are over 166 alien and invasive plant species have been recorded from different parts of country (Tiwari et al., 2005). However, the number of species may be more.

Study Area

Rupandehi lies between 27° 40' .016" to 27° 40' .252" N and 83º 27'.955" to 83º 28'.255" E in Terai region of Nepal. It occupies an area of 1360 Km² (DDC, Rupandehi, 2007) within political boundaries of Palpa district on North, Mahrajganj and Siddhartha Nagar district of Uttar Pradesh (India) in South, Nawalparasi district in East and Kapilbastu district in West (Fig.1). It lies in tropical region with characteristic monsoon rainfall and three distinct season hot and dry summer (March to May), hot and moist rainy season (June to September), and cold and dry winter (October to January). Maximum temperature ranges from 35º to 41ºC in summer and 15º to 22º C in winter and minimum temperature from 30º to 32ºC in summer and 10º to 14ºC in winter. Soils in this district are silty loam, sandy loam and are suitable for wheat, sugarcane, rice and other species. So to the status of alien species in Rupandehi district, we made a field survey and selected only the agricultural land areas which are economically very important. During the survey, we have collected a large number of alien plant species from the agricultural land areas. The main objectives of this study are to document the invasive alien plant species from different village development committees of Rupandehi district of Western Nepal.

Methodology

The work was undertaken through field survey in some selected agricultural land areas particularly wheat, sugarcane and paddy during the period of 2011-2013 in the selected VDCs (Bagauli, Bogadi, Siloutiya,and Bairghat of Marchwar, Saljhandi, Parroha, Rudrapur, Gajedi, Semlar, Motipur, Shankarnagar, Karahiya, Makrahar, Sou. Pharsatikar etc.) of the district. The information regarding the alien plant species has been gathered mostly from local farmers, old and knowledgeable farmers. The alien plant species were collected in its flowering stage in most of the cases. The plant samples were collected and processed following the routine method of plant collection and herbarium technique (Lawrence, 1951; Judd et al., 2002). The specimens have been identified using relevant floras and standard literatures (Hooker 1872-1897, Polunin and Stainton, 1984; Stainton, 1988; Grierson and Lang, 1983-2001; Noltie, 1994) and nomenclatures of the identified species follows Hara and Williams (1979), Hara et al., (1978, 1982), and Press et al., (2000).

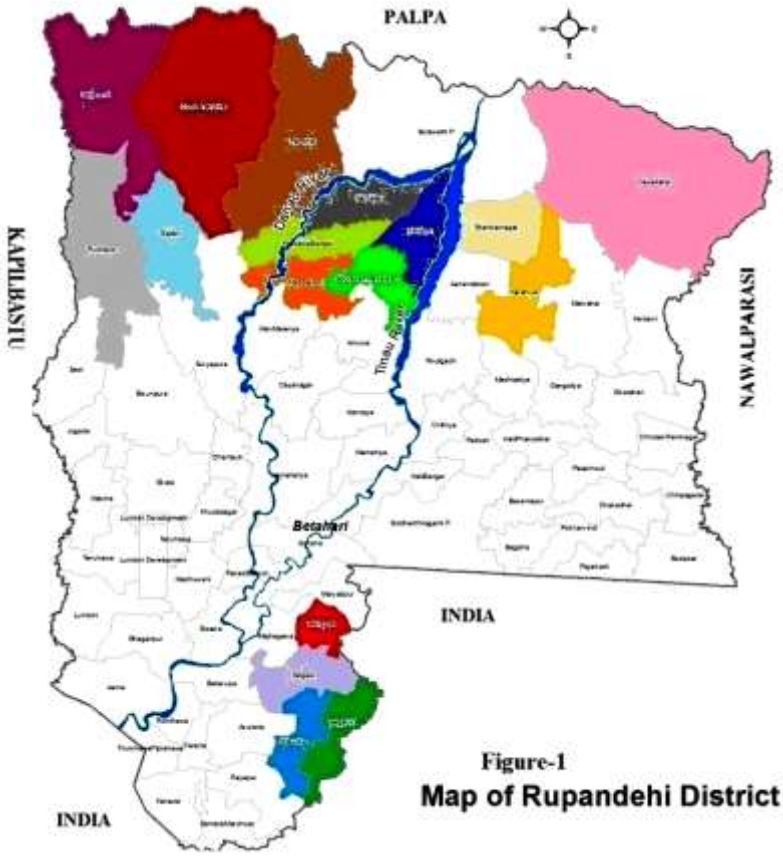

Figure-1
Map of Rupandehi District

Observation

During the field survey a total of fifty-five alien plant species from different agricultural land areas belonging to twenty-four families were reported and presented in (Table-1). Largest number of alien species belong to family Poaceae (14 species), followed by Fabaceae, Asteraceae (6 species each), Amaranthaceae (5 species), Euphorbiaceae (3 species) Cyperaceae, Solanaceae, (2 species each) and Acanthaceae, Asclepiadaceae, Aizoaceae, Cannabinaceae, Capparaceae, Chenopodiaceae, Commelinaceae, Convolvulaceae, Malvaceae, Nyctaginaceae, Oxalidaceae, Papaveraceae, Primulaceae, Scrophulariaceae, Tiliaceae, Verbenaceae, and Zygophyllaceae (1 species each) (Fig. 2).

Table 1: List of alien plant species reported in this study.

S.N	Alien plant species name	Family	Habit
1	*Achyranthes aspera* L.	Amaranthaceae	Annual herb
2	*Acrachne racemosa* (Heyne ex Roem. & Schult) Ohwi	Poaceae	Annual herb
3	*Ageratum conyzoides* L.	Asteraceae	Annual herb
4	*Alternanthera sessilis* (L.) DC.	Amaranthaceae	Perennial herb
5	*Amaranthus spinosus* L.	Amaranthaceae	Annual herb
6	*Anagalis arvensis* L.	Primulaceae	Annual herb
7	*Argemone mexicana* L.	Papaveraceae	Annual herb
8	*Boerhaavia diffusa* L.	Nyctaginaceae	Perennial herb
9	*Calotropis procera* (Aiton) Dryander	Asclepiadaceae	Perennial shrub
10	*Cannabis sativa* L.	Cannabinaceae	Perennial bushy shrub
11	*Cassia occidentalis* L.	Fabaceae	Perennial shrub
12	*Cassia tora* L.	Fabaceae	Annual herb
13	*Celosia argentea* L.	Amaranthaceae	Annual herb
14	*Chenopodium album* L.	Chenopodiaceae	Annual herb
15	*Cleome viscosa* L.	Capparaceae	Annual herb
16	*Commelina benghalensis* L.	Commelinaceae	Annual herb
17	*Corchorus acutangulus* L.	Tiliaceae	Annual herb
18	*Croton bonplandiarum* Baill.	Euphorbiaceae	Annual herb
19	*Cynodon dactylon* (L.) Pers.	Poaceae	Annual herb
20	*Cyperus esculentus* L.	Cyperaceae	Annual herb
21	*Cyperus rotundus* L.	Cyperaceae	Perennial herb
22	*Dactyloctenium aegypticum* (L.) P. Beauv.	Poaceae	Annual herb
23	*Datura stramonium* L.	Solanaceae	Annual herb
24	*Digera arvensis* Forsk.	Amaranthaceae	Annual herb
25	*Digitaria ciliaris* (Retz.) Koeler	Poaceae	Annual herb
26	*Dinebra retroflexa* (Vahl) Panz.	Poaceae	Annual herb
27	*Echinochloa crus-galli* (L.) Beauv.	Poaceae	Annual herb
28	*Eleusine indica* (L.) Gaertn.	Poaceae	Annual herb
29	*Eragrostis cynosutoides* (Retz.) Beauv	Poaceae	Perennial shrub
30	*Eupatorium adenophorum* Spreng	Asteraceae	Perennial shrub
31	*Euphorbia hirta* L.	Euphorbiaceae	Perennial herb
32	*Imperata cylindrica* L.	Poaceae	Perennial herb
33	*Ipomea carnea* Jacq.	Convolvulaceae	Perennial shrub
34	*Lantana camara* L.	Verbenaceae	Perennial shrub
35	*Lathyrus aphaca* L	Fabaceae	Annual herb
36	*Lathyrus odoratus* L.	Fabaceae	Annual herb

Table 1 (Contd.): List of alien plant species reported in this study.

S.N	Alien plant species name	Family	Habit
37	*Mimosa pudica* L.	Fabaceae	Perennial shrub
38	*Oxalis corniculata* L.	Oxalidaceae	Annual herb
39	*Parthenium hysterophorus* L.	Asteraceae	Annual herb/shrub
40	*Phalaris paradoxa* L.	Poaceae	Annual herb
41	*Phragmites karka* (Retz.)Trin. ex Steudel	Poaceae	Annual shrub
42	*Phyllanthus niruri* L.	Euphorbiaceae	Annual herb
43	*Ruellia tuberosa* L.	Acanthaceae	Annual herb
44	*Scoparia dulcis* L.	Scrophulariaceae	Herb
45	*Setaria plicata* (Lam.)T. Cooke	Poaceae	Annual herb
46	*Setaria viridis* (L.) P. Beauv.	Poaceae	Annual herb
47	*Sida rhombifolia* L.	Malvaceae	Annual shrub
48	*Solanum nigrum* L.	Solanaceae	Annual herb
49	*Sonchus oleraceous* L.	Asteraceae	Annual herb
50	*Sorghum halpense* Pers.	Poaceae	Annual herb
51	*Trianthema portulacastrum* L.	Aizoaceae	Perennial shrub
52	*Tribulus terrestris* L.	Zygophyllaceae	Annual herb
53	*Tridax procumbens* L.	Asteraceae	Annual herb
54	*Trifolium repens* L.	Fabaceae	Annual herb
55	*Xanthium strumarium*	Asteraceae	Annual herb

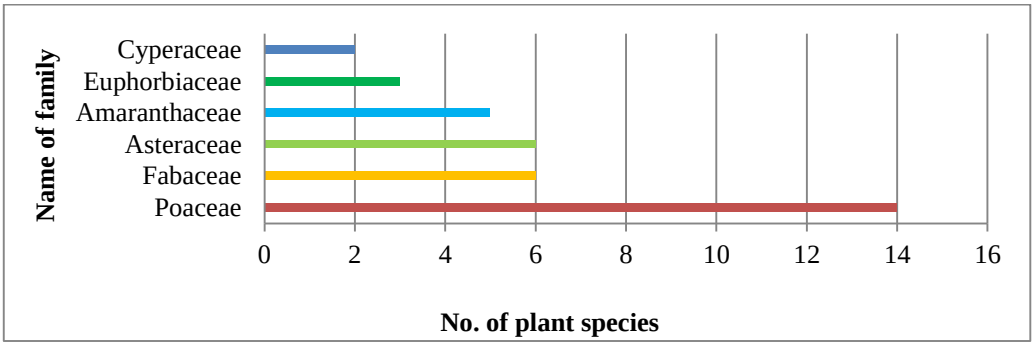

Fig. 2: Name of the families with highest number of alien species

Result and Conclusion

During observation it was found that total fifty-five invasive species belong to twenty-four families of which highest number of species belonging to family Poaceae followed by Fabaceae, Asteraceae, Amaranthaceae, Euphorbiaceae, and Cyperaceae and so on (Fig. 3). These species are introduced in the field accidently because farmers and cultivars of this district bring seeds for cultivation from Nautanwa of Mahrajganj district and Naugarh of Siddhartha Nagar district U.P., India.

Because of open boarder, alien species easily entered in the crop fields. They compete with crop plants for food, water, and other nutrients and reduce the productivity of that crop.

A national strategy to manage invasive alien plants is needed to consider a broad range of management actions simultaneously. There is no any special rule or regulations for preventing introduction and control of invasive alien species, except for the plant quarantine law. The current quarantine law concerned with organisms that may bring harm to agriculture and forestry, but not much attention is given to those invasive alien species that may pose potential threats to ecosystems and biodiversity. The custom and quarantine departments also lack adequate capacity for controlling introduction of alien species in the country, and do not have a sound inspection and quarantine system to follow up. To prevent the entry of alien species government of Nepal, enhancing the quarantine and detecting capacity of the custom and quarantine departments through appropriate facilities, training and incentive measures is needed. If any way alien species introduced in the field, government of Nepal should provide training about eradication of alien species to crop cultivars.

Fig. 3: Photographs of some common invasive alien plant species of Rupandehi district

Fig. 3 (Contd.): Photographs of some common invasive alien plant species of Rupandehi district

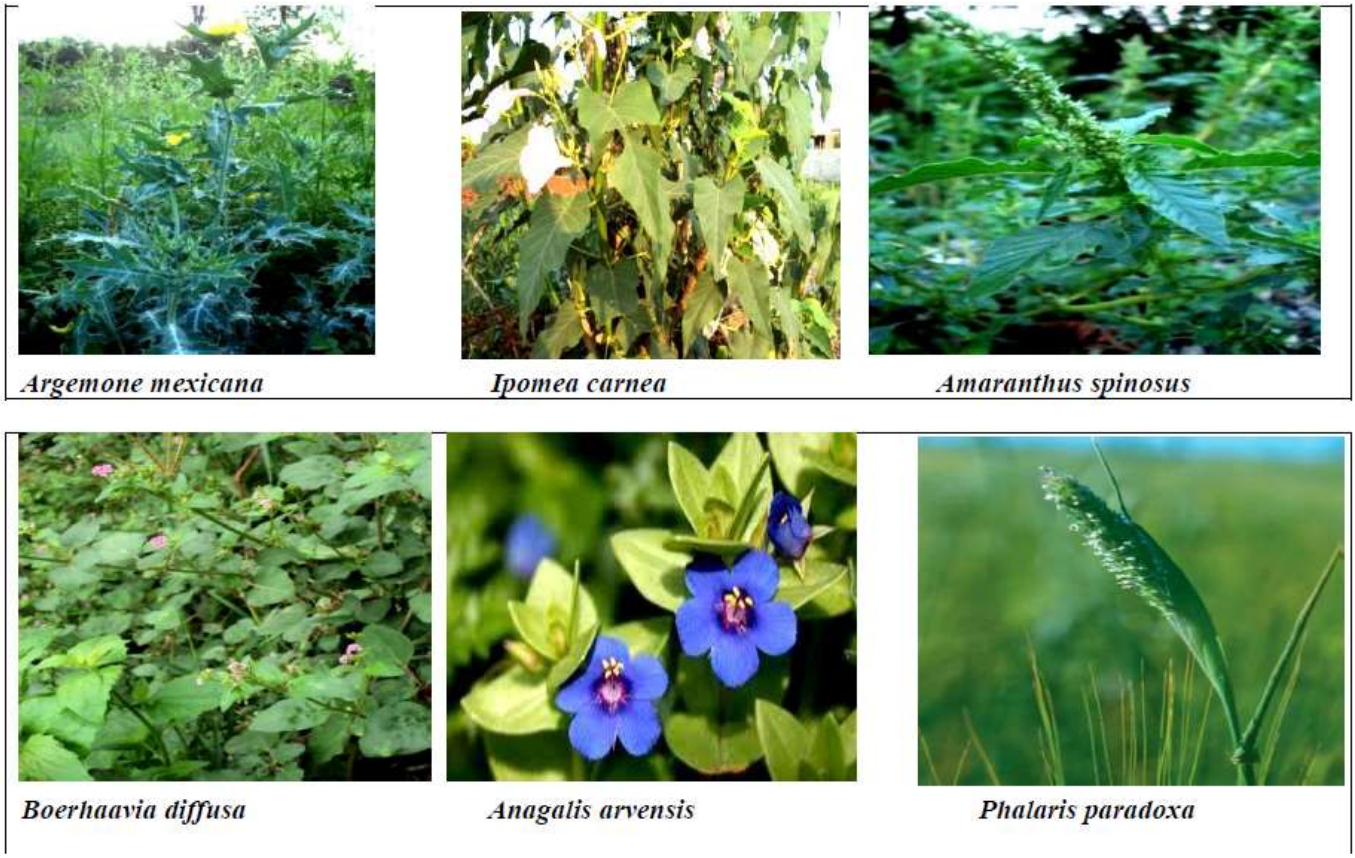

Fig. 3 (Contd.): Photographs of some common invasive alien plant species of Rupandehi district

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References

D'Antonio CM, Kark S (2002) Impacts and extent of biotic invasion in terrestrial ecosystem. *Trends in Ecology and Evolution*, **17** (5): 202-204. DOI: 10.1016/SO169-5347(02)02454-0

District Development Committee (2007) District Profile of Rupandehi, Govt. of Nepal.

Ehrenfeld JG (2010) Ecosystem consequence of biological invasion. *Annu. Rev. Ecol. Evol. Syst.*, **41**: 59-80. DOI: 10.1146/annurev-ecolsys-102209-144650

Gaertner M, Breeyen AD, Hui C, and Richardson DM (2009) Impacts of alien plant invasions on species richness in mediterranean- type ecosystem: a meta-analysis. *Progr. Phys. Geogra.*, **33 (3)**:319-338. DOI: 10.117/0309133309341607

Grierson AJC and Long DG (2001) *Flora of Bhutan Vol. 1, Part-3, Vol. 2, part 1-3*. Royal Botanic Garden, Edinburgh, and Royal Government of Bhutan.

Hara H, Stearn WT and Williams LHJ (1978) *An Enumeration of the Flowering Plants of Nepal. Vol.* 1. Trustees of British Museum (Natural History) London

Hara H and Williams LHJ (1979) *An Enumeration of the Flowering Plants of Nepal. Vol.* 2. Trustees of British Museum (Natural History) London

Holmes TP, Aukema JE, Holle BV, Liebhold A and Sills E (2009) Economic impacts of invasive species in forest, past, present, and future. *Annuals of the New York Academy of Sciences* ***1162:*** 18-38. DOI: 10. 1111/j.1749-6632.2009.0446.x

Hooker JD (1872-1897). *The flora of British India*, Vols. 1-7. L. Reeve & Co. London

Judd WS, Campbell CS, Kellogg EA, Stevens PF and Donoghue MJ (2002) Plant Systematics: a phylogenetic approach, 2nd edition. Sinauer Associates, Inc. USA.

Kunwar RM (2003) Invasive alien plants and *Eupatorium*: Biodiversity and livelihood. *Himalayan Journal of Sciencce*, **1** (2): 129-133.

Lawrence GHM (1951) *Taxonomy of Vascular plants*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.

Liao C, Peng R, Luo Y, Zhou X, Wu X, Fang C, Chen J and Li Bo (2008) Altered ecosystem carbon and nitrogen cycle by plant invasion: a meta-analysis, *New Phytol.*, **177**: 706-714. DOI: 1111/j.1469-8137.2007.02290.x

McNeely JA, Mooney HA, Neville LE, Schei P and Waage JK (2001) Global Strategy on Invasive Alien Species IUCN-The World Conservation Union, Gland.

Meyerson LA, Mooney HA (2007) Invasive alien species in an era of globalization. *Frontiers in Ecology and the Environment* **5** (**4**): 199-208.

Millennium Ecosystem Assessment (2005) Ecosystem and Human well-being, Synthesis Report Washington DC: Island Press.

Moore PD (2000) Alien invaders. *Nature* **403 (6769)**: 492-3. DOI: 10.1038/35000686.

NBS (2002) Nepal Biodiversity Society. HMG, Ministry of Forest and Soil Conservation, Kathmandu, Nepal.

Noltie HJ (1994) Flora of Bhutan. Vol. III Part I. Royal Botanic Garden, Edinburgh, and Royal Government of Bhutan.

Pejchar L and Mooney HA (2009) Invasive species, ecosystem services and human well-being. *Trends in Ecology and Evolution* **24** (9): 497-504. DOI: 10.1016/j.tree.2009.03.016.

Polunin O and Stainton A (1984) *Flowers of the Himalayas*. Oxford University Press, London.

Powell KI, Chase JM and Knight TM (2011) A synthesis of plant invasion effects on biodiversity across spatial scales. *Am. J. Bot.*, **98**: 539-548. DOI: 10.3732/ajb.1000402.Epub2011

Press JR, Shrestha KK and Sutton DA (2000) *Annotated Checklist of the Flowering Plants of Nepal*. The Natural History Museum, London and Central Department of Botany, Tribhuvan University, Nepal.

Rai RK Scarborough H (2013) Economic value of mitigation of plant invaders in subsistence economy: Incorporating labour as a mode of payment. *Environment and Development Economics*, **18**(2):225-244. DOI 10.1017/s1355770x1200037x

Shrestha TB (1999) Nepal Country Report on Biological Diversity. IUCN, Kathmandu, Nepal.

Shrestha TB and Joshi RM (1996) Rare, Endemic, and Endangered plants of Nepal, WWF Nepal Program, Kathmandu, Nepal.

Stainton A (1988) *Flowers of the Himalaya*: A Supplement, Oxford University Press. New Delhi, India.

Tiwari S, Adhikari B, Siwakoti M and Subedi K (2005) An Inventory and Assessment of Invasive Alien Species of Nepal. IUCN Nepal, Kathmandu.

Tylianakis, JM, Didham RK, Bascompte J and Wardle DA (2008) Global change and species interaction in terrestrial ecosystem. Eco. *Lett*, **11(**12**)**:1351-1363. DOI: 10.1111/j.1461.0248.2008.01250.x.

Vila M Tessier M, Suchs CM, Brundu G, Carta L, Galandis A, Lambdon P, Manca M, Medail F, Moragues E, Travesel A, Troumbis AY;, Hulme PE (2006) Local and regional assesment of the impacts of plant invaders on vegetation structure and soil properties of mediterranean Islands. *J. Biogeogr*., **33**: 853-861. DOI. 10.1111/j.1365-2699.2005.01430.x.

Wilcove DS, Rothstein D, Dubow J, Phillips A, Losos E (1998) Quantifying threats to imperiled species in the United States. *Bio Science* **48** (8)**:**607-615.