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DIVERSITY OF INVASIVE SPECIES AND THEIR ECOLOGICAL IMPACTS IN NORTHERN KERALA, INDIA

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Abstract

The present study deals with the implication of invasive plant species on the diversity of Kannur District Ghats of Kerala State, India. A total number of 27 invasive alien species under 27 genera belonging to 8 families have been recorded based on field exploration and literature consultations. Among these, 3 species are being used by local inhabitants for medicinal purposes. It is evident from the study that, 23 species have been introduced intentionally, while the remaining species established unintentionally through trade. The present study concluded that, a better planning is needed for early detection to control and reporting of infestations of spread of naturalized species to be scrutinized.

Key words: Invasive species, Floristic composition, Habitat loss, Northern Kerala.

INTRODUCTION

Invasive species are considered to be one of the greatest threats to biodiversity and to the ecological and economic well-being of society and the planet. Invasive species is a phrase with several definitions. The first definition expresses the phrase in terms of non-indigenous species (e.g. plants or animals) that adversely affect the habitats they invade economically, environmentally or ecologically. It has been used in this sense by government organizations as well as conservation groups such as the IUCN. The second definition broadens the boundaries to include both *native* and *non-native* species that heavily colonize a particular habitat as detailed by CBD, 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. Invasive alien species, introduced and/or spread outside their natural habitats, have affected native biodiversity in almost every ecosystem type on earth and are one of the greatest threats to biodiversity. Since the 17th century, invasive alien species have contributed to nearly 40% of all animal extinctions for which the cause is known (Lambert *et al.*, 2013). The impacts of invasive species on ecosystem services have attracted worldwide attention. Despite the overwhelming evidence of these impacts and a growing appreciation for ecosystem services, however, researchers and policymakers rarely directly address the connection between invasions and ecosystem services. Various attempts have been made to address the ecosystem processes that are affected by invasive species (Allan, 1969; Levine *et al*. 2003; Burns, 2006).

MATERIALS AND METHODS

The data on occurrence of alien invasive species in various places of Northern parts of Keralas was obtained by on-road survey covering aquatic, terrestrial. A total of 25 point observations were made. At each location, information was collected on the AIS and the impacted native species and habitats. Each of the species recorded was then subjected to the Invasive Species Assessment Protocol (Morse *et al*., 2004) so as to calculate the invasive rank (I-Rank) of the species. Description of the invasive rank used in the study is given in Table 1. On the factors that influence the position of a species in the I-Rank, the assessment protocol describes that " factors which can push a species" I-Rank upward (towards high) are the ability to change ecosystem processes; invade relatively undisturbed ecological communities; cause substantial impacts on rare or vulnerable species of ecological communities, or high-quality examples of more common communities; wide distribution and general abundance where present; ability to disperse to new areas readily; and difficulty of control. Conversely, species with minimal impacts on ecosystem processes, native species, and ecological communities will generally be assigned an I-Rank of Low or Insignificant. Other factors that can push a species' I-Rank downward are lack of potential to spread beyond a small existing range, stable or decreasing abundance within the current range, and ease of control. Name of the plant and Family were recorded.

RESULTS

Of the 27 Alien Invasive Species (AIS) found in the Northern parts of Kerala state, 13 are of high risk, 7 pose medium risk, 5 pose low risk and the rest 2 are insignificant as per the risk assessment conducted (Table 2). There are 4 trees, 14 shrubs, 2 herbs and 7 climbers among the alien species found in the Kannur and Kasaragod district. The land of origin of the AIS happens to be America for 11 species, South America for 10 species, Central Ameriaca for 6 species, Central and South

America for 4 species, and Asia for 3 species. Alien species, one each has also been from Africa, Australia, West and Central Africa and the West Indies. It is also important to note that most of the introductions into the forests of Kerala were intentional. Six species were accidentally introduced and the motive and mode of introduction of one species (*Alternanthera brasiliana*) could not be deciphered.

DISCUSSION

Impact of Invasive Species

Invasive alien species transforms the structure and species composition of ecosystems, either directly by out competing them form resources or indirectly by changing the way nutrients are cycled through the system thus making it difficult for native species to re-establish. Modes of resource acquisition and consumption of these species may cause a change in soil structure, its profile decomposition, nutrient content of soil, moisture availability etc. IAW replaces economically important native plant species and increases the investment in agriculture, disrupt prevailing vegetation dynamics and alter nutrient cycling (Carlton and Ruiz, 2005). Many IAW grow faster than native plants and reproduce quickly and thus replace indigenous plants and completely alter the composition of the area they have colonised. IAW also crowd out native plants upon which wildlife depend for food. IAW decrease water supply by degrading water catchment areas and freshwater ecosystem. IAW alter fire frequently and increase fire intensify which can result in complete alternation of the community from woody species dominance to grassland (Carlton, 1996; David *et al*., 2005; Niklas, 2008).

Exotic plants can modify the activity of pollinators through differential production of nectar than native species. Invasive species that are closely related with rare native species have the potential to hybridize with the native species. Harmful effects of hybridization can have lead to a decline and even extinction of native species. Natural wild species can be threatened with extinction through the process of genetic pollution. Agricultural and grazing lands as well as protected areas are threatened by rapidly growing species of plants. IAW may affect the productive capacity of the land and reduce crop yields. It also necessitates labour intensive control efforts. Farmers everywhere are plagued by invasive weeds. In developing countries farm income may be so low that farmers are unable to cope with potentially invasive species (Panetta and Scanlan, 1995; Nilsson and Grelsson, 1996; Torchin *et al*., 2003).

Invasive alien species are increasingly seen as a threat not only to biodiversity and ecosystem services but also to economic development and human well being. *Acacua mearnsii* is responsible for respiratory problems and skill allergies (dermatitis). Aquatic invasive alien weeds like *Eichhornia crassipes*, *Pistia lanceolata* and *Salvina molesta* act as alternate host and vectors of malaria, yellow fever encephalitis, dengue fever and filaiasis.

Every alien species needs to be considered potentially invasive until convincing evidence indicates that it present no such threat. The earlier the problem of an invasive alien species is addressed the more cost effective action is likely to be. Strict measures both at the governmental levels should be taken up to face the problem of invasive aliens in the country (Reichard and Hamilton, 1997). Public awareness about such plants amongst the rural and tribal people is most important and in order to create this exhibitions, training campus and workshops at the village level involving persons of botanists agriculturalist and forest department should organised. Invasive alien weeds do not wait so do not hesitates to act upon so that by 2020 our biodiversity would be rich thriving abundant and most importantly diverse. The study has identified 27 AIS in the various places of Kannur which fall under high risk, moderate risk, low risk and insignificant categories. All high and moderate risk species warrants immediate attention and those species in other categories need constant monitoring. The approaches towards this can be classified under the following four categories (Torchin *et al*., 2003; Reichardson *et al*., 2011).

Table 1: Description of Invasive Rank used in the study

Rank	Description
High	Species represents a severe threat to native species and ecological communities
Medium	Species represents moderate threat to native species and ecological communities
Low	Species represents a significant but relatively low threat to native species and ecological communities
Insignificant	Species represents an insignificant threat to native species and ecological communities

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Table 2: Alien Invasive Species in Northern Kerala region and their Risk Classes

Sl. No	Species	Family	Habit	Local Name	Rank	Introduction	Native to	Purpose of Introduction
1	*Acacia mearnsii*	Acanthaceae	Tree	Karuva	High	International	Australia	Afforestation
2	*Ageratum conyzoides*	Asteraceae	Herb	Appa	Medium	International	Central America	Ornamental
3	*Antigonon leptopus*	Polygonaceae	Climber	Valli	Medium	International	Mexico	Ornamental
4	*Arundo donax*	Poaceae	Shrub	-	Mediium	International	South Asia	Hedge plant
5	*Chromolena odorata*	Asteraceae	Shrub	Communist Pacha	High	Accidental	America	-
6	*Eichhornia cassipes*	Pontederiaceae	Shrub	Kulavazha	High	Accidental	Amazon basin	-
7	*Heliconia psittacorum*	Heliconiaceae	Shrub	Vazha	Medium	International	Caribbean	Ornamental
8	*Hypoestes*	Acanthaceae	Shrub	Ila cheera	Mediu	International	America	Ornamental

	sanguinolenta				m			
9	*Hyptis capitata*	Lamiaceae	Shrub	-	Medium	International	Central America	Ornamental
10	*Ipomea cairica*	Convolvulaceae	Climber	-	Medium	International	Central America	Ornamental
11	*Jatropha gossypifolia*	Euphorbiaceae	Shrub	Chuvanna kadalavanakkku	Insignificant	International	South America	Hedge plant
12	*Lantana camera*	Verbanaceae	Shrub	Kongini	High	International	Central and south America	Ornamental
13	*Leucaena leucocephala*	Mimosaceae	Tree	-	Low	International	America	Social forestry
14	*Limnocharis flava*	Alistemataceae	Shrub	Manja payal	Medium	International	America	Accidental
15	*Merremia vitifolia*	Convolvulaceae	Climber	Vana vayara	High	Accidental	Asia	-
16	*Mikania micrantha*	Asteraceae	Climber	Dritharashtra Pacha	High	International	South America	Cover Crop
17	*Mimosa diplotricha*	Asteraceae	Shrub	Anathottavadi	High	International	South America	Cover crop
18	*Mucuna breacteata*	Fabaceae	Climber	Thottapayar	High	International	Asia	Cover Crop
19	*Phytolacca octandra*	Phytoloccaceae	Herb	-	Insignificant	International	America	Ornamental
20	*Pistia stratiotes*	Araceae	Shrub	Water lettuce	High	International	America	Accidental
21	*Prosopis juliflora*	Mimosaceae	Tree	Vanni	High	International	South America	Fuel wood
22	*Salvinia molesta*	Salviniaceae	Shrub	African Payal	High	International	Brazil	Accidental
23	*Scirpus atrovirens*	Cyperaceae	Shrub	Pullu	Medium	International	-	-
24	*Senna siamea*	Ceasapiniaceae	Shrub	Ponninthakara	Medium	International	America	Ornamental
25	*Sesbania bispinosa*	Fabaceae	Shrub	-	Low	International	North Africa	Accidental
26	*Sphagneticola trilobata*	Asteraceae	Herb	Vennapacha	High	International	America	Ornamental
27	*Tithonia diversifolia*	Asteraceae	Shrub	Kaippan Pacha	Medium	International	Central America	Ornamental