



Exotic species diversity in a famous picnic spot of Doon valley

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Abstract

The present study was carried out in Sahastradhara, a famous picnic spot of Doon Valley. During the tourist season, more than 5 lakh tourists visit the site for their recreation. The tourist activities has declined the native species diversity and promoted the introduction of 96 exotic species. Tropical America and Tropical South American plants have contributed to 45% and 2% of the total invasive diversity respectively. Asteraceae with 13 species is the most dominant family of the site.

Keywords: Exotic, Diversity, Picnic Spots, Sahastradhara, tourism, Disturbed Sites

Introduction

The structure and composition of a plant community reflects the nature of the basic trophic structure and forms habitat for many organisms. Several abiotic and biotic factors influence the vegetation of an area. Quantitative information on the vegetation structure and composition is crucial for conservation of bio-diversity in an area. The promotion of tourism in an area around the nature creates lot of pressure both on soil and vegetation of the area. In tourist spots soil and vegetation properties and the ecosystem properties are influenced by tourist pressure. This pressure reduces the amount of litter and organic matter in the upper layer of the soil. This ultimately results in unstable soil with various site effects like high compaction, reduce infiltration and increase bulk density and soil erosion. The native plants find this situation unfavourable and emigrate the disturbed areas leaving an open area for opportunistic species.

Material and Methods

Sahastradhara is a famous tourist destination of Doon valley during the tourist season (summer) due to perennial flow of water in Baldi river. Therefore high biotic interference level is observed. As a result many invasive exotic species have entered

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in to the ecosystem. Among them *Lantana camara*, *Parthenium hysterophorus*, *Ageratum conyzoides*, *Adhatoda zeylanica* and *Chromolena odorata* are very frequent and abundant. The study site chosen for the present study are facing variety of biotic pressure in the form of tourism, collection of fuel and fodder, cattle grazing, mining. In recent past, after the inception of Uttarakhand in 2000, Doon Valley is expanding exponentially. Moreover, there is sharp increase in tourist influx in Sahastradhara, Lachhiwala and relatively new tourist area Maldevta. The tourism has continuously affected the dynamics and phytodiversity of the picnic spots. For recording the flora of the study area, extensive field studies were conducted during the year 2014-2016. Usual methods of collection, preservation and maintenance of specimens in the Herbarium were followed (Jain & Rao, 1977). Several attempts were made for collection in different seasons. Plant specimens in flowering and fruiting stages were collected at regular intervals throughout the year. Field notes on vernacular names, habit, habitat, colour of flowers, flowering and fruiting time of each taxon were regularly recorded with the plant collection. The growth form, habit, and nature of the perennating buds of different plant species were recorded and classification was done as per the Raunkiaer (1934). The plant specimens (herbs, shrubs, trees and ferns) collected during field trips were identified with the help of regional floras and confirmed after matching these specimens with authentically identified specimens preserved in the



Herbaria of Forest Research Institute (DD) and Botanical Survey of India, Northern Circle (BSD), both at Dehra Dun. After identification, all the specimens were preserved and mounted on herbarium sheets and deposited in the Herbarium of Ecology Research Laboratory, Botany Department D.A.V. (P.G.) College Dehradun. The description of plants has been examined with the help of available literature (Gaur, 1999; Babu, 1977 and Duthie 1906).

The genera and species were arranged alphabetically while families are listed according to Bentham and Hooker's system. Each species is followed by a note about its vernacular name, habit,

period of flowering and fruiting and colour of flowers.

Results and Discussion

A total of 96 species belonging to 80 genera and 33 families have been recorded as alien plants of the study area. Among these, the dicots are represented by 78 species under 69 genera and 32 families (Table 1). A total of seven broad geographical regions are found contributing all the exotic species (Fig. 1). Tropical America alone made a contribution of 45% species followed by Tropical South America (22%). Minimum (3%) exotics are introduced from Australia (Fig. 2).

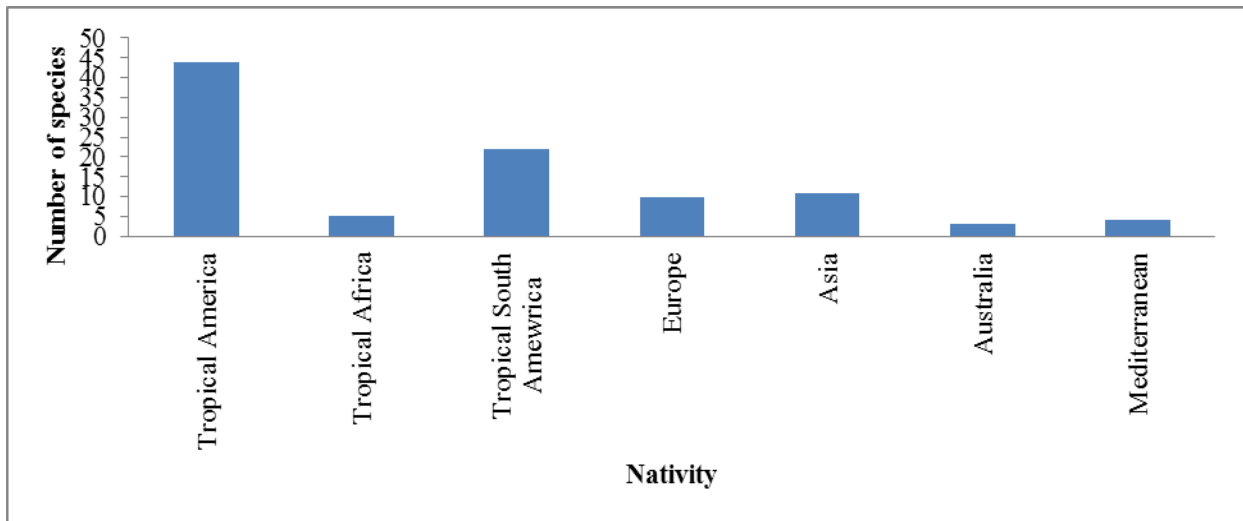


Fig. 1 : Status of Exotic Species in the Study Area

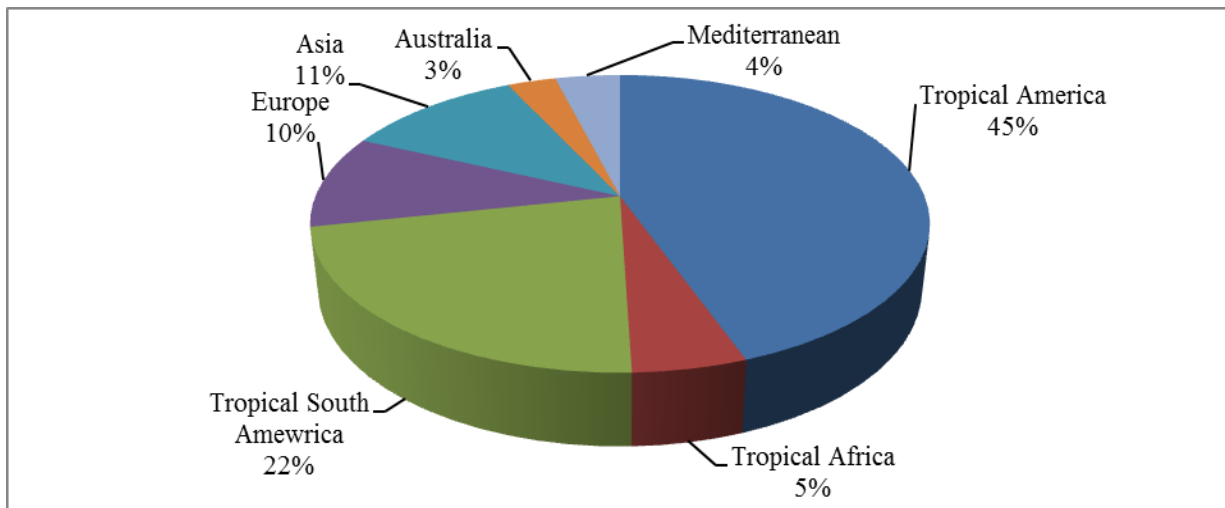


Fig. 2 : Percentage of Exotic Species



In view of habit, annuals contributed 70 species of herbs, shrubs (17 species) and trees (9 species). The important shrubs include *Opuntia stricta*, *Lantana camara*, *Ipomoea carnea*, *Ricinus communis* and *Solanum torvum*. Among the dominant families of the exotics Asteraceae occupied first place with 13 species followed by Euphorbiaceae (8 species), Solanaceae (6 species), Amaranthaceae (5 species) and Convolvulaceae and Caesalpiniaceae (05 species each). Some of the exotics have become the part of the diversity and governed by ecosystem rules. But few of the species like *Parthenium hysterophorous*, *Ageratum conyzoides*, *Chromolena odorata*, *Opuntia stricta* have become invasive. The vegetation structure and function respond to climate, topography, soil and biotic pressure. These factors are primarily responsible for local ad landscape level variation in vegetation thereby producing spatial heterogeneity (Timilsina *et al.* 2007). Heywood (1989) indicated a correlation between the global size of taxa at family level and number of exotic species within these taxa. Members of Asteraceae, Brassicaceae, Fabaceae represent most alien species in the world (Pysek, 1998). In the present study members of Asteraceae are mostly exotic followed by Euphorbiaceae. Fridley *et al.* (2007) have observed that a species introduced from tropical origin adapt well in tropical destination. In the present study most of the species belong to tropical America or tropical South America which confirms the above findings. The success of invasion lies in minimum demand of space, food, shelter, tolerance to harsh conditions and greater viability. Asteraceae is the dominant exotic and invasive family not only in the present study area but also in India (Rao and Murugan, 2006; Reddy, 2008). Singh *et al.* (2010) and Chandrashekhar *et al.* (2012, 2015) also recorded the dominance of Asteraceae in invasive alien flora of U.P., Uttarakhand and Himachal Pradesh. A positive correlation between human impact and exotic species richness was observed by Lonsdale (1999). This also indicate that the landuse intensity facilitates the exotics (Biswas *et al.*, 2007). Similar findings are observed in this study. Majority of the exotic alien species are tropical American in the present study. Reddy (2008) and Singh *et al.* (2010) have also recorded similar findings with reference to India and U.P. The invasion or introduction of exotic is a serious concern for native flora and ecology and it needs timely measures for their control. The dominance of invasive species can lead to change in community structure and the bio-geochemical cycling.

Table 1 : Exotic Plant Species from the Study Area

Name of the Species	Habit	Nativity
<i>Agave americana</i> L.	H	Tropical America
<i>Ageratum conyzoides</i> L.	H	Tropical America
<i>Amaranthus spinosus</i> L.	H	Tropical America
<i>Anagallis arvensis</i> L.	H	Europe
<i>Apium graveolens</i> L.	H	Europe
<i>Argemone mexicana</i> L.	H	South America
<i>Asclepias curassavica</i> L.	H	Tropical America
<i>Bidens biternata</i> (Lour.) Merrill & Sherff	H	Tropical America
<i>Bischofia javanica</i> Bl.	T	Indonesia



<i>Boerhavia erecta</i> L.	H	Tropical America
<i>Brassica campestris</i> L.	H	Mediterranean
<i>Brassica juncea</i> (L.) Czernajew & Cosson.	H	Continental Asia
<i>Broussonetia papyrifera</i> Ventenat	T	China/Japan
<i>Caesalpinia pulcherrima</i> (L.) Sw.	S	Brazil
<i>Calotropis gigantea</i> (L.) R.Br.	S	Tropical Africa
<i>Calotropis procera</i> (Willd.) Dryand.	S	Tropical Africa
<i>Cassia obtusifolia</i> L.	H	Tropical America
<i>Cassia occidentalis</i> L.	H	Tropical America
<i>Cassia tora</i> L.	H	Tropical South America
<i>Celosia argentea</i> L.	H	Tropical Africa
<i>Celtis australis</i> L.	T	Australia
<i>Centaurea cyanus</i> L.	H	Mediterranean
<i>Cestrum nocturnum</i> L.	S	West Indies
<i>Chenopodium album</i> L.	H	Europe
<i>Chenopodium ambrosioides</i> L.	H	Tropical America
<i>Cichorium intybus</i> L.	H	Europe
<i>Cleome viscosa</i> L.	H	Tropical America
<i>Conyza canadensis</i> (L.) Cronquist	H	Europe
<i>Convolvulus arvensis</i> L.	H	South America
<i>Corchorus aestuans</i> L.	H	Tropical America
<i>Coronopus didymus</i> (L.) J. Smith	H	South America
<i>Crotalaria pallida</i> Ait.	H	Tropical America
<i>Cuscuta reflexa</i> Roxb.	H	Mediterranean
<i>Cyperus difformis</i> L.	H	Mediterranean



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<i>Cyperus iria</i> L.	H	Tropical America
<i>Datura metel</i> L.	S	Tropical America
Name of the Species	Habit	Nativity
<i>Delonix regia</i> (Bojer ex Hook.)	T	Medagascar
<i>Desmodium tortuosum</i> (Sw.) DC.	H	Tropical America
<i>Echinochloa colona</i> (L.) Link	H	Tropical South America
<i>Emilia sonchifolia</i> (L.) DC.	H	Tropical America
<i>Erigeron karvinskianus</i> DC.	H	Central America
<i>Eucalyptus alva</i>	T	Australia
<i>Eupatorium adenophorum</i> Spreng.	H/US	Tropical America
<i>Euphorbia geniculata</i> Ortega	H	Tropical America
<i>Euphorbia heterophylla</i> L.	H	Tropical America
<i>Euphorbia hirta</i> L.	H	Tropical America
<i>Euphorbia prostrata</i> Aiton	H	Tropical America
<i>Euphorbia tirucali</i> Brandis	S	Kenya
<i>Evolvulus nummularius</i> (L.) L.	H	Mexico
<i>Galinsoga parviflora</i> Cav.	H	Tropical America
<i>Gnaphalium pensylvanicum</i> Willd.	H	Tropical America
<i>Gomphrena celosioides</i> Martius	H	South America
<i>Grevillea robusta</i> A.Cunn.	T	Australia
<i>Hyptis suaveolens</i> (L.) Poiteau	H	Tropical America
<i>Imperata cylindrica</i> (L.) P. Beauv.	H	Tropical America
<i>Indigofera linifolia</i> (L.f.) Retz.	H	Tropical South America
<i>Ipomoea carnea</i> (L.) Sweet	S	Tropical America
<i>Ipomoea eriocarpa</i>	H	Tropical Africa



<i>Ipomoea hederifolia</i> L.	H	Tropical America
<i>Jatropha curcas</i> L.	S	Tropical America
<i>Lagerstroemia floribvunda</i> Jack.	T	Malaysia
<i>Lantana camara</i> L.	S	Tropical America
<i>Lonicera japonica</i> Thumb.	S	China
<i>Lycopersicon esculentum</i> Miller	H	Tropical America
<i>Malvastrum coromandelianum</i> (L.)Garcke	H	Tropical America
<i>Melia azedarach</i> L.	T	Iran
<i>Mentha piperita</i> L.	H	Europe
<i>Mimosa pudica</i> L.	H	Brazil
<i>Mirabilis jalapa</i>	H	Peru
<i>Nerium oleander</i> L.	S	China
<i>Opuntia stricta</i>	S	Tropical America
<i>Oxalis corniculata</i> L.	H	Europe
<i>Oxalis corymbosa</i> DC	H	Tropical America
<i>Parthenium hysterophorus</i> L.	H	Tropical North America
Name of the Species	Habit	Nativity
<i>Passiflora foetida</i> L.	H	Tropical South America
<i>Peperomia pellucida</i> (L.) Kunth	H	Tropical South America
<i>Physalis minima</i> L.	H	Tropical America
<i>Physalis peruviana</i> L.	H	Peru
<i>Plumeria alba</i>	T	Tropical America
<i>Portulaca pilosa</i> L.	H	Tropical South America
<i>Ricinus communis</i> L.	S	South America
<i>Sida acuta</i> Burm. f.	H	Tropical America



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<i>Silene alba</i> (Mill.) Krause	H	Europe
<i>Solanum hispidum</i> Pers.	S	Peru
<i>Solanum nigrum</i> L.	H	Tropical America
<i>Solanum torvum</i> Swartz	S	West Indies
<i>Solanum viarum</i> Dunal	H	Tropical America
<i>Stellaria media</i> (L.) Villars	H	Europe
<i>Syndrella vialis</i> (Lees) A. Grey	H	Tropical South America
<i>Tegetes minuta</i>	H	South America
<i>Thevetia peruvaina</i> (Pess.) Schum.	S	Tropical America
<i>Tridax procumbens</i> L.	H	Tropical Central America
<i>Triumfetta rhomboidea</i> Jacq.	H	Tropical America
<i>Urena lobata</i> L.	S	Tropical Africa
<i>Xanthium strumarium</i> L.	H	Europe
<i>Youngia japonica</i> (L.) DC.	H	Tropical South America

Conclusion

Tourism has negative impact on the native flora. It not only accelerates soil erosion but also introduces opportunistic invasive species in the area that gradually replaces the native flora. In the present study, out of 276 species as many as 96 species were found exotic.

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