



RESEARCH PAPER

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A physico-social analysis of terrestrial invasive plants species in sub-tropical sub-humid tract of district Haripur

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Article published on November 08, 2017

Key words: *Parethenium hysterophorous*, *Broussonetia papyriera*, *Cannabis sativa*, Invasive, Quadrat

Abstract

Climate changes, landowner diversity, human socio-cultural, the biological and ecological characteristics of invasive plants and the nature of the communities they invade are the major drivers of plant invasion. This study aimed to investigate a physico social analysis of terrestrial invasive plants species in sub-tropical sub-humid tract of District Haripur and to identify and enlists non-native invasive plants in Haripur district. Study was carried out in district Haripur of KP Pakistan. First, abundance of occurrences of all major invasive plants was assessed to rank the top four invasive plants in the region. Secondly; collected data was statistically analyzed for top four invasive plants. Study revealed ranking and perceptions of these top four plant species across this area i.e. *Parethenium hysterophorous*, *Broussonetia papyriera*, *Cannabis sativa*, *Eucalyptus camaldulensis*. It has been concluded that pathways of plant invasion are versatile and current management efforts are not sufficient to limit this invasion coverage. Adoption of an integrated invasive management approach by combining all issues, specifically climate change, existing social and political issues related to land use and land ownership by amenity oriented lifestyles and introduction and expansion pathways of identified plant species is recommended.

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Introduction

Invasive plants species is not native to a specific location and has a tendency to spread aggressively outside its natural range to cause damage to the environment, human economy or human health (Robbins, 2004). Climate change, land ownership diversity, human socio-cultural and political attitudes, and biology and ecology of invasive plants have been identified as four of the major causes of the invasive plant problem (Robbins, 2004). Human mediated social and economic preparation of the landscape has also been attributed as another important reason for the invasion problem (Alderman, 2004). Sometimes, the natural enemies as 'biological control agents' might become invasive (Mc Neeley, 2011).

Furthermore, the culturally and politically laden recognition and definition of species as "exotic" or "invasive" has also been recognized as another major component of the species invasion problem. Some authors restrict 'environmental weeds' to refer to weeds of areas managed for conservation, while others describe 'environmental weeds' in both forms as native and semi-native ecosystems species including areas managed for conservation as well as areas managed for other uses (Swarbrick and Skarratt, 1994; Jackson, 2004). Much of the literature defines the term 'invasive' negatively, although in some instances 'invasive' are actually desirable or at least tolerable (Mack, 1996).

Invasive plants are ever-changing landscape processes, decreasing the agreeableness and productivity values of landscapes and threatening variety throughout the globe (Cook and Dias, 2006). 1% of the overall or 200-250 species are concerned in ninety fifth issues of our agricultural weed (Holm, 1978). Species or invaders of invasive plant create a substantial threat to species extinction and native biodiversity (Coutts-Smith *et al.*, 2006). Invasive plants have a wide variety of demographic characteristics and ecological and socio-cultural roles, and include herbs (such as annuals, biennials and perennials),

shrubs, trees, vines, ferns, gymnosperms and aquatic plants (Randall, 1997).

The most cost distinctive characteristics of invasive plant species include self-compatibility, seed longevity, rapid seedling growth, vigorous vegetative growth and competitive morphology such as a smothering growth form (Baker, 1965). Further attributes of successful invaders may include high dispersal ability by human and non-human vectors (such as tourists, migrants, animals and birds), flexible life history or use of resources, high population growth rate both sexually and asexually, short life cycle and high resource allocation to reproduction, at a young age grasp sexual maturity, produce lots of seeds or offspring have high genotypic and phenotypic plasticity, and engage in chemical competition by producing allopathic toxins (Bazaz, 1986).

Farmers and land managers around the world have been fighting the invasive plant problem on their properties and public lands for a long time. But these overwhelming problems were brought to the world's attention more than half a century ago (Elton, 1958). Conservationists and environmental managers should focus much more on environmental impact of species irrespective of the native/alien debate (Davis, 2011). This study has focused on investigative measures for reduction of invasive plants in sub-tropical sub-humid area of district Haripur. This study will also provide base line knowledge for future researchers. The major objectives of the present study were to identify and assess the spread of the invasive plant species of district Haripur.

Materials and methods

Area of the study

Area of the study was District Haripur and it is situated at a distance about 65 km i.e.40 miles approx. north from capital of Pakistan, Islamabad and about 35 km i.e.22 miles from south of Abbottabad. The altitude of district Haripur is 520 m (1,706 ft.), situated in a hilly plain area.

Ethno botanical approach, using indigenous knowledge of the local communities is also employed in study of invasive plants. For this purpose, survey methodology is be used to determine the extent of invasive plants. Survey area selected for investigation was around 20-25 km radius of Haripur city, in north up to Chachiya, in south up to Aloli, in East up to Lora chowk, in West up to Dingi tube well, during the survey residential and cultivated areas were analyzed.

Sample collection

Primary data were collected through personal observation in order to collect and identify Invasive Plant Specimens.

The field visits were organized in the areas allocated in district Haripur. The area was repeatedly visited for the collection of invasive species from March 2016 to May 2017 in order to achieve the objectives of the present study. During the field visit the invasive species in the selected sites were keenly observed with special focus on its spread, and ecological disturbance caused by them in the study area.

Table 1. Quantification of collected plants.

S. No.	Species	Aloli	Chachiya	DingiTubewell	Lora chowk
1	<i>Parthenium hysterophorous</i>	1492	1870	1914	1562
2	<i>Cannabis sativa</i>	1200	686	1078	1006
3	<i>Broussonetia papyrifera</i>	447	730	536	838
4	<i>Eucalyptus camaldulensis</i>	40	08	368	42

Parthenium hysterophorous had an impact on pastures and crops and aggressively colonizes disturbed sites. Because of this 40% agricultural yield loss has been observed in India. Especially 40% to 97% of yield *Sorghum bicolor* grain was loss in Ethiopia when *Parthenium hysterophorous* is left uncontrolled during whole season. The natural ecosystem has been upset as the fast growing *Broussonetia papyrifera* was introduced to non-native areas and this disrupts the native habitat, forest edges and canopy gaps.

Broussonetia papyrifera is an invasive species and is the most important source of pollen allergy in the

Methodology

Quadrat method was practiced for sampling the invasive species of the study area by using 10x10m, 3x3m and 1x1m size quadrates. To assess the distribution of invasive plants species the quadrates were used in fields of agricultural crops, wastelands and roadsides. Six locations of each union council were sampled with a distance interval of 1ha. Density, relative density, frequency and relative frequency were studied by using following formulas for determining the spread trend of each invasive plant species in the study area.

Results and discussion

Parthenium hysterophorous Cannabis sativa, Broussonetia papyrifera and *Eucalyptus camaldulensis* are four most abundant invasive species that were found in the study area. Characteristics of the most abundant invasive plants are as follows.

region which almost affected half of population i.e. 46 % of Islamabad and Azad Jammu & Kashmir.

Cannabis sativa is destroying natural vegetation in the area and disrupting wildlife. *Eucalyptus* has harmful effects on germination and seedling growth of wheat, barley, lentil, chickpea, mustard and many weeds.

Eucalyptus leaves are the main source of toxic compound.

Quantification of most abundant invasive species

These species were quantified from nominated locations using *quadrat* sampling.

Table 1 shows the quantification of plants from Aloi, Chachiya, Dingi Tubewell , Lora chowk.

Statistical analysis of most abundant invasive species

Statistical analysis was performed on these four abundant species by using different parameters that

are prevalence rate, absolute frequency, relative frequency, absolute density and relative density as shown in Table 2.

Table 2. Statistical analysis of most abundant invasive plants species.

Species	Prevalence (%)	Absolute Frequency AF (%)	Relative Frequency RF (%)	Absolute Density (AD)	Relative Density RD (%)
<i>Parthenium hysterophorous</i>	50.63	100.00	28.57	427.375	50.63
<i>Cannabis sativa</i>	29.39	93.75	26.79	248.125	29.39
<i>Broussonetia papyrifera</i>	18.89	81.25	23.21	159.4375	18.89
<i>Eucalyptus camaladensis</i>	1.10	75.00	21.43	9.25	1.10
Total	100.01	350.00	100.00	844.19	1023.26

One of the major global concerns, the reduction in biodiversity has sparked the need for a management system for the enhancement and safety of native species, communities and ecological processes. This will help establish biodiversity at property as well as landscape level. Invasive plants are affecting the cultural resources in the form non-native invasive “weeds” that are unsightly. A more worrying prospect is the growth of prohibited invasive species. This is why designed landscapes require constant maintenance including the removal of such unwanted plant species and ensuring the landscape’s value remains intact. Invasive plants are also harmful towards the yield in agricultural products which leads to loss in production within that particular vicinity and ultimately drainage of proper capital.

Conclusion

Current study concluded that there are more than twenty one species which are non-native out of which four are more abundant in District Haripur. Field study concluded that pathways of plant invasion are versatile and current management efforts are not sufficient to limit this invasion coverage. Adoption of an integrated invasive management approach by combining all issues, specifically climate change,

existing social and political issues related to land use and land ownership by amenity oriented lifestyles and introduction and expansion pathways of identified plant species is recommended.

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