Impact of Alien Invasive Plant Species on Crop fields and Forest areas of Hawalbag Block of Kumaun Himalaya—People’s perceptions

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Abstract: The present investigation was carried out in five villages of Hawalbag block of Almora district in the Kumaun Himalaya. The inhabitants of the area were found to be well aware about the alien invasive plant species and their negative impacts on crop fields, forest areas, grazing lands and even human health. Invasion and introduction of alien invasive plant species, such as Ageratum conyzoides, Bidens pilosa, Eupatorium adenophorum, Parthenium hysterophorus and Lantana camara was apparent for a period of more than two to three decades in the study area. Of these five major alien invasive species Ageratum conyzoides, Bidens pilosa and Parthenium hysterophorus widely impacted crops and vegetables of the rainy season on crop fields while Parthenium hysterophorus, Eupatorium adenophorum and Lantana camara decreased the productivity of valuable fodder grasses and herbs in the forest areas and even replaced these. The overall results observed during the investigation on alien invasive plant species were their wide impact on the socio-economic status and health of the inhabitants of the area. 94.11% of the inhabitants believed that the arrival and invasion of alien plants species was due to the changing climatic conditions while 70.58% said it was because of degradation of forests and another 52.98% held forest fires responsible for it. 88.12% of them reported that they applied preventive measures and practices by cutting and burning, while 11.88% mentioned that they used chemicals and pesticides, to get rid of these invasive species. The main purpose of this study was to document the perceptions of people on the basis of their knowledge about alien invasive plant species, their impact on crops, vegetables, fodder and the socio-economic status of the inhabitants of the area.

Key Words: Alien invasive species; climate change, people perception, Kumaun Himalaya

Introduction

The entire Himalaya is a repository of enormous floral and faunal diversity. Floral diversity plays an important role in fulfilling the daily needs of the inhabitants, like fuel, fodder, timber, agricultural implements, edible fruits and medicinal plants. However, now-a-days the native floral diversity has been affected by the invasion or introduction of alien invasive plant species due to changing climatic conditions. Climate change and invasive species present two of the greatest threats to biodiversity and the provision of valuable ecosystem services (Burgiel and Muir 2010). Climate change contributes to erratic rainfall, drying up of local springs and streams, adjustment of species distribution, phenology and morphology, shift in agriculture calendar, emergence of invasive species and outbreak of diseases and pests, etc (IPCC 2007). Alien invasive species which become established in natural or semi natural ecosystems or habitats serve as an agent of change, and threaten native biological diversity (IUCN 2000).

Invasive alien species threaten the environment, economies, and human welfare (Lodge et al. 2006). They reduce biodiversity, replace economically important plant species and increase the investment in agriculture and silviculture (Ricchardi et al. 2000), disrupt prevailing vegetation dynamics and alter nutrient cycling (Richardson 1998). They can promote fire and alter water and nutrient availability. They have a major impact on catchment hydrology; 30 to 70 per cent of lower water runoff is reported from watershed areas with dense stands of alien species (Geldenhuys 1986). Plant invasions dramatically affect the distribution, abundance and reproduction of many native species (Sala et al. 1999). Therefore, impacts of invasive alien species are immense, insidious and irreversible (Mcneely 2000). A total of 190 invasive alien species under 112 genera, belonging to 47 families have been recorded from the Indian Himalayan region with background information on family, habitat and nativity. Among these, the dicotyledon habitats are represented by 40 families, 95 genera and 170 species and the mono-cotyledon by 7 families, 17 genera and 20 species (Sekar 2012).

Materials and Methods

Almora district is between 79° 44’ 35” E longitudes and 29° 32’ 55” N latitudes. The total geographical
area of the district is around 3090 sq. km. The present study was conducted in 5 villages of Hawalbag block, of Almora district, to assess the impact of alien invasive plant species on both crop fields and forest areas. The information was gathered through the questionnaire method in the year 2015 (August-September). Personal interviews were also conducted with middle aged and older people to collect information from them about the introduction and listing of major alien invasive plant species, their establishment, spread and their impacts on crop fields and forest areas, their socio-economic impacts and the executed management measures. The information was gathered by the first author, with the help of a questionnaire after holding prolonged discussions about the alien invasive plants species during the household survey. After collecting the information the data were analyzed and compiled along with the available related literature and the report was then documented.

**Results and Discussion**

During the field investigation and household survey, it was found that the inhabitants of the area were well aware about alien invasive plant species and their negative impacts on crop fields, forest areas, grazing lands as well as human health (Table-1). According to the perceptions of the inhabitants both the crop fields and forest areas including grazing land were most vulnerable to the invasion of Ageratum conyzoides, Bidens pilosa, Eupatorium adenophorum, Parthenium hysterophorus and Lantana camara species. The majority of inhabitants (70.58%) responded about having observed the invasive species in their area for over two to three decades followed by 17.64% saying that they had seen these for one to two decades while (11.76%) reported about having observed these for less than a decade. Lantana camara (47.05%) Eupatorium adenophorum (41.17%) followed by (11.76%) Parthenium hysterophorus were abundantly seen in the area. The majority of responses (94.11%) reported climate change, (70.58%) forest degradation, (52.94%) forest fire, followed by (41.1%) over exploitation and (17.64%) grazing factors, being responsible for the introduction and spread of alien invasive plant species in the area. 100 % agriculture land, forest area and grazing land were being affected by invasive species. A majority inhabitants 88.12% applied cutting and burning practices followed by 11.88% who used chemicals and pesticides for removing alien invasive species from agricultural areas, forest areas and grazing lands respectively (Table-2).

**Result table-1: Showing the responses of peoples to open ended questions:**

<table>
<thead>
<tr>
<th>A-</th>
<th>What do you mean by alien invasive species?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
<td>Those very bad and dangerous/ destructive plant species (herbs and shrubs) or weeds which are replacing valuable crops and fodder grasses on both crop fields and forest areas including grazing lands. These have apparently spread on large areas of forests, agriculture and grazing lands for a period of two to three decades.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B-</th>
<th>Mention the name of major alien invasive plant species which got introduced and spread in your area over a period of two to three decades?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
<td>Eupatorium adenophorum (Kala bains); Parthenium hysterophorus (Gajar Ghas); Lantana camara (Kuri); Ageratum conyzoides (Gamluwa) and Bidens pilosa (Kumaria ghas).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C-</th>
<th>Are the alien invasive plant species harmful if yes, how?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response (i)</td>
<td>Yes, they kill the seedlings of the crops and vegetables and decrease their productivity; they also replace (by decreasing biomass and density) valuable fodder grasses from the forest areas and grazing lands through their invasion and introduction.</td>
</tr>
<tr>
<td>Response (ii)</td>
<td>Increase the possibility of asthma, breathing troubles followed by increasing allergenic problems through their flowers, spikelets and flower dust.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D-</th>
<th>Are these invasive species changing your socio-economy due to their arrival and introduction?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
<td>The production of crops and vegetables is badly decreasing and therefore, making as dependent on the market. The biomass of valuable fodder and grasses from forest areas and grazing lands is also getting reduced due to invasion of these dangerous weeds or invasive species which is raising the problems of livestock rearing. This is ultimately weakening our socio-economy.</td>
</tr>
</tbody>
</table>
E- What practices and measures are applied for management of alien invasive species?

> Response
> Cutting stalks of invasive species and piling them up for drying and then burning them up with the help of village based teams such as Mahila Mangal Dals, Navyuvak Mangal Dals and other societies of village. In some cases some chemicals and weedicides are also being used.

Result Table 2:- Showing the responses of village based (in %) questionnaire on alien invasive plant species

<table>
<thead>
<tr>
<th>A- Since when you have observed the invasive plant species in your area?</th>
<th>&lt;10 years</th>
<th>10-20 years</th>
<th>20-30 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response (in %)</td>
<td>11.76</td>
<td>17.64</td>
<td>70.58</td>
</tr>
</tbody>
</table>

B- Which invasive species is abundantly seen in your area?

<table>
<thead>
<tr>
<th>Response (in %)</th>
<th>Eupatorium adenophorum</th>
<th>Lantana camara</th>
<th>Parthenium hysterophorus</th>
</tr>
</thead>
<tbody>
<tr>
<td>41.17</td>
<td>47.05</td>
<td>11.76</td>
<td></td>
</tr>
</tbody>
</table>

C- Problem or harmful effect for health from invasive plant species.

<table>
<thead>
<tr>
<th>Response (in %)</th>
<th>Asthma &amp; breathing</th>
<th>Asthma &amp; Allergy</th>
<th>Chest pain &amp; Asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td>66.47</td>
<td>23.52</td>
<td>10.01</td>
<td></td>
</tr>
</tbody>
</table>

D- What are factor responsible for introduction and spared of invasive plant species?

<table>
<thead>
<tr>
<th>Response (in %)</th>
<th>Grazing</th>
<th>Forest Degradation</th>
<th>Climate change</th>
<th>Over exploitation</th>
<th>Forest fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.64</td>
<td>70.58</td>
<td>94.11</td>
<td>41.1</td>
<td>52.94</td>
<td></td>
</tr>
</tbody>
</table>

E- To what extent is the ecosystem affected and harmed by the alien invasive plant species?

<table>
<thead>
<tr>
<th>Response (in %)</th>
<th>Forest area</th>
<th>Agriculture land</th>
<th>Grazing land</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

F- What practices are utilized to remove the alien invasive plant species?

<table>
<thead>
<tr>
<th>Response (in %)</th>
<th>Cutting and Burning</th>
<th>Use of chemical and pesticides</th>
</tr>
</thead>
<tbody>
<tr>
<td>88.12</td>
<td></td>
<td>11.88</td>
</tr>
</tbody>
</table>

Conclusion

According to people’s perceptions, the result reveals that the alien invasive plant species have been causing the loss of plant diversity in both crop and forest areas over the last two to three decades. The native plant diversity was more vulnerable due to the invasion of Parthenium hysterophorus, Eupatorium adenophorum and Lantana camara followed by Ageratum conyzoides, Bidens pilosa. Moreover, the habitat degradation and changing pattern of valuable crop and fodder plants (especially herbs and grasses) has been observed for the last two to three decades in the area. Eupatorium adenophorum, Parthenium hysterophorus and Lantana camara were found spreading in large areas of under forest and grazing lands while Ageratum conyzoides, Bidens pilosa and Parthenium hysterophorus were the worst weeds in the crop fields. Therefore, the inhabitants of the area have been facing the problem of low productivity of crops and livestock development. These major alien invasive species have also affected human health as well as the socio-economic of the inhabitants. There is an immediate need to take-up management measures for the prevention and control of these weeds, because the important agro and forest biodiversity may face extinction in near future, due to these weeds, if they are allowed to grow uncontrolled.

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References


