Maintaining stream beaches

Streamside plants and alien plants

Gravel stream beaches are widely found along the middle reaches of Japanese streams, which are generally steep. Gravel stream beaches are severe places for most plant species to grow due to strong solar radiation and high temperatures, but there are plants that have adapted to such a severe environment, e.g., Artemisia capillaris, Aster kantoensis, Lactuca tamagawaensis. These plants, called "stream beach plants", grow in a relatively scattered fashion over the gravel stream beaches and constitute ecosystems specific to gravel stream beaches.

However, stream beach plants are declining and many species are even in danger of extinction. One of the principal causes of this decline is alien plants. Among plants introduced from abroad, there are many species that grow vigorously in gravel stream beaches, and these plants increasingly occupy stream beaches, taking over the habitats of native stream beach plants.

In order to conserve stream beach plants and ecologically sound stream beach vegetation, the effects of selective removal of alien plants from stream beach vegetation must be evaluated. As a fundamental study, we conducted a selective removal experiment at the Aqua Restoration Research Center.

Methods

The experiment was conducted at the center's Riverside Plant Protection Research Zone. Twenty square quadrats (2m x 2m) each were established in the zone, over which, on March 15, 2000, Potentilla chinensis, Artemisia capillaris, Dianthus superbus, Galium verum, and Anaphalis yedoensis seeds were sown. The seeds had been collected in the previous year on stream beaches near the center along the Kiso River. In 10 of the twenty quadrats, all alien plants were removed once a month from April to August 2000 (removal quadrats) (Figure 1). The other 10 quadrats were left intact and used as the control (Figure 1). Almost no new alien plants were observed during and after September.

Alien plants become dominant unless they are selectively removed.

From April to August 2000, 21 species of alien plants grew in these quadrats, including: Dodia tenuis, Eragrostis curvula, Cornusocida, and Dianthus superbus. In October 2000, vegetation in the removal quadrats was divided into grids of 20 cm intervals, plant species that grew at the intersections were recorded, and the number was totaled for each plant species. The selective removal caused a clear difference in species composition. In the control quadrats, Dodia tenuis, an alien plant, dominated (Figure 3). On the other hand, in the removal quadrats, Artemisia capillaris was relatively abundant, although Diodia tenuis was most dominant (Figure 3).

Alien plants are a major cause of the decline in native plants inhabiting stream beaches.

We investigated the effect of experimental selective removal of alien species from stream beach vegetation on the number and growth of native species. The results of the experiment showed that alien plants became dominant without the selective removal, and that native plants, such as Artemisia capillaris and Galium verum, recovered just by removing the nearby alien plants. These results suggest that the selective removal of alien plants is an effective method to conserve native vegetation.

Table 1

<table>
<thead>
<tr>
<th>Species</th>
<th>Treatment</th>
<th>Number of samples</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
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<tbody>
<tr>
<td>Artemisia capillaris</td>
<td>Removal</td>
<td>10</td>
<td>90.6</td>
<td>26</td>
<td>210</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>10</td>
<td>40.3</td>
<td>4</td>
<td>108</td>
</tr>
<tr>
<td>Potentilla chinensis</td>
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<td>0.8</td>
<td>0</td>
<td>3</td>
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<td>Control</td>
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<td>0.2</td>
<td>0</td>
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<tr>
<td>Galium verum</td>
<td>Removal</td>
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<td>14.3</td>
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<td>6</td>
</tr>
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<td></td>
<td>Control</td>
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<td>3.6</td>
<td>0</td>
<td>24</td>
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<tr>
<td>Dianthus superbus</td>
<td>Removal</td>
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<td>0.4</td>
<td>0</td>
<td>2</td>
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<tr>
<td></td>
<td>Control</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 1

Quadrat arrangement in the experimental zone

- 2m
- 2m
- 2m
- 2m

Figure 2

Mean number of plants in a quadrat and standard deviation

- Coverage by plants (%)
- Plant height (cm)

Figure 3

Number of plants

- Native species
- Alien species

Figure 4

Size of Artemisia capillaris

- Removal quadrats
- Control quadrats

Figure 5

Number of stream beach plants per quadrat

- Species
- Treatment
- Number of samples
- Mean
- Minimum
- Maximum

- | Species             | Treatment | Number of samples | Mean  | Minimum | Maximum |
- |---------------------|-----------|-------------------|-------|---------|---------|
- | Artemisia capillaris| Removal   | 10                | 90.6  | 26      | 210     |
- |                     | Control   | 10                | 40.3  | 4       | 108     |
- | Potentilla chinensis| Removal   | 10                | 0.8   | 0       | 3       |
- |                     | Control   | 10                | 0.2   | 0       | 6       |
- | Galium verum        | Removal   | 10                | 14.3  | 0       | 6       |
- |                     | Control   | 10                | 3.6   | 0       | 24      |
- | Dianthus superbus   | Removal   | 10                | 0.4   | 0       | 2       |
- |                     | Control   | 10                | 0     | 0       | 0       |

Table 1