

Streamside plants and alien plants

Native and alien plants in stream beach ecosystems

The photograph above is of *Dianthus superbus*. The photographs on the front page are of: *Carex thunbergii* (whole), *Potentilla chinensis* (top right), and *Commelina communis* (bottom left). (Photographed by Jun Miyazaki)



Native plants

Native plants such as *Potentilla chinensis*, *Artemisia capillaris*, *Dianthus superbus*, *Galium verum*, and *Anaphalis yedoensis* grow on stream beaches.



Artemisia capillaris



Galium verum



Potentilla chinensis

Alien plants

Various species have been brought from foreign countries and their distributions have expanded as a result of greening projects and the urbanization of streamside areas. There are many species that can grow well even in sandy and gravelly stream beaches.



Coreopsis lanceolata



Eragrostis curvula



Diodia teres



Removal quadrats
all alien plants are removed once a month



Control quadrats
no alien plants are removed



Removal quadrats

Quadrats
2m x 2m square sections established at the Riverside Plant Protection Research Zone
Alien plants were removed once a month from 10 quadrats out of 20. The remaining quadrats were left intact (i.e. control quadrats).

Controlling alien plants is the key to restoring the stream beach vegetation

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 on stream beach vegetations 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 (native stream beach plants) were uniformly 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: *Diodia teres*, *Eragrostis curvula*, *Coreopsis lanceolata*, and *Oenothera biennis*. In October 2000, vegetation in the removal quadrats was significantly taller and sparser than in the control quadrats (Figure 2, t-tests, P<0.05). This should be mainly attributable to the difference in species composition of the vegetation. In order to investigate the abundance of each species, the quadrats were 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, *Diodia teres*, an alien plant, dominated (Figure 3). On the other hand, in the removal quadrats, *Artemisia capillaris* was relatively abundant, although *Digitaria ciliaris* was most dominant (Figure 3).