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.

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Diodia teres, which dominated in the control quadrats, is a short plant (10 to 30 cm high), and yet it inhibited the growth of the stream beach plants, since it densely covers the ground.

Alien plants reduced the number and size of stream beach plants.

In the autumn of the year in which the seeds were sewn (October 20), four species of stream beach plants were identified: *Artemisia capillaris*, *Potentialla chinensis*, *Galium verum*, and *Dianthus superbus*. For all these species, the mean number in a quadrat was significantly larger in the removal quadrats than in the control (Table 1, t-test $P<0.05$).

The effect of removing alien plants was also observed in the size of the stream beach plants. The sizes of *Artemisia capillaris* were analyzed using D^2H as an index (D is the diameter of the stem near the ground surface, H is the plant height, and D^2H is correlated with the dry weight of the plant). The analysis showed that the plants in the removal quadrats were twice as large as the plants in the control quadrats (Figure 4).

In the removal quadrats, 21% of *Artemisia capillaris* in the quadrats flowered, while only 8% flowered in the control quadrats. This suggests that alien plants possibly inhibit the population growth of stream beach plants.

Removal of alien plants as an approach to protect streamside environments

This study suggested that 1) alien plants may become dominant on gravel stream beaches unless they are removed, and 2) selective removal of alien plants from areas where seeds of stream beach plants exist may restore the original stream beach vegetation. The results of this study suggest that removal of alien plants is an effective measure in the protection of natural streamside environment.

Larger-scale experiments will be conducted to investigate methods of removing alien plants that can be used in stream management.

Column

In the middle reaches of the Kinugawa River, an invasive alien grass *Eragrostis curvula* has flourished as sand has accumulated on gravely stream beaches, and native plant species inhabiting gravely sand beaches, such as *Aster kantoensis*, are rapidly dwindling. As part of conservation efforts, *Eragrostis curvula* vegetation that had established on the stream beaches of the Kinugawa River was removed using heavy machines, the fine sand on stream beaches was removed by water jets to restore the gravely stream beaches, and the seeds of *Aster kantoensis*, which were collected from remnant populations, were sown to conserve the species.

■ Quadrat arrangement in the experimental zone

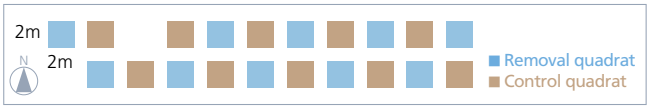
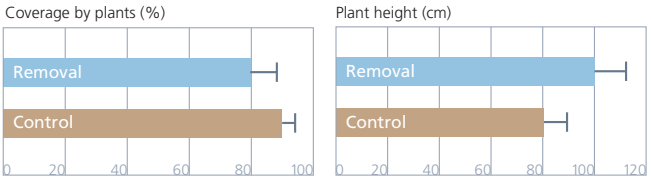


Figure 1

■ Mean number of plants in a quadrat and standard deviation



※The coverage and plant height were determined in October 2000. Figure 2

■ Number per species determined using the intersection method
(data on 10 quadrats of southern side of the experimental zone are shown)

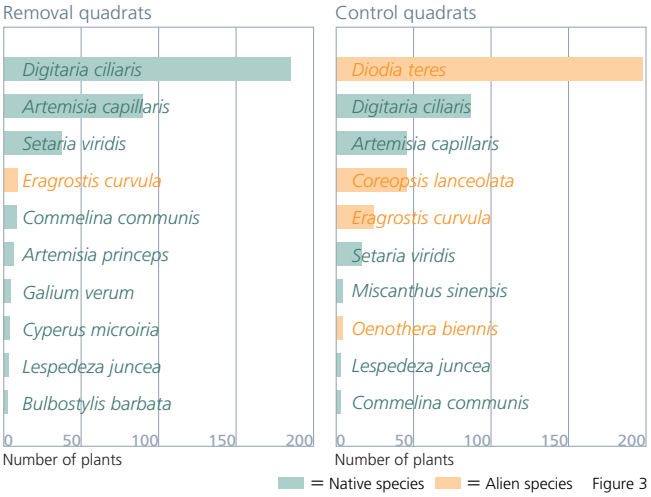


Figure 3

■ Size of Artemisia capillaris

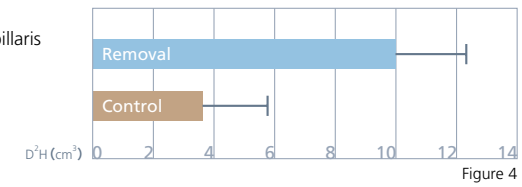


Figure 4

■ Number of stream beach plants per quadrat

Species	Treatment	Number of quadrats	Mean	Minimum	Maximum
Artemisia capillaris	Removal	10	90.6	26	210
	Control	10	40.3	4	108
Potentialla chinensis	Removal	10	0.8	0	3
	Control	10	0.2	0	3
Galium verum	Removal	10	14.3	0	68
	Control	10	3.6	0	24
Dianthus superbus	Removal	10	0.4	0	2
	Control	10	0	0	0

Table 1