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From prized beauty to outlaw

The tale of Japanese knotweed



Several species of knotweed have become invasive pests.

Schedule nine of the UK Wildlife and Countryside Act, covers the list of 'plants that may not be planted or otherwise caused to grow in the wild,' with fines of up to £5000 and/or 2 years imprisonment; but why should such a draconian act be needed?

When the Act was introduced in 1981, only giant hogweed, giant kelp, Japanese knotweed and Japanese seaweed were on the list of restricted 'invasive' species. In 1992 nine more joined the club, followed by a further thirteen in 2005 and thirty-seven in 2010. Among the latest additions are two species of rhododendron, the Virginia creeper and the entire *Elodea* genus (the pondweed commonly used in school lab experiments). So, what's wrong with these plants?

According to 2015 estimates, there are currently 2000 non-native species established in Great Britain, and 10-12 new species are added every year. While most of the established alien species cause no disturbance, around 10% of them have a severe negative impact on the local ecosystem; we call these 'invasive'.

Although their number is very small, the damage invasive species causes can be considerable and their cost to the British economy is currently estimated at £1.7 billion per year. In the absence of the herbivores and parasites which keep them in check in their countries of origin, invasive non-native plants outcompete their native counterparts for space, light, nutrients and pollinators, and ultimately cause a loss of biodiversity. However their effects can be even more devastating than this.



Japanese knotweed in flower



The stem of a Japanese knotweed

Key words

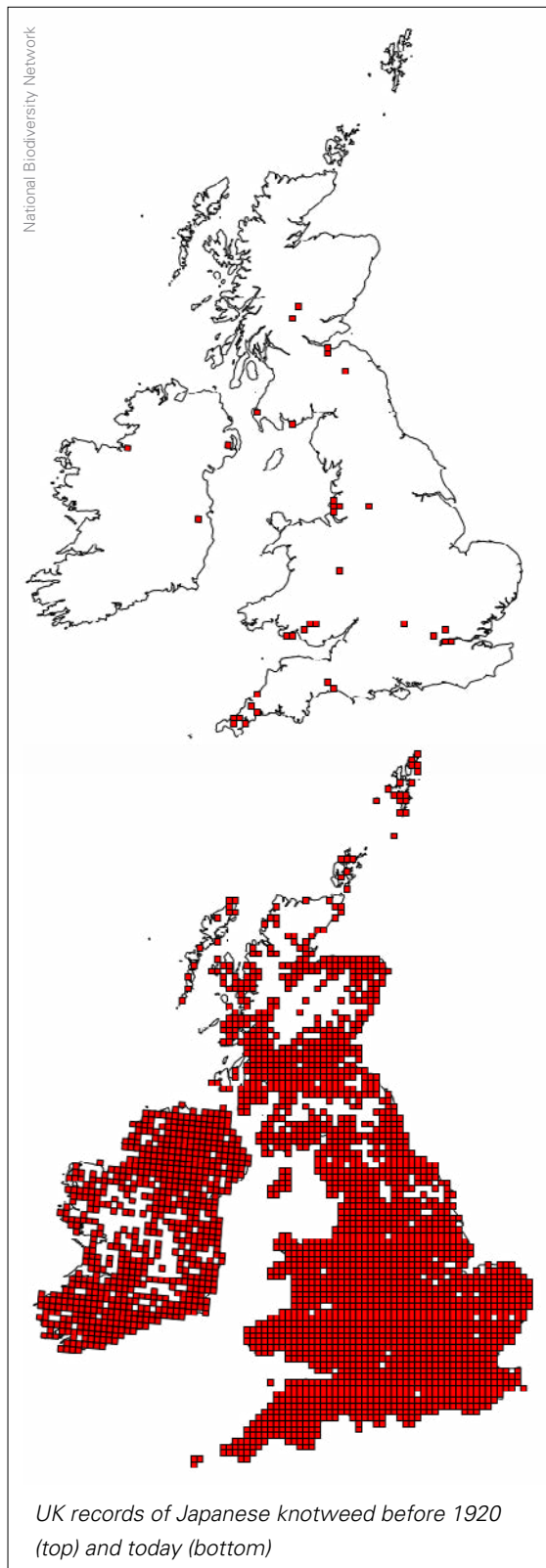
plants
invasive species
biocontrol
pathogen

The knotweed menace

From gold medal winner at the 1847 show of the Society of Agriculture and Horticulture in Utrecht to outlaw bandit in just over one century, Japanese knotweed's story is not uncommon among invasive plants. Many were imported as ornamental beauties and later escaped into the wild. It was very soon after its introduction that Victorian gardeners realised that *Fallopia japonica* (Japanese knotweed) was 'easier to plant than to get rid of' and that it should be treated with caution.

Japanese knotweed is listed by the World Conservation Union (IUCN) as one of the world's 100 worst invasive species and its total annual cost to the British economy is around £166 million. October 2014 legislation states that failing to prevent Japanese knotweed from spreading to a neighbour's property can result in a community protection notice, on-the-spot fines of £100 or prosecution with fines of £2500 and even imprisonment.

Knotweed is an early coloniser of volcanic soils in its native Japan. It can tolerate extreme temperatures and harsh conditions. In winter it dies back to its roots, but in spring it forms vigorous shoots that can grow through tarmac and concrete at a speed of one metre per month. It eventually forms large stands up to 3-4 m in height, which shades out other plants, ultimately ending up as a Japanese knotweed monoculture. Some building societies have even refused to grant a mortgage to knotweed-infested properties. Its dead canes – which take up to three years to decompose – can clog up flood drains and the extensive system of rhizomes (underground stems) burrows into riverbanks, creating flood risks.



Work in progress to eradicate the alien and invasive Japanese knotweed in Dundonald, Northern Ireland

One good piece of news is that all the *Fallopia japonica* plants in the UK are females – clones of the infamous Victorian specimen – so the plant can only propagate vegetatively. Unfortunately, a piece of rhizome as small as a fingernail can regenerate a whole new plant. It can only be disposed of with a special licence. Homeowners can attempt to repeatedly cut the plant above ground until the rhizomes' energy reserves are exhausted, but this will take years. Or they can call specialised companies which will extensively excavate and treat the soil chemically or by sifting. Stem injection with herbicides is also possible.

Biological control of knotweed

What turns a regular member of the plant community of one country into an indomitable pest in another? Fundamentally, the absence of its natural predators, competitors and pathogens. Strategies for their control can therefore include locating natural enemies. In the case of knotweed, scientists at CABI (Centre for Agriculture and Biosciences International) in Surrey, in collaboration with their Japanese counterparts, scanned through more than 200 natural enemies of the plant in Japan. From this, two promising candidates to bring Japanese knotweed under control in the UK have been identified.

In 2010 the insect *Aphalara itadori* was released into the wild (a first in Europe for the releasing of a biological control agent against an invasive plant). This will be monitored until 2016 to ensure that it doesn't affect any other organism than Japanese knotweed. If the experiment is successful, larger scale releases will follow.

The second candidate for the role of 'biocontrol agent' against Japanese knotweed, is the leaf-spot fungus *Mycosphaerella polygoni-cuspidati*. Further studies on this are underway, but first signs are very promising.



Leaf spot fungus, *Mycosphaerella polygoni-cuspidati*, on knotweed leaves

Climate change and invasive plants



Floating pennywort in a stream in southern England

It is quite likely that climate change will favour the establishment of invasive species. Scientists testing the responses of Japanese knotweed and British native plants to different patterns of fertiliser application found that the knotweed did better than the natives when the application of fertiliser was erratic. As climate change will increase variability of resources and will put native plants under stress, invasive plants might become an even bigger problem.

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Other invasive plants in the UK

Plant	Problem
Giant hogweed <i>Heracleum mantegazzianum</i>	The furanocoumarins in the plant's sap cause damage to DNA which make the affected skin sensitive to sunlight, an effect that can last for years.
Himalayan balsam <i>Impatiens glandulifera</i>	The soil on which these species grow becomes depleted of the fungi on which native species are highly dependent. It can produce up to 800 seeds per plant, which shoot out of the pods up to 7 m away.
Common rhododendron <i>Rhododendron ponticum</i>	Rhododendron will out-compete most native plants. It grows to many times the height of a person, allowing very little light to penetrate through its thick leaf canopy, eliminating native plant species. This leads to the consequent loss of the associated native animals.
New Zealand pigmyweed <i>Crassula helmsii</i>	Forms dense mats and can impede drainage, causing flooding. Displaces other aquatic plant species and reduces amenity use of the waterbody.
Floating pennywort <i>Hydrocotyle ranunculoides</i>	Grows up to 20cm per day and can regenerate from tiny fragments. Arrived as an ornamental plant in the late 1980s, it is now one of the worst invasive aquatic plants.
Water fern <i>Azolla filiculoides</i>	Forms floating mats up to 30 cm thick which can double in size every 4-5 days.