Asian knotweed

(*Reynoutria* sp.)

Managing Japanese knotweed at the confluence of the Luye and Durance Rivers

Development board for the Durance River basin (SMAVD)

■ The SMAVD, a public river-basin territorial agency created in 1976, now groups 78 towns along the Durance River, the Vaucluse, Bouches-du-Rhône, Alpes-de-Haute-Provence and Hautes-Alpes departmental councils, and the regional council. The SMAVD was made responsible for managing the public fluvial domain along the Durance in 1982 and the board is active essentially in the fields of flood management, improved safety, sediment transport, the preservation and management of the natural heritage and management of the various uses of the domain.

■ The work to preserve and manage the natural heritage consists of maintaining and enhancing the riparian vegetation, creating wetlands, protecting remarkable natural areas, scientific monitoring of natural areas and creating fish passes (alone or in conjunction with EDF, the national electricity company), etc. Since 2006, the SMAVD has managed the Durance Natura 2000 site.

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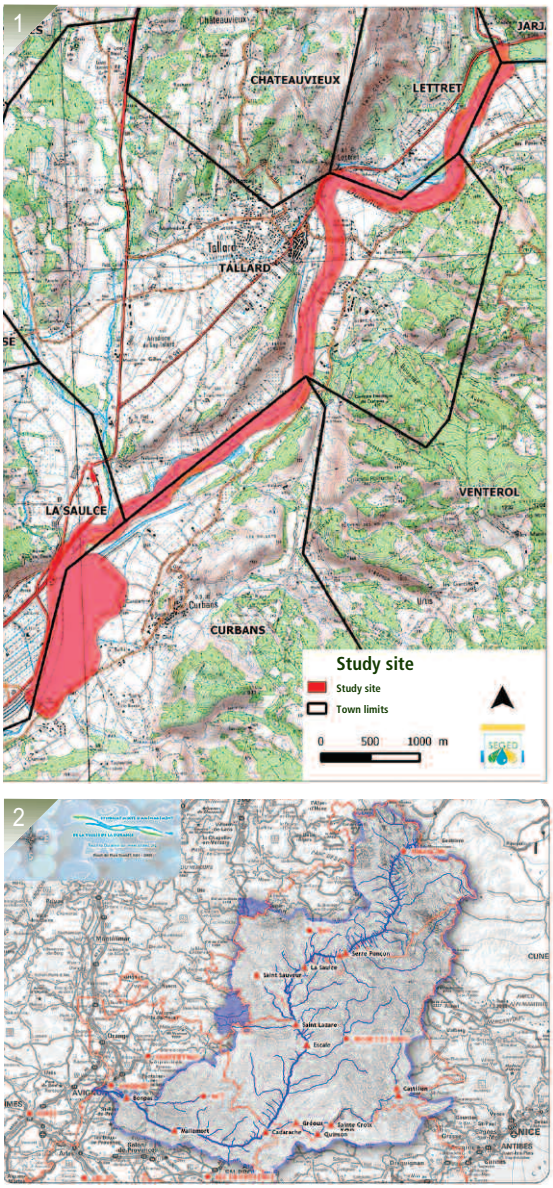
Intervention site

■ The Durance originates at the Montgenèvre mountain pass and flows into the Rhône 305 kilometres downstream. The river basin covers a surface area of approximately 14 280 square kilometres (about half of the entire Provence-Alpes-Côte-d'Azur region) and at least part of six departments in the region, plus a small section of the Drôme department.

■ Since 2004, the Durance, at the point where it is joined by the Luye River, has been heavily colonised by Japanese knotweed that was introduced in the area around the town of Gap. Floods along the Luye spread the knotweed to the confluence with the Durance. The hydrological regime of the Durance slowed the colonisation process of the knotweed, but the higher regime and the releases of large amounts of water since 2008 caused bank erosion in certain sectors that had been colonised by knotweed. As a result, the species was disseminated over a distance of approximately five kilometres downstream of the confluence with the Luye.

■ The intervention zone is located in the towns of Curbans and Venterol in the Alpes-de-Haute-Provence department and in the towns of Saulce, Tallard, Lettret and Jarjayes in the Hautes-Alpes department. EU-listed habitats exist within the intervention zone, including stands of grey alder and white willows. These habitats are home to a large number of EU-listed species, e.g. the black kite and the Eurasian beaver. A large number of invasive alien species (IASs) have also been observed, e.g. giant goldenrod, Kashmir balsam, box elder, Virginia creeper, pale galingale, ailanthus and summer lilac.



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1.2. Intervention sites.

Disturbances and issues involved

■ Impact on native plants and on habitats

■ In some places, other species can be eliminated by Japanese knotweed through competition and a reduction of sunlight. Large stands of knotweed reduce the diversity of habitats. The plant can snuff out the regeneration of other riparian vegetation. The habitat and its functions for other species are degraded.

■ Impact on the landscape and on human activities

■ The plants produce a more uniform landscape and make access to and circulation on river banks more difficult.

Interventions

■ Management campaign in 2011

■ An initial management campaign against knotweed was carried out in 2011. Following a map-based assessment by EDF in 2010, the priority efforts to eradicate the plants were launched in the stands most heavily eroded by the floods and along the flow channels enabling the dispersal of the plants in the riparian vegetation. In April 2011, mechanical extraction techniques were employed, followed by grinding and tarping of the soil. Barriers were installed to block access to the riparian vegetation. A total of 2 075 cubic metres of material were removed and treated.

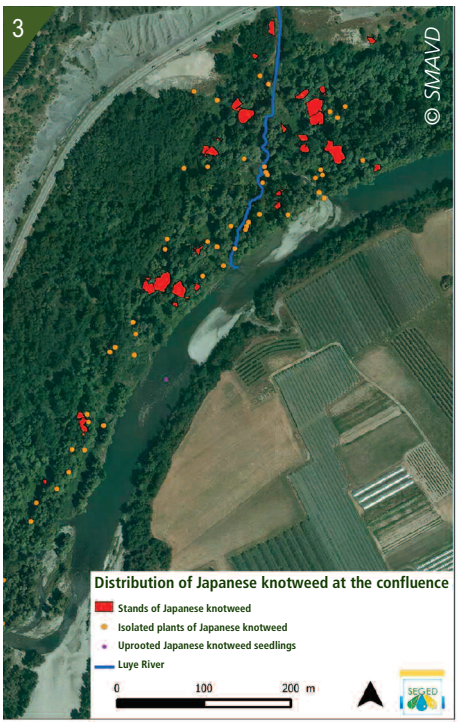
■ In 2012, seedlings were manually uprooted along side channels containing water in the sector from the confluence to the Saulce dam. In 2013, the hydrological conditions during the spring did not allow for a second manual campaign. In 2014, a few knotweed plants were observed outside the tarped areas and along the access trails in spite of the precautions taken by the companies involved.

■ Survey in 2014

■ The survey was carried out by two ecologists over a total of nine days during the months of April, May and June 2014. The technique consisted of walking along the foot of each bank and on the sand bars in the middle of the river, throughout the entire study area. Knotweed points (individual plants) and stands were located using a GPS device. Recorded information included the diameter and average height of the stalks, as well as the type of colonised environment. Stakes were placed around knotweed stands to locate them again more easily. A total of 28 stands as well as 59 points were staked out.

■ Along the Luye, numerous stands of knotweed upstream of the surveyed area represented a risk of contamination and caused a high concentration of Japanese knotweed at the point of confluence between the Luye and the Durance. Knotweed densities dropped with the distance downstream from the confluence. The observed plants furthest downstream were located six kilometres from the confluence.

■ In comparison with the surveys run in 2011, the overall number of points had decreased, notably on the right bank of the Luye, but new points had appeared along the upstream section of the river. Renewed growth was observed in several areas, notably the downstream section of the Durance where a point not observed in 2011 was also noted.



3. Distribution of Japanese knotweed on the study site in 2014.
4. Japanese knotweed in the riparian vegetation.

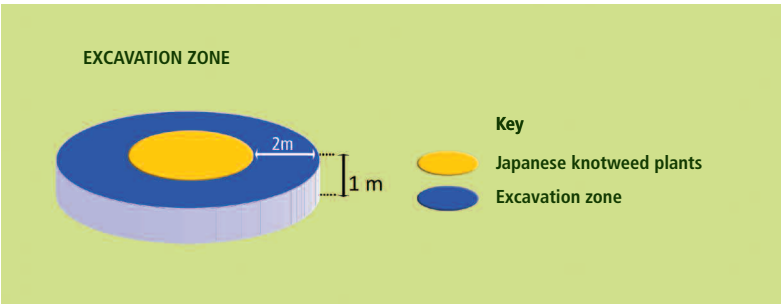
■ Mechanical removal, manual removal and felling of trees

■ The results of the first eradication campaign were encouraging and it was decided to launch a second phase of work in the area following the survey in 2014. Several technical approaches were studied:

- mechanical removal (excavation) of the plants;
- mechanical combined with manual removal;
- mechanical combined with manual removal and targeted felling of trees in the removal zone;
- targeted removal of the plants;
- no intervention.

■ After comparing the various techniques, mechanical and manual removal with targeted felling of trees in the removal zone was selected. Mechanical removal consists of digging up the soil in a circle running two metres beyond the last stalks and to a depth of one metre.

Diagram showing the extent of mechanical removal.



■ Prior to starting the work, cleaning areas for the machines had to be established to avoid any risk of disseminating IASs (invasive alien species). The type of machine used depends on the available access, e.g. a tracked excavator, a tractor with a trailer, a front-end loader, a dumper, etc.

■ The presence of knotweed in the immediate vicinity of trees in the riparian vegetation hindered mechanical removal and made it necessary to cut the trees on certain sites, however the numbers cut were limited to a strict minimum in order to avoid creating clearings (sunlight). Selective cutting was done within one metre around the outermost stalks of the stand mixed in with the trees. Trees along ditches and at distances greater than one metre around the outermost stalks of the stand were kept wherever possible. In the work areas, the plants were removed as carefully as possible mechanically and manually to uproot a maximum amount of rhizomes without damaging the trees, using shovels, pickaxes and a mechanised wheelbarrow to load and move the waste.

■ This technique diminished the impacts on the riparian vegetation by limiting both the number of trees cut and the risks of colonisation by other IASs through excessive opening of the environment due to the cutting of trees and the creation of tracks. Prior to cutting trees, an ecologist checked them for cavities conducive to bats and artificial nesting spots were created. The overall figures for the project were the following:

- mechanical removal was used for 28 stands and 39 plants;
- manual removal was used for 20 plants;
- the total volume of soil removed was previously estimated at 3 363 cubic metres.

5. Rhizomes waiting to be ground up.
6. Storage area.

Number of Japanese knotweed plants/stands in the study area and estimated volume of soil removed.

	Mechanical removal						Manual removal					
	Left bank of the Luye			Right bank of the Luye			Left bank of the Luye			Right bank of the Luye		
	Number	Surface area (m^2)	Volume removed (m^3)	Number	Surface area (m^2)	Volume removed (m^3)	Number	Surface area (m^2)	Volume removed (m^3)	Number	Surface area (m^2)	Volume removed (m^3)
Stands												
Isolated plants		125.6	125.6		364.24	364.24		125.6	125.6		364.24	364.24
Total		1 430.6	1 430.6		1 913.24	1 913.24		1 430.6	1 430.6		1 913.24	1 913.24

■ Waste management and treatment of the contaminated soil

■ The soil was treated using the “grinding-tarping” technique. The soil was ground using a stone grinder to fragment the rhizomes and damage the fine roots:

- the dried soil was spread in a layer ten centimetres thick;
- it was ground in one direction, then a second time in the perpendicular direction and finally stored in piles 1.2 metres high;
- the machines were systematically cleaned before leaving the site.

■ The soil was then covered for several months with opaque tarps that were not waterproof in order to block photosynthesis, but enable the rhizomes to rot:

- a double layer of tarp was placed over the soil;
- the edges of the tarps were extended a full metre in all directions;
- various materials were placed on the tarps to keep them in place;
- a fence was put up to keep large animals from damaging the tarps.

■ Two storage areas, 3 047 and 3 900 square metres in size, were created, the first on the left bank and the second on the right bank of the Luye. At the end of the work, a control group of rhizomes was laid out on each storage site to monitor the rotting process. Each group comprised five rhizomes with two nodes and five with one node, buried ten centimetres under the ground and tarped soil.

■ Planting willows

■ In addition to the work described above, willow cuttings were planted in order to:

- restore the native plant communities (white willows);
- create a cover for the bared surfaces to limit the risks of them being colonised by invasive species;
- compete with the knotweed in the worked areas, particularly where any residual rhizomes remained.

■ The cuttings must be planted in the spring or fall, before freezing temperatures, in densities of four to five cuttings per square metre. Purple willow, almond willow, bitter willow and white willow are the recommended species for cuttings.

■ Work schedule

■ July-August 2015

Preparation of the work sites, installation of the storage areas, clearing of access trails, cutting of trees and checks on hollow trees.

■ September 2015

Mechanical and manual removal of the plants, grinding of the soil, grinding of tree trunks.

■ October 2015

Placing the tarps on the soil, securing the sites, removal of the site installations and execution of the inspection plan.

■ April 2016

First passage over the worked areas (manual uprooting of seedlings) and planting of the willow cuttings, inspection of the storage areas.

■ October 2016

Second passage over the worked areas.

■ April 2017

Third passage and checks on the growth of the willows.

Results and costs

■ Technical results of the work

■ A total of 39 stands and 59 isolated plants were treated over a surface area of almost 4 000 square metres (three additional stands were discovered and treated during the work). The volume of removed material was close to 4 000 cubic metres. One hundred trees were cut. The work techniques adopted made it possible to avoid cutting 210 trees on the work sites.

■ It was finally decided not to plant willow cuttings on certain sites because some excavated areas were of more ecological value as a string of ponds. A number of large excavated areas were partially planted with willow cuttings to create shade for those areas. The access tracks were restored and replanted. The fence was checked and all cables were tightened. The tarps were checked to ensure that they were still correctly positioned.

■ In April 2016, a check was run on the excavated areas, on the soil contaminated by the knotweed, on the tracks and on the other sectors affected by the work:

- on the left and right banks of the Luye, a few rhizomes were collected in the bottom of the excavated areas. A larger number of sprouts were found among the vegetation developing on the vertical banks of the excavated areas. They continued well beyond the two metres around the knotweed stands marked with stakes. The plants and rhizomes were completely uprooted. On the tracks, five rhizome fragments were collected;
- all 12 isolated points along the Durance were inspected. A few rhizome fragments were collected and burned.

■ Two stages of vegetation development were observed. First, a number of very young plants sprouting from small fragments of rhizome rootlets, and secondly, a more advanced stage of plants with stalks 20 to 40 cm high, sprouting from rhizomes cut during the excavation work. Given the differences between the two stages, prolonged monitoring of the sites was considered necessary. All the sites were inspected again in June 2016. A volume of plants equivalent to 15 bags containing 80 litres each (1.2 cubic metres) was removed, primarily from the sides of the excavated holes and from the root system of the trees.

■ Financial aspects

■ The work was carried out in the framework of the Val de Durance river contract. The total cost was 138 000 euros including VAT.

■ Source of funding: Rhône-Méditerranée-Corse water agency (30%), Provence-Alpes-Côte-d'Azur region (30%), SMAVD internal funding (40%).

7. Storage area.
8 and 10. Excavated ponds
9. Recreated ponds.
11 et 12.Knotweed shoots sprouting from rhizomes in the soil. June 2016.

Budget. More detailed information on costs on request.

Work	Total cost ex. VAT (euros)
Preparatory work	21 796
Earthwork and grinding	54 137
Tarping, seeding and planting	19 451
Management and treatment of any waste discovered during the work	3 305
Monitoring and passage for uprooting	3 920
Inspections	2 450
Fence and storage area	9 470
TOTAL	114 799

Outlook

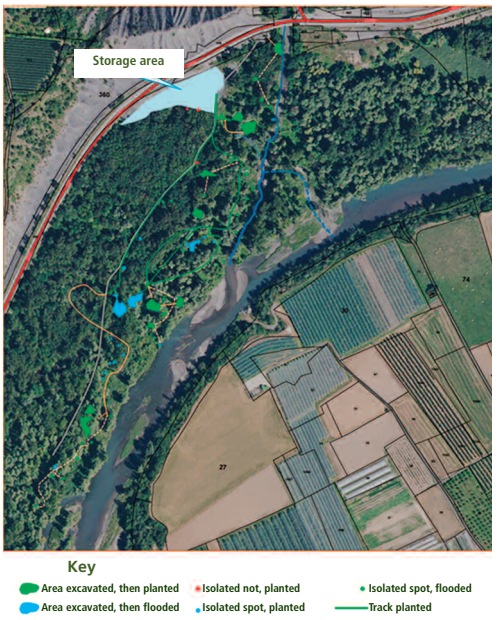
■ Following a new assessment, the new sprouts will be treated in 2017. The storage areas will be restored to their original condition in 2018.

Information on the project

■ Articles in the local press covered the two eradication campaigns. Local elected officials visited the site in February 2016.

Authors: Emmanuelle Sarat (IUCN French committee), Laure Moreau and François Boca (SMAVD). February 2017.

13 **Inspection plan for the planted zones and tracks Right bank of the Luye**



13. Inspection plan for the planted zones on the right bank of the Luye.

For more information

■ SMAVD internet site: http://www.smavd.org/
■ SMAVD. 2015. Éradication de la Renouée du Japon à la confluence Luye/Durance. Rapport de fin de chantier 2015. 7 pp.
■ SEGED-SMAVD. 2015. Éradication de la Renouée du Japon à la confluence Luye/Durance : dossier de projet. 89 pp

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