



Alligator weed

(*Alternanthera philoxeroides*)

Experiments on management techniques for alligator weed along the Ouvèze River (Vaucluse department)

National botanical conservatory in Porquerolles (CBNMed)

■ This agency, awarded public status in 1990, works under the auspices of the Port-Cros national park. Its duties cover nine departments in the southern section of the PACA region and the eastern section of the Occitanie region.

■ The main missions include:

- gaining knowledge on wild plants and Mediterranean vegetation (inventories, counting populations of threatened species, organising local networks, etc.);
- conserving rare and threatened species (*in situ* and *ex situ* conservation, management of plant invasive alien species (IAS));
- science-advice work for State services and local governments (examining requests for waivers to eliminate protected species, support work for the State and local governments, etc.).

■ Contact: Cyril Cottaz, IAS policy officer - c.cottaz@cbnmed.fr

Intervention site

■ Alligator weed was first noted in July 2013 by the Aquascop engineering firm in the centre of the town of Sorgues (Vaucluse department), on the right bank of the Ouvèze River that originates in the Drôme department and is a tributary to the Rhône River. In 2015, the weed covered an area spanning 300 linear metres (over 1 000 square metres).

■ The site belongs to the town of Sorgues and is managed by the Ouvèze Provençale board (SMOP). It lies next to a walking path along the river used by numerous walkers throughout the year.

Disturbances and issues involved

■ *Alternanthera philoxeroides* is listed as a regulated species of Union concern (European regulation 1143/2014). In the PACA region, according to the regional IAS policy, it is considered an “emerging” threat, i.e. a priority species requiring rapid action to avoid its widespread dispersal.



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1, 2. The site of the alligator weed on the right bank of the Ouvèze River.

■ The species can form dense, single-species beds that severely affect native species and modify the landscape.

■ The location of the site, only three kilometres upstream of the confluence with the Rhône, represented a serious risk of dispersal to the Rhône.

Interventions

■ Following the discovery of the plants, a status report was prepared by CBNMed and students from the University of Aix-Marseille, followed by a letter alerting the Prefect of the Vaucluse department to the situation at the end of 2014.

■ In September 2015, a meeting was held to discuss various intervention scenarios and to train the local operators on identifying the plant. Participants in the meeting included the Rhône-Méditerranée-Corse Water Agency, the Pays de Rhône et Ouvèze intermunicipal board (CCPRO), the town of Sorgues, the Vaucluse departmental council, the PACA Nature Conservatory (CEN PACA), the Vaucluse Departmental Territorial Directorate (DDT 84), the PACA Environmental Directorate (DREAL PACA), the Vaucluse Fishing Federation and SMOP.

■ In 2016, a request for funding from the State was made and a protocol was drafted for an experiment on a technique to eradicate the species. According to the available literature, manual uprooting of the aquatic and terrestrial stalks is one of the most effective methods. This technique was therefore tested in 2016 on three sets of ten plots (1 square metre each) under three different conditions:

- one uprooting per year, in the summer;
- two uprootings per year, in the summer and fall;
- a single uprooting in the summer and installation of an opaque tarp (comprising several layers of black plastic), fifty metres long and secured to the ground with large, metal staples.

■ First, a fishing net was set from the middle of the river to the bank, a few metres downstream of the uprooted area, to avoid dispersal of plant fragments.

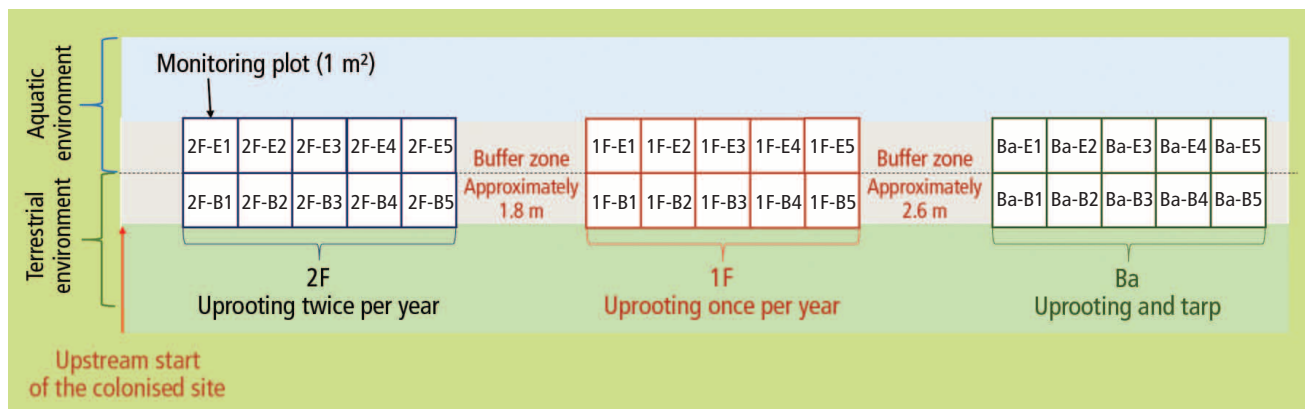


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3, 4. Uprooting work done by the volunteer students.



Layout of the monitoring plots according to the different test conditions.

■ The stalks that were underwater on the intervention dates were manually uprooted by volunteers working in the water, using waders. On the river bank, in addition to manual uprooting, part of the underground rhizome system was removed using a pickaxe, to a depth of 10 to 20 centimetres.

■ A monitoring protocol was established for the test areas, including phytocological and mesological surveys carried out prior to each uprooting operation.

■ The green waste produced by the uprooting was removed for incineration, taking care to avoid the loss of any fragments.

■ In 2017, the tarp used in 2016 was deemed too thin because light filtered through. In addition, sprouts were observed around the staples used to secure the tarp. In 2018, a more opaque tarp was used.

■ In the fall of 2017, the CBNMed used kayaks to monitor the banks upstream and downstream of the colonised area, but no other colonised sites were discovered along the Ouvèze River. Monitoring in 2018 produced the same results, i.e. no new colonised sites.

■ Of interest is the fact that another site colonised by *Alternanthera philoxeroides* was discovered on the Petit Rhône, in the town of Saintes-Maries-de-la-Mer in the Bouches-du-Rhône department, i.e. 110 kilometres downstream from Sorgues. The plants were immediately uprooted by the CBNMed in an effort to rapidly eradicate the colony. In January 2019, the site was monitored in conjunction with the Camargue regional nature park and a 450 square metre colonised zone was found. Management work is now in the planning stage.

Results and costs

■ Results

■ No significant differences were observed between one uprooting per year and two per year. Uprooting was relatively effective the first year with the colonised surface areas dropping from respectively 55% and 65% of the total monitored area to less than 20% in September 2017. However, a limited increase in the colonised surface areas was subsequently observed in July 2018.

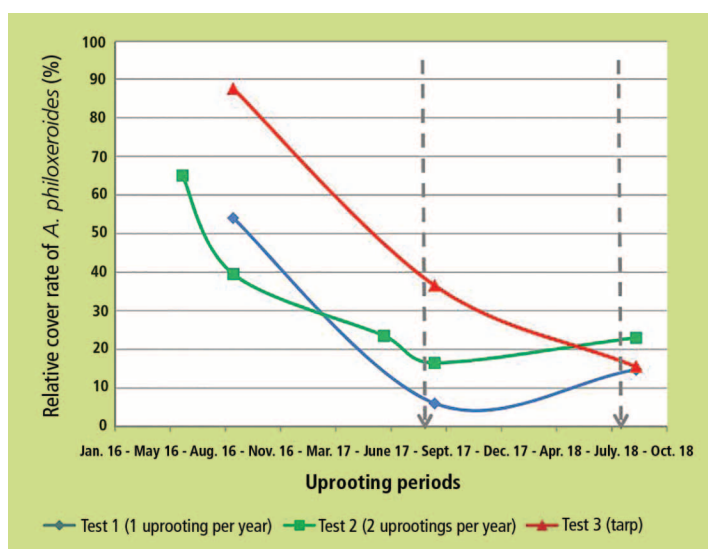
■ It should be noted that clearing work, using a brush cutter, took place on the site prior to the monitoring visits in 2017 and 2018, due to communication errors between the municipal services in charge of maintaining the river banks. These incidents complicated the assessment of the surface areas covered by the alligator weed, however the actual impact was probably limited due to the low-lying nature of the plant.

■ In these areas, the growth of new vegetation was highly variable, depending on the topology and the hydrographics (above the water line or below). Taxonomic diversity varied only slightly, however species with high cover rates, e.g. water finger grass (*Paspalum distichum*, another IAS) and *Carex riparia* (a native species), dominated in areas where they had not been abundant previously. Other invasive alien species were observed following the interventions, namely *Xanthium orientale subsp. italicum* and *Ludwigia peploides subsp. montevidensis*.

■ In the tarped area, the surface area covered by the species dropped continuously, from 87% in 2016 (surface area prior to uprooting) to 37% in September 2017 (when the tarp was changed) and to 16% in 2018. The remaining plants had wilted and were in the process of dying. It should be noted that the tarp led to the virtual disappearance of all vegetative components of the species present, both native and alien, and resulted in bare soil.



5. Installing the tarp.



Cover rates of *A. philoxeroides* depending on the three intervention modes.

■ Costs

■ The total cost of the work done over the years 2016 to 2018 amounted to approximately 10 000 €. That included all travel, the purchase of equipment and the payroll costs of CBNMed, the project coordinator. The project was made possible by financial aid by the French State (80%) and in-house financing by CBNMed (20%).

■ A number of organisations were involved to various degrees in the project, including the Rhône-Méditerranée-Corse Water Agency, CEN PACA, ANSES, the town of Sorgues, Compagnie Nationale du Rhône, Pays de Rhône et d'Ouvèze intermunicipal board, Vaucluse Departmental Council, Vaucluse Departmental Territorial Directorate, AFB PACA-Corse interregional office, PACA Environmental Directorate, Vaucluse Fishing Federation, PACA region, Camargue Regional Nature Park, Ouvèze Provençale board, Intermunicipal board to protect the banks of the Eygues, Sorgues basin board, Camargue Gardoise board, RMB Bucchi company, Les amis des marais du Vigueirat environmental-protection group.

■ A large part of the uprooting work was done by volunteer students from the “Managing natural environments and fauna” programme at the La Ricarde agricultural high school in Isle-sur-Sorgue (representing over the three years a total of 68 students who each contributed 2.5 days of work). They were accompanied by volunteers from CEN PACA, AFB, Vaucluse Fishing Federation and CBNMed.

Salient project figures.

Date	Opérations	Time invested (man-days)	Linear distance (metres)	Volume removed (cubic metres)
June 2016	Inventory	2	-	-
	Uprooting	3	9	0.9
September 2016	Inventory/Training	3	-	-
	Uprooting/Tarping	20	22	3.15
June 2017	Inventory	1	-	-
	Uprooting	1	9	0.15
September 2017	Inventory/Training	6	-	-
	Uprooting	25	9	1.02
	Inspections by kayak	2	-	-
June 2018	Submerged plots, uprooting planned but not done	2	-	-
September 2018	Inventory/Training	3	-	-
	Uprooting	23	9	0.48
	Inspections by kayak	2	-	-

Information on the project

■ Information on the work was provided via:

- communication documents (warning alert, species fact sheet, etc.);
- CBNMed Facebook site (<https://www.facebook.com/CBNMediterranean>);
- class work by the students at the La Ricarde agricultural high school;
- a one-day training session in May 2016, organised by CBNMed and Onema (now OFB), to inform the river technicians on the problem. Approximately 30 per-



sons from different organisations attended the training programme that addressed the following points:

- invasive alien plants;
- the regulatory context in both France and Europe;
- the regional strategy in the PACA region;
- management techniques for a few aquatic and river-bank species;
- alligator weed, its habitats, the context in PACA, how to recognise the plant, the experimental project on manual uprooting.

Outlook

- The results observed in 2018 were subsequently confirmed and the tarp was definitively removed in 2020. No new sprouts were observed.
- Uprooting followed by tarping would appear to be the best solution. After removing the tarp, it would be necessary to replant the banks with native plants (using the local Végétal brand of plants, for example). Annual inspections will be necessary to check that the alligator weed does not recolonise the area. In areas with stone banking, manual uprooting is difficult and it is often not possible to fully remove the plant, particularly the roots. This aspect must be taken into account for future operations in order to ensure the complete eradication of the plants. Similarly, the presence on the site of *Paspalum dilatatum* and *Ludwigia peploides*, two species that can spread rapidly, should be taken into account in the strategy for the work.
- In 2019 and 2020, CBNMed undertook new inspections on the Ouvèze and the Rhône Rivers. Alligator weed had spread widely between Sorgues (Ouvèze) and Avignon (Rhône). In 2019, a multi-year provisional budget to manage the species was drawn up by CBNMed and presented to site managers and local stakeholders. For the Ouvèze River, the budget represented almost 240 000 euros. Currently, the Ouvèze manager cannot initiate management of the species and no work has yet been undertaken. In September 2020, CBNMed trained stakeholders along the Rhône on the identification and management of the species. Initial work on manual uprooting, with support from the national agencies (Vaucluse DDT and PACA DREAL) was undertaken on the downstream section of the Rhône, near Avignon, by the Compagnie nationale du Rhône (CNR), the French Biodiversity Agency, the Avignon Urban Board, the Camargue Regional Nature Park (a Natura 2000 site) and CBNMed.
- The participation of the Ouvèze and Rhône managers in managing alligator weed is highly necessary and urgent. Over the past three years, the species has spread rapidly. CBNMed can help site managers by providing updated observation data of the species and providing scientific and technical support for their management work.

Authors: Cyril Cottaz, CBNMed, Éléonore Terrin, CBNMed and Doriane Blottière, for the IAS Resource Centre. March 2019. Editor: French Biodiversity Agency

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6 - Training session on how to identify alligator weed.

7 - Part of the fact sheet used to identify the species.

For more information...

- BNMed Porquerolles, 2018. *Alternanthera philoxeroides*. Plant invasive alien species. (In French) http://www.invmed.fr/src/listes/fiche_taxon.php?cd_ref=81831
- Cottaz C., Paquier T. and Diadema K., 2018. Alligator weed, *Alternanthera philoxeroides*. An experiment in managing an emergent IAS in the PACA region, on the Ouvèze River (Sorgues, 84). CBNMed, 47 pp. (In French) <http://www.fcbn.fr/vegetal-local-vraies-messicoles>
- CBNMed resource centre, see the file on alligator weed. <http://www.cbnmed.fr/src/ress.php>
- Fried G, Magoga E. and Terrin E., 2016. Alligator weed. A topic requiring attention. The work group on biological invasions in aquatic environments. (In French) <http://especies-exotiquesenvahissantes.fr/lherbe-a-alligator/>