Water primrose

***(Ludwigia* spp.)**

Experiment on restoring wet meadows colonised by water primrose in the Isac marshes (Loire-Atlantique department)

Development agency for the Vilaine River basin (IAV)

■ The agency is a public entity founded in 1970 by the Ille-et-Vilaine, Morbihan and Loire-Atlantique departments.
■ This interdepartmental organisation was awarded the status of a public river-basin territorial agency in 2007 (EPTB Vilaine). It is active in the hydrographic basin of the Vilaine River which covers over 10 000 square kilometres and comprises approximately 12 600 kilometres of watercourses.
■ The main objectives of the agency are to prevent floods, manage the production of drinking water with the Arzal dam and implement the policy of the Vilaine SBMP (targeting water quality and quantity). The agency also manages the Marais de Vilaine Natura 2000 site.
■ The work presented here was carried out in the framework of the European Interreg IVa cross-Channel WOW "WOrking Wetlands" programme.
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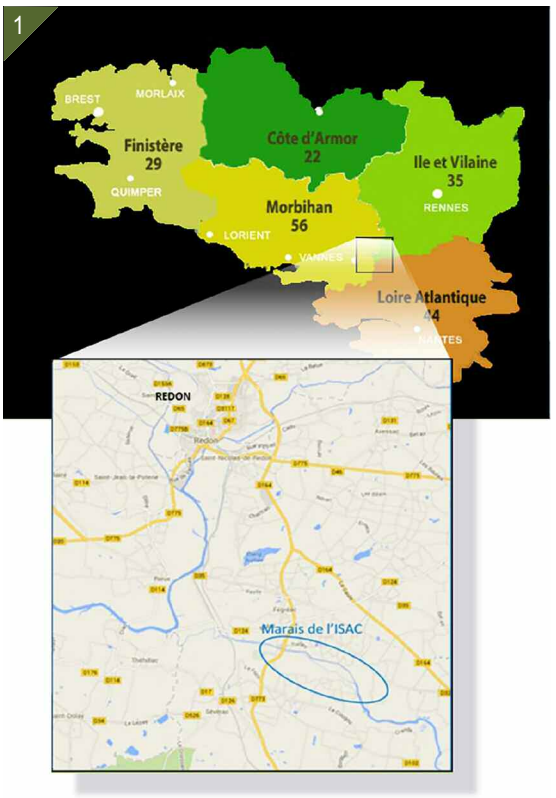
Intervention site

■ The site covers approximately 600 hectares and is located in the Isac marshes in the Loire-Atlantique department (44), approximately 12 kilometres to the SE of the town of Redon, between the villages of Fégréac, Sévérac and Guenrouet, and within the Marais de Vilaine Natura 2000 site (10 000 hectares).
■ The soil is loamy (former marine mud flats) with a high clay content. Pockets of peat may also be found. The average elevation lies between 1.9 and 2.1 metres A.S.L.
■ A network of ditches evacuates the water to the Isac River. The water level is managed by a system of gates at the meeting point with the Vilaine River. In the winter (December to February), the water level is maintained at 2.4 metres A.S.L., whereas in the summer, water is pumped to maintain the level at 1.8 metres A.S.L. to facilitate the farm work (primarily late hay making).



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1. The Isac marshes in western France.

Disturbances and issues involved

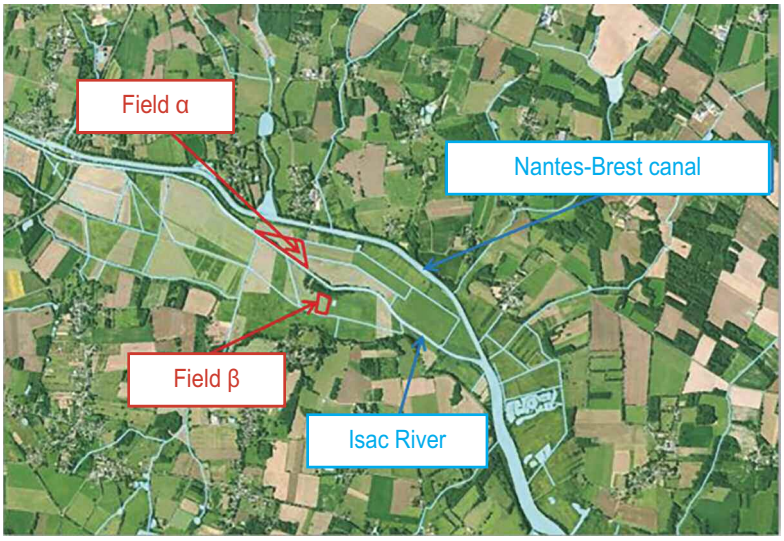
■ Large-flower water primrose (*Ludwigia grandiflora subsp. hexapetala)* observed in the hydraulic network also extensively colonised meadows, to the detriment of the native flora.
■ Its expansion negatively impacts floristic diversity and farming activities. For farmers, there are three major consequences, namely the drop in forage value, the requirement that they withdraw the colonised areas from those receiving CAP subsidies and their exclusion from the benefits of agri-environment-climate measures.
■ In addition, the presence of the invasive species creates difficulties in managing water levels for pike. To encourage the growth of native species rather than water primrose, water levels are lowered early in the spring, a period during which juvenile pike need stable water levels.

Interventions

■ The objective was to test different soil-management techniques using very common farming equipment to remove water primrose while restoring native species.

■ The experiments took place in two fields (see the map below), namely field α in 2013 and field β in 2014, in order to avoid any bias in the results from one year to the next. The particular area was selected because colonisation by water primrose was fairly homogeneous throughout that area and the farmer agreed to use his fields for the experiment.

■ In 2013 and 2014, two control zones were created, one without any work (no mowing or tillage) and the second with only mowing (no tillage).



Map showing the location of the experimental plots.
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■ Interventions in 2013

■ Several types of tillage in conjunction with sowing of native plants were tested in order to restore the grass cover.

■ The work was done on strips of land approximately 25 metres long and 3 metres wide (the width of the tillage tools).

■ Two different types of experiment were carried out on field α:

- stripping of approximately 10 cm of topsoil with the aerial parts of the plants and the roots with any substrate, followed by different types of tillage (meadow harrow (MH) or vibrocultivator (VIB)) and sowing;
- mowing followed by tillage (vibrocultivator) and sowing of different plants.

■ Two different types of plants were sown, reed canary grass (*Phalaris arundinacea* (PA)) and tall fescue (*Festuca arundinacea* (FA)), and marsh hay with a high content of great manna grass (*Glyceria maxima* (GM)) was spread. These species were selected because they were deemed suitable for the wetlands in question.

■ The vibrocultivator turns over and mixes the soil to a depth of 15 to 20 cm. It loosens, dries and mixes the soil, thus reactivating the grain bank and resulting in better germination. The meadow harrow treats only the very superficial layer of soil, to a depth of approximately 5 cm.

■ The vibrocultivator was used only once and always lengthwise.

2. The experimental zone prior to the work.
3. The zone after removal of the topsoil.
4. The vibrocultivator in action.
5. 6. The zone just after the work.

■ The work took place during the first two weeks of July and represented a total of approximately 50 hours of work (not including preparation, plus preliminary and subsequent monitoring).

Table 1. Tested operations in 2013.

Code	Operation 1	Operation 2	Operation 3
STRIP	STRIPPING	X	X
STRIP	STRIPPING	X	X
STRIP-MH	STRIPPING	MEADOW HARROW	X
STRIP-MH-PA	STRIPPING	MEADOW HARROW	SOW PA
STRIP-MH-FA	STRIPPING	MEADOW HARROW	SOW FA
STRIP-MH-GM	STRIPPING	MEADOW HARROW	GM
STRIP-VIB-GM	STRIPPING	VIBROCULTIVATOR	GM
STRIP-VIB-FA	STRIPPING	VIBROCULTIVATOR	SOW FA
STRIP-VIB-PA	STRIPPING	VIBROCULTIVATOR	SOW PA
STRIP-VIB	STRIPPING	VIBROCULTIVATOR	X
VIB	MOWING	VIBROCULTIVATOR	X
VIB-GM	MOWING	VIBROCULTIVATOR	GM
VIB-PA	MOWING	VIBROCULTIVATOR	SOW PA
VIB-FA	MOWING	VIBROCULTIVATOR	SOW FA
MOW CONTROL	MOWING	X	X
CONTROL	X	X	X

■ Interventions in 2014

■ The work was done on experimental plots measuring 4x4 metres with tillage tools 3 metres wide.

■ The vibrocultivator appeared to have produced good results in 2013 and was tested again in 2014 under different conditions.

■ A soil aerator, called an actisol, was also available and was tested. It uses blades to aerate the superficial horizon and to stimulate the biological activity of the soil. The blades may be tilted more or less to increase or decrease their penetration in the soil.

■ In 2013, the vibrocultivator was used strictly lengthwise in the fields, but in 2014 it was also used cross-wise because that seemed to have more impact on the water primrose.

■ The difference between a single passage during the summer and five passages, once per week over five weeks, was also tested.

■ The work started on 22 July, somewhat later than in 2013 due to the weather conditions. Approximately 20 hours were spent on preparation (organisation, installing posts) and 25 hours on the actual work (mowing, tillage, etc.).

7. Monitoring the results in October 2013.
8. The actisol soil aerator.
9. Renewed growth of water primrose in May 2014 in the area treated in 2013.
10. Renewed growth of water primrose in July 2015 in the area treated in 2014.

Table 2. Tested operations in 2014.

Code	Operation 1	Tool	Operation 2	Operation 3 (number of passages)
VIB-1pass-Length	MOWING	VIBROCULTIVATOR	Passage lengthwise	1
VIB-1pass-Cross	MOWING	VIBROCULTIVATOR	Criss-crossing	1
VIB-5pass-Length	MOWING	VIBROCULTIVATOR	Passage lengthwise	5
VIB-5pass-Cross	MOWING	VIBROCULTIVATOR	Criss-crossing	5
ACTI-1pass-0deg	MOWING	ACTISOL	Min. blade angle	1
ACTI-1pass-Xdeg	MOWING	ACTISOL	Max. blade angle	1
ACTI-5pass-0deg	MOWING	ACTISOL	Min. blade angle	5
ACTI-5pass-Xdeg	MOWING	ACTISOL	Max. blade angle	5
MOW CONTROL	MOWING	X	X	X
CONTROL	X	X	X	X

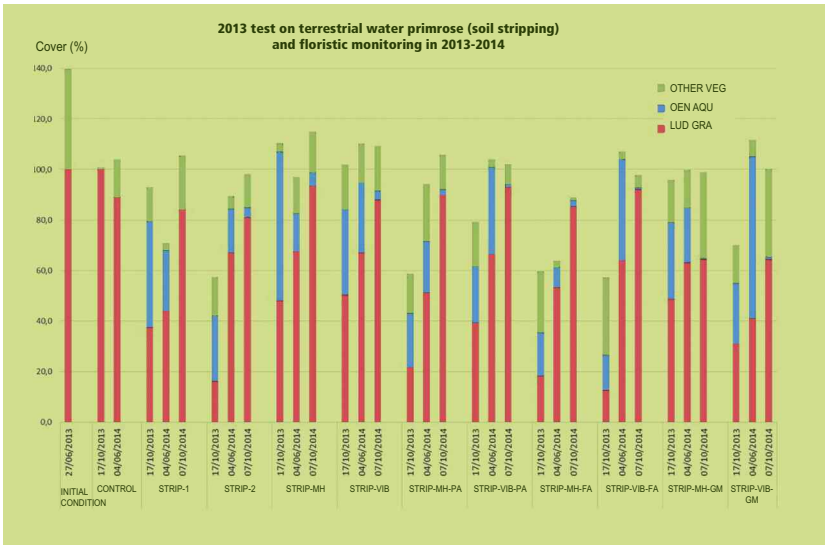
Results and costs

Results for 2013

The results of the experiments in 2013 were not satisfactory. Under virtually all conditions and even though some positive results were observed at the end of the growing season with a notable drop in the cover of water primrose, the species grew back strongly (cover rate > 80%) in 2014.

The only operations to produce a lower cover rate by water primrose (approximately 60%) were STRIP-MH-GM and STRIP-VIB-GM. This was because the corresponding plots were covered with hay and colonised (cover rate almost 30%) by floating sweet-grass (*Glyceria fluitans*). This species developed due to the more humid conditions created by the stripping of the topsoil, which created depressions in the field.

The stripping also had an effect on the development of fineleaf waterdropwort (*Œnanthe aquatica*) at the end of the growing season and the start of the next. The seed bank of this species would seem to have been stimulated and the more favourable hydric conditions enabled its development.

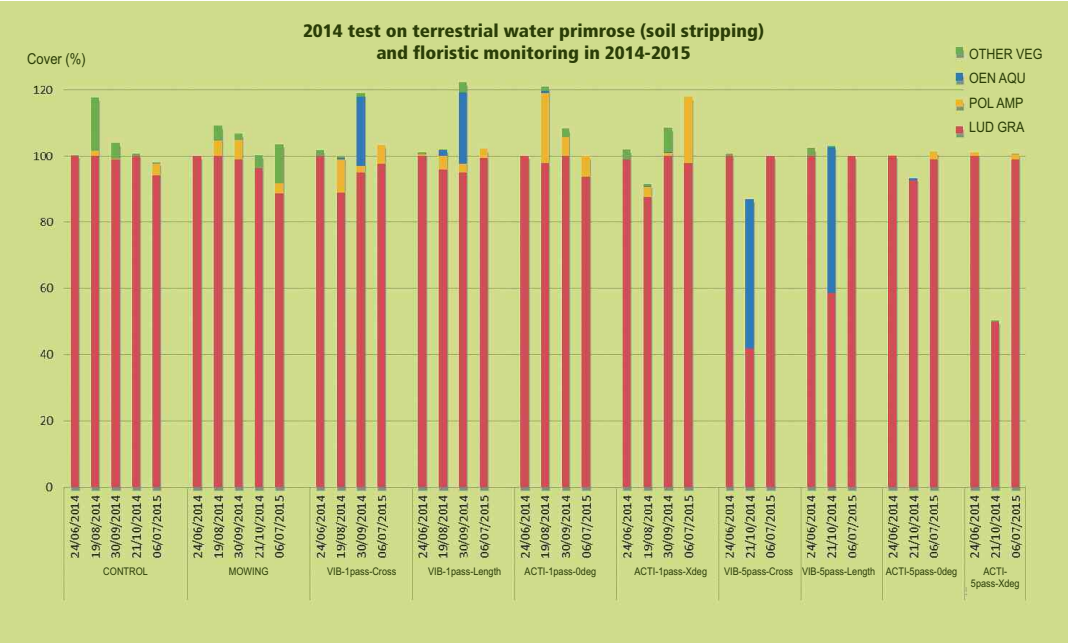


Results of the experiments in 2013.

■ Results for 2014

■ The results of the experiments in 2014 demonstrated the ineffectiveness of the various operations given that water primrose again covered over 90% of the treated areas just one year after the work.

■ The development of fineleaf waterdropwort (shown in blue in the graph) was again noted, as well as that of water knotweed (*Persicaria amphibia*) (in yellow) in the areas with only one passage of the tools.



Results of the experiments in 2014.

■ Financial aspects

Table listing the expenses incurred for the experiments (in euros, including VAT).

	2013	2014	2015*	TOTAL
Equipment and seeds	913.07	187.20	-	1 100.27
Work	1 582.46	1 749.00	-	3 331.46
Scientific monitoring	7 355.40	7 380.00	-	14 735.40
Personnel costs	1 433.60	1 183.60	215.20	2 832.40
TOTAL	11 284.53	10 499.80	215.20	21 999.53

** Drafting of the report.*

■ The costs were covered by the following organisations:

- 50% by the European INTERREG fund;
- 30% by the Loire-Bretagne Water agency;
- 20% by the Development agency for the Vilaine River basin.

Information on the project

■ These experiments were carried out in the framework of the Interreg IVa cross-Channel WOW programme and were presented in the reports filed for the programme. In that the results were not positive, no further publications were made.

Outlook

■ The lack of results in the experiments on techniques to restore the marsh land meant there was no point in pursuing the experiments. Management of terrestrial water primrose in the Isac marshes is now done strictly by adapting the water levels. Regrowth of the native vegetation in the spring is encouraged by lowering the water level earlier in the season than would be the case if there were no water primrose.

Author: Benjamin Bottner, EPTB Vilaine. June 2017.

For more information

■ Internet site presenting the European Interreg IVa cross-Channel WOW "WOrking Wetlands" programme.
http://www.eptbvilaine.fr/site/index.php/projet-wow

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