### Starting conditions

Dry heath and land dunes were planted with Corsican Pines.

### Restoration measures

| 2005 | The plantation was cut down. The forest floor, mostly consisting of needles, was removed allowing the heath seed bank to resurface. Stumps were left standing intentionally. |

### Objectives

| Expansion of the area of dry heath and heath on land dunes. |

### Management measures

| Extensive grazing by Galloway cattle. |

---

End result after removal of pines and sod-cutting

Woodlarks will benefit from the restoration works.
Evaluation

Species/communities

Fairly quickly, both heath on land dunes (*Genisto anglicae-Callunetum* and *Corynephoretalia canescents*) and dry heath started to develop. All species typical of this type of vegetation colonised the treated zone spontaneously. The cut zones now offer ideal breeding habitat for Nightjar (*Caprimulgus europaeus*). In one particular parcel the number of breeding pairs has increased from 1 to 6 in one year's time. The stumps will offer ideal opportunities for ant colonies and sunning lizards (*Lacerta vivipara*), and will provide food and shelter for beetles. They will be gradually consumed by fungi. Birds such as *Caprimulgus europaeus, Lullula arborea* and *Anthus trivialis* will also use them frequently.

Abiotic conditions

The removal of pines and the organic topsoil layer will allow more sunlight and water to penetrate into the seed bank below.

Other lessons learned

Habitat restoration from Corsican Pine is not difficult.

Future points of attention for sustainable results

Bramble appears to become dominant in local, humous places, which may present problems. Mowing will probably be necessary.

Public support

Negative reactions were received because a forest was cut down and, initially, only an open felled area was visible. However, with sufficient information most people were able to see the point.

The Dommel flows through the Hageven and is the subject of a remeandering project. Poplar plantations have been transformed to more natural woodland types or wet meadows.
27. Smeetshof (Bocholt)

Hilde Stulens (VLM), Hilde Heyrman (VLM), Elvira Jacques (ANB) & Joost Dewyspelaere (Natuurpunt)

Natura 2000 area: yes
Management authority: Natuurpunt

Ecosystem type

Mosaic of small streams and artificial drainage channels, hydrophilous tall herb vegetations, wet grasslands, alder forest and heathland relicts (187ha) in a former marshland area in the Campine ecoregion on the Dutch-Belgian border (> 10,000ha), which was drained for agriculture and forestry in the 19th and 20th century.

Restoration measures, objectives and results

Starting conditions

The area surrounding the ‘Veldhoverbeek’ stream (c. 55ha) was dominated by arable land with a network of drainage ditches. The area is very suitable for marsh restoration thanks to the relatively high natural groundwater level and seepage pressure.

Restoration measures

2003-2004

- Raising the groundwater level by removing drains or putting them out of action, filling or damming of ditches, placing a dam to divert peak discharges into the marsh.
- Local breaching or leveling of banks along the stream.
- Raising the bank at the border of the site, to prevent water flowing out of the restored marsh and to minimise effects in groundwater hydrology on surrounding land.
- Removal of hedgerows and lanes (poplar and Quercus rubra).
- Top soil removal in a former maize field over 2ha with 50cm and over 3ha with 30cm at the lowest point of the area to create a basin with permanent seepage water

Objectives

Development of a flood marsh, mainly fed by seepage and rain water during most of the year, but also used for holding surface water in peak discharge moments of the Veldhoverbeek (about once a year). The aim is to create a mesotrophic marsh area with hydrophilous tall herb vegetations and willow and alder carr.

Management measures

- Water supply from the Veldhoverbeek into the marsh is being controlled.
- Continuous extensive cattle grazing; during summer additional grazing with horses.
- Flailing of Juncus effusus vegetation.

Evaluation

Species/communities

The surface area of water and marsh strongly increased in the northern part of the area. In the southern part wet grassland developed, but got largely overgrown by Juncus effusus.
A strong increase was noticed in breeding water and marsh birds, such as Luscinia svecica, Tachybaptus ruficollis, Podiceps nigricollis, Anas querquedula, Acrocephalus scirpaceus, Anas strepera, Anas crecca and also in a number of species that are declining in the rest of Flanders, like Porzana porzana, Rallus aquaticus, Locustella luscinioides and Emberiza schoeniclus. In three years time, the area has evolved from rather uninteresting for dragonflies to prime habitat for them, with 36 species of which 10 are on the red list, such as Brachytron pratense and Aeschna isosceles.
Abiotic conditions

The massive occurrence of *Juncus effusus* in large parts of the flow marsh may be the result of stagnating surface water and internal eutrophication. The latter is due to phosphate mobilization after renewed irrigation and flooding of former agricultural fields deficient in lime (with high concentrations of phosphate due to former manuring). Recent data however suggest the trophic level of the water is slowly decreasing.

Other lessons learned

In future restoration projects it is recommended to investigate the nutrient content of the soil first. This allows the evaluation of possibilities for valuable marsh vegetations and of the depth at which the possible phosphate front needs to be dug off. Indeed, the best solution for the phosphate problem is still the single removal of the phosphate-rich topsoil layer.

Future points of attention for sustainable results

*Juncus effusus* takes advantage of the fluctuating water levels, nutrients and trampling by cattle, while it is hardly grazed. In addition, cattle tend to avoid the wetter patches, which is exactly where the species dominates. Therefore mowing management of *Juncus effusus* is necessary for a more species rich vegetation composition. The effects of the new hydrological conditions on marsh development will be monitored after project completion.

Public support

A formerly inaccessible agricultural area is made accessible to the public, e.g. by walking paths. The applied procedure of land development for nature consists of several moments of participation of stakeholders and public agencies.
Evaluation

**Species/communities**

After two years, a relatively large area of tall herb vegetation developed with notable breeding birds such as *Luscinia svecica*, *Anas strepera*, *Rallus aquaticus*, and *Emberiza schoeniclus*. In the alluvial forest breeding birds like *Scolopax rusticola*, *Ficedula hypoleuca*, and *Oriolus oriolus* were observed, while in the dryer parts *Emberiza citronella* is breeding as well. Notable dragonfly species were recorded such as *Ischnura pumilio*, *Aeschna juncea*, *Aeschna isosceles*, *Somatochlora metallica*, and *Sympecma fusca*. A limited area of new mesotrophic alder forest has already established. Up till now the heathland restoration is moderately successful with colonisation of species such as *Calluna vulgaris*, *Cytisus scoparius*, *Genista anglica*, and different *Carex* species.

**Abiotic conditions**

Due to internal eutrophication the water quality is problematic (see higher).

**Public support**

The followed procedure of land development for nature provides several moments of public participation in planning and decision of the project measures.
Outlet construction of the flow marsh and view on the alluvial forests (2004).
28. Vallei van de Drie Beken (Diest, Tessenderlo, Beringen)

Niko Boone (INBO)

Natura 2000 area: yes (80% of the currently managed area)
Management authority: Agency for Nature and Forests
Supporting authorities: Flemish Land Agency (local land bank), province of Vlaams-Brabant, province of Limburg, city of Diest

Ecosystem type
A wide valley, consisting of three main brooks, flanked by a continuous row of tertiary hills in the Campine ecoregion (c. 350ha).

Restoration measures, objectives and results

Starting conditions
Since the 1970s weekend cottages were built illegally. Due to the marshy conditions it was necessary to create deep and artificial ponds for the raising of the soil (up to as much as 2.5m).

<table>
<thead>
<tr>
<th>Year</th>
<th>Restoration measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999-2007</td>
<td>About 15ha of the valley area was restored by:</td>
</tr>
<tr>
<td></td>
<td>- Removal of illegal cottages, caravans, fences, waste and exotic trees and shrubs.</td>
</tr>
<tr>
<td></td>
<td>- Ponds have been filled in or restored with gentle slopes and removal of bank protection.</td>
</tr>
<tr>
<td></td>
<td>- Cyprinid fish were removed as much as possible, as well as invasive aquatic plants (Myriophyllum aquaticum and Ludwigia grandiflora).</td>
</tr>
</tbody>
</table>

Objectives | Management measures
--- | ---
Restoration of the valley landscape: mesotrophic peat bogs and ponds with rich aquatic life, Calthion grassland, wet tall herb vegetations with reed | Pioneer vegetations with Juncus effusus and willow or alder saplings are controlled by mowing twice a year during a transition period. This frequency of mowing continues in Calthion grassland, but in tall herbs it is limited to once every 3 to 5 years.

Evaluation

Species/communities
- New species or increased numbers of particular dragonflies were observed around restored ponds: e.g. Sympetrum pedemontanum, Lestes barbarus, Gomphus pulchellus and, a priority species, Cordulia aena. For all of these species, egg depositing has been observed. More priority species are expected from source populations in the neighbourhood. Hobby (Falco subbuteo) reacted quickly to the new situation and re-established itself as a breeding bird in the area.
- Large Marsh Grasshopper (Stethophyma grossum) colonised a restored parcel from a source population at about 1km.
- Though the severely disturbed soil is dominated by mainly Juncus effusus, priority species of hydrosere vegetation (e.g. Carex vesicaria, Carex rostrata, Hydrocotyle vulgaris, Comarum palustre, Equisetum fluviatile) and of Calthion grassland (e.g. Caltha palustris, Juncus acutiflorus, Scirpus sylvaticus, Carex disticha, Carex ovalis) also appear. Comarum palustre, Equisetum fluviatile and Caltha palustris were already present in the immediate vicinity, while the other species have recovered mainly from the seed bank.
- In a number of restored ponds, the priority species of mesotrophic waters Utricularia australis and Hottonia palustris have expanded.
Abiotic conditions

Most ponds were dug in sand and/or peat soils. Pond sections that were filled in with mineralized peat are colonised by very productive *Juncus effusus* vegetations. In the sections that have been scraped off or filled in with sand *Juncus effusus* is less dominant. Results differ greatly between parcels, but so far no research has been carried out to explain these differences. Because of industrial and domestic discharges of waste water no single measuring point in the 3 brooks currently meets the basic water quality. In the ponds, which are fed by ground and rainwater, water quality is good.

Other lessons learned

Invasive species like *Ludwigia grandiflora* and *Myriophyllum aquaticum* were mechanically controlled during restoration, with varying success. After restoration both mechanical and chemical means were used. In a few cases of very large populations complete filling in of the pond was the better option. In 10% of the ponds invasive species still remain a problem. Mowing reduces particularly the biomass of *Juncus effusus*, allowing e.g. smaller sedges, *Lotus pedunculatus* and *Ajuga reptans* to germinate and expand.
Future points of attention for sustainable results

The current poor water quality in the brooks does not allow measures for restoration of the water balance in the valley. Efforts have been done at policy level to solve the water quality problem by 2011 to a large extent. Restoration of the water balance is also hampered by the fragmented ownership situation. In this respect the continuation of a specific land purchasing policy is important.

Public support

At the start of the project (1999) there was ample support from the local authorities and public prosecutor to solve the problem of illegal buildings and to impose nature restoration measures. On this subject an informative meeting was held with all authorities involved and information was intensively and personally communicated to owners and local residents.

Starting conditions

Former dry heathlands and Nardus grasslands were planted with trees or were spontaneously encroached with scrubs and trees due to a lack of management.

Restoration measures

<table>
<thead>
<tr>
<th>Year</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-2005</td>
<td>1.3ha of a Pinus sylvestris and Quercus rubra plantation and saplings of willow and birch were cut with removal of the litter layer.</td>
</tr>
</tbody>
</table>

Objectives Management measures

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Management measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restoration of structure-rich dry heath and Nardus grassland.</td>
<td>Grazing by sheep, with cyclic cutting of sapling growth.</td>
</tr>
</tbody>
</table>

Evaluation

Species/communities

- Calluna vulgaris, Cytisus scoparius and Vaccinium myrtillus expanded. Other typical species appeared, like Nardus stricta, Galium saxatile, Carex pilulifera, Luzula multiflora, Juncus squarrosus, Potentilla erecta and Illecebrum verticillatum.
- The population of Field Cricket (Gryllus campestris) expanded and Mole Cricket (Gryllotalpa gryllotalpa) colonised the area.
- Small Heath (Coenonympha pamphilus) is regularly present.
- Tree Pipit (Anthus trivialis) has been reconfirmed as a breeding bird.

Other lessons learned

The removal of stumps made it possible to mow the site in the transitional stage enabling the successful control of birch and brambles.

Public support

These small-scale restoration measures were supported by local authorities and residents. Unfortunately, a small group of local people are opposed to the extending of the same measures on a larger scale (10ha).
Restoration of Calthion grassland (mainly), Arrhenaterium grassland and Agrostis grassland.

1999-2007 17ha were restored into permanent grassland. Lolium multiflorum was sown on fields or mowing management was started from natural sapling growth.

Objectives Management measures

| Restoration of Calthion grassland (mainly), Arrhenaterium grassland and Agrostis grassland. | Mowing twice a year or mowing followed by grazing. |

Evaluation

Species/communities

- The former intensive agricultural use sometimes leads to dominance of certain species, such as Juncus effusus, Cirsium arvense and Holcus lanatus.

- Several target species appeared of Calthion grassland (e.g. Cirsium palustre, Lychnis flos-cuculi, Juncus acutiflorus, Carex disticha, C. ovalis, Myosotis scorpioides, Ajuga reptans); Arrhenaterium grassland (e.g. Leucanthemum vulgare, Centaurea jacea) and Agrostis capillaris grassland (e.g. Luzula campestris, Hypochaeris radicata, Ornithopus perpusillus, Trifolium arvense).

- A number of new grasslands already appeal to butterflies such as Lycaena phlaeas, Polyommatus icarus, Anthocharis cardamines and Papilio machaon.

- The sown parcels are of later date. An accurate comparison between the sown and unsown parcels is not yet possible.

Other lessons learned

- Colonisation rate presumably depends on previous history (duration of field management) and the presence of species in the neighbourhood.

- Cirsium arvense has been chemically controlled once on a parcel in an agricultural area. The population has decreased strongly, but has not disappeared. On a similar parcel, a few years of mowing have led to the same result and chemical control will therefore no longer be applied preferably.

Public support

In Flanders there is still a legal obligation to exterminate Cirsium arvense populations. This is often a problem in restoration projects on former agricultural land.
29. Vallei van de Zwarte Beek (Hechtel-Eksel, Heusden-Zolder, Houthalen-Helchteren, Beringen, Lummen, Halen, Diest)

Steven Vangompel (Natuurpunt)

Natura 2000 area: yes
Management authority: Natuurpunt
Supporting authorities: Flemish Regional Authority; province of Limburg; Ministry of Defence; city of Beringen

Ecosystem type

Upstream: groundwater fed, species-rich fen meadows and marshes on peat soil; Downstream: more agricultural and mesophile grasslands, both situated in the Campine ecoregion (> 1,500ha).

Restoration measures, objectives and results

Starting conditions

In the eighties a man-made brook, named Oude beek, was dug out down to 1.4m below the surface, with draining and eutrophication of the peat area as major consequences.

Restoration measures


In the upstream part, several dams were constructed with organic material, and the removed bed material was pushed back in. The degraded peat on the bank was cut away. In 1998 similar interventions were done on a more downstream location. All measures together affected an area of about 65ha.

Objectives

Restoration of ground water dependent communities by shallow- ing the bed up to 10cm below surface level.

Management measures

Mowing 1x per year (meadow and small sedge vegetation).

Thanks to the restoration of the groundwater levels poplar plantations died off and were transformed into mesotrophic grazing marsh or alluvial alder forest.
Evaluation

Species/communities

Caricion curto-nigrae, Carici elongatae-Alnetum glutinosae, Filipendulion and Lolio-Cynosuretum lotetosum uliginosi communities in the valley recovered successfully. Poplar plantations died on site and were replaced by mesotrophic Alder forest. Nitrophilous plant species vanished and were slowly replaced by mesotrophic bog communities with target species such as Calla palustris, Potentilla palustris, Menyanthes trifoliata and Viola palustris. Later on, bird species such as Gallinago gallinago, Rallus aquaticus, Botaurus stellaris and Circus cyaneus were recorded (again) or increased in number.

Other lessons learned

The water levels in the area are monitored by local volunteers and were crucial for monitoring results.

Future points of attention for sustainable results

To prevent acidification, maintenance of small drainage channels in the area are important to prevent stagnation of rainwater.

Public support

For land owners more downstream, the restoration was of little consequence, which enabled the execution of a similar project in 1998 more downstream.

Current view of the impounded Oude beek, colonised by Calla palustris and Equisetum fluviatile a.o.
Evaluation

Species/communities

The project was very successful with re-colonisation of species such as *Drosera intermedia*, *Eriophorum angustifolium*, *Rhynchospora alba*, *R. fusca*, *Trichophorum cespitosum* subsp. *germanicus*, *Gentiana pneumonanthe* and *Narthecium ossifragum*. Butterflies such as *Maculinea alcon* and *Callophrys rubi* returned as well.

Public support

There was no interference with military purposes, so military support was no problem.
Artificial water channel and ponds for fish reproduction/migration and for amphibians; marsh vegetation; wet grasslands for meadow birds.

2002-2004 A bypass channel of 775m with 12 fish ladders was created to allow fish migration around the old water mill. 3ha of adjacent artificial fish ponds were restored, next to the additional creation of a marshy zone.

Objectives Management measures

Artificial water channel and ponds for fish reproduction/migration and for amphibians; marsh vegetation; wet grasslands for meadow birds. Sheep grazing (surrounding wet grasslands)

Evaluation

Species/communities

Interesting fish species were *Leuciscus cephalus* and *Leucaspius delineatus*. Bird species like Common Snipe (*Gallinago gallinago*) increased as a result of the interesting foraging site.

Abiotic conditions

Water quality improved as a result of reed colonization.

Other lessons learned

The in- and outlet angles of the bypass channel were not constructed optimally: the stream flow they provide is too weak, allowing not enough water (and fish) through the channels and ponds. This will be fixed in the future.

Future points of attention for sustainable results

Mowing of the surrounding wet grasslands and cyclical dredging of the ponds will be necessary, respectively to prevent tree encroachment and to preserve open water.

Public support

Local residents were especially concerned about possible risks of flooding. They also complained about the temporary smell and smoke during burning of exotic plant species. A local meeting was held to inform the residents about the project. The site has become an interesting observation post for birdwatchers.
30. Groot Wijven (Zonhoven)

Lily Gora & Tom Verschraegen (ANB)

Natura 2000 area: yes
Management authority: Agency for Nature and Forests
Supporting authorities: The project was possible thanks to a management agreement with the private owners of the pond.

Ecosystem type
Large mesotrophic pond with amphibious *Littorelletalia* and/or *Isoëto-Nanojuncetea* communities in the sandy Campine ecoregion and part of the largest pond complex in Belgium (‘Vijvergebied Midden-Limburg’).

Restoration measures, objectives and results

<table>
<thead>
<tr>
<th>Starting conditions</th>
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<tbody>
<tr>
<td>A 16ha large pond, suffering from turbid water and lack of vegetation due to intensive carp culture (1500 kg/ha).</td>
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<table>
<thead>
<tr>
<th>Restoration measures</th>
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<tbody>
<tr>
<td>2002-2003</td>
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<tr>
<th>2003-2005</th>
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<tbody>
<tr>
<td>- Ending of the aquaculture through relocation.</td>
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<tr>
<td>- Temporarily reclaiming the pond.</td>
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<tr>
<td>- Constructing shallow reed islands, planted with local reed roots (2.2ha).</td>
</tr>
<tr>
<td>- Remodelling the banks.</td>
</tr>
<tr>
<td>- Slowly raising of the water level to enable <em>Littorellion</em> and reed vegetation to develop on the shallow banks and the islands.</td>
</tr>
<tr>
<td>- Introducing of clear water fish species (Roach-Tench-Pike).</td>
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<table>
<thead>
<tr>
<th>Objectives</th>
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<tbody>
<tr>
<td>Pond with rich submerged and amphibious vegetation and clear water fish community; reed islands for Bittern and Little bittern.</td>
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<tr>
<th>Management measures</th>
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<tbody>
<tr>
<td>Temporarily reclaiming the pond once every few years; eradication of invasive non-native fish species; occasional mowing of the reedbeds.</td>
</tr>
</tbody>
</table>

Evaluation

**Species/communities**
- *Littorella uniflora*, *Hypericum elodes*, *Eleocharis acicularis*, *Pilularia globulifera*, *Elatine hexandra*, *E. hydropiper*, *E. triandra*, *Eleocharis ovata* and *Isolepis setacea* immediately colonised the shallow banks.
- The small island was successfully colonised by reed.
- Since 2005: calling males of Tree Frogs (*Hyla arborea*), but reproduction was not confirmed.
- In 2007: 3 breeding pairs of Bittern (*Botaurus stellaris*).

**Abiotic conditions**
The water stayed clear until 2006. Probably, the turbidity increased due to the more dominant presence of the invasive exotic fish species *Carassius auratus gibelio*. 
Other lessons learned

- Gradually raising the water is beneficial for the development of rich amphibi-ous vegetation.
- Bittern prefers the reedbeds on the islands for nesting. The presence of a bird hide caused no significant disturbance for this species.

Future points of attention for sustainable results

The water needs to be kept clear by periodically reclaiming the pond, together with removing most of the fish populations, except for some clear water species. Monitoring of the water quality will be necessary.

Public support

The private owners agreed on the restoration of the pond on the condition that they could use a part of the pond for some recreational activities, adjacent to their houses. They also wanted to keep an open view on the central open water area.

Thanks to the restoration works 3 pairs of Bittern were breeding in the area in 2007.
31. Kikbeekbron (Opgrimbie)

Kris Van Looy (INBO)

Natura 2000 area: yes
Management authorities: Agency for Nature and Forests
Supporting authorities: Regional Landscape Authority ‘Kempen en Maasland’, National Park Authority ‘Hoge Kempen’

Ecosystem type

Heathland restoration in a former gravel-sand extraction pit on the terrace slope of the Campine plateau (Campine ecoregion)

Restoration measures, objectives and results

Starting conditions

In the heart of the national park ‘Hoge Kempen’, a large gravel-sand extraction (15-50m deep, 96ha) was under finalisation, with strong potential of restoration of heathland and spring-fed pioneer situations. Finalisation was at hand without eye for these potentials. The successful spontaneous recolonisation process with heathland vegetation on the soft slopes and surroundings of the pit was undone by the planting of pines.

Restoration measures

1998

More than 50ha of pine plantations were removed to restore the heathland recolonisation process.

2001-2006

A new plan for the final design of the pit with local restoration measures was elaborated between 2001-2006. High eroding walls, gully erosion and broader riparian zones were integrated in the more dynamic landscape with more opportunities for pioneer communities, species of microhabitats and gradient-rich environments and landscape processes. The following restoration measures were taken:
- steep gravel pit wall (20m high) left untouched to allow erosion processes (pioneer situations);
- water impoundments to restore regional groundwater table;
- reshaping the slopes of the pit for the enlargement of the riparian area around the lake;
- ecoduct over highway E34 connecting the core areas of the National Park Hoge Kempen;
- restoration of low productive grasslands of acid sandy soils on former intensively used agricultural land by natural grazing (20ha).

Objectives

Heathland landscape on natural sandy slopes with attention for natural landscape processes of wind and water (shifting sands, erosion, dry pits). Special attention for the following target communities and species: pioneer conditions with Nanocyperion vegetation, land dunes and open sandy soils with different kinds of dry heathland, shrubs and oak-forests, Caprimulgus europaeus, Lullula arborea, Saxicola torquata, Lucanus cervus, Coronella austriaca, Bufo calamita.

Management measures

Year round natural grazing was installed over the larger area (200ha).
Evaluation

Species/communities

- Nightjar (*Caprimulgus europaeus*) especially, but the other target species as well, benefited from the restoration project. The snake *Coronella austriaca*, the toad *Bufo calamita* and the butterfly *Hesperia comma* are present on the former excavation slopes.

- The mineral soils showed interesting pioneer conditions in the riparian area with important populations of *Lycopodium inundatum, Drosera rotundifolia* and *D. intermedia*; for the dryer situations the hybrid *Festulpia* and *Filago minima* are characteristic.

- Pioneer species colonised immediately after restoration, such as *Oedipoda caerulescens, Bufo calamita* and *Charadrius dubius*.

- The heathlands, fens and grasslands recovered with typical plant species such as *Corynephorus canescens*.

Abiotic conditions

- The restoration of gradient-rich environments, enabling natural processes of wind and water allow a more sustainable protection of typical pioneer communities and developments in this nutrient-poor environment. The result of the restoration measures is a much more diverse landscape with erosion walls and ridges, different levels of water tables, fens, wet and dry heathlands.

- Groundwater lowering due to deep gravel pit extraction is successfully restored by impounding the lake.

Other lessons learned

- Close collaboration between ecologists and extraction companies can provide opportunities for successful nature rehabilitation. For biodiversity it was certainly a better alternative than the afforestation with pines that was originally planned by the company.

- The location of the project in the middle of a national park and surrounded by valuable nature areas and the grazing management over a larger area, contributed to the fast colonisation of the site by target communities and species.

Future points of attention for sustainable results

The site is the centre of the 5000ha of national park, but within the park it is still surrounded by some large agricultural and recreational areas, disconnecting the natural areas and preventing an integrated management.

Public support

As it is a project within the national park developments, with the benefits of touristic developments around the park, the acceptance is good. Ecotourism is a blooming business in the region benefitting from the project.

The gravel-sand pit Kikbeekbron during exploitation and after completion of the works. Slopes were restructured, shallow water zones were created and former pine plantations were logged.
Larvae of the Silver-spotted Skipper (*Hesperia comma*) live on *Festuca filiforis* and other grasses of open sand dunes and dry heathlands. Adults search for nectar in the surroundings.
32. Forest reserve Joseph Zwaenepoel (Hoeilaart, Sint-Genesius-Rode)

Natura 2000 area: yes
Management authority: Agency for Nature and Forests

Ecosystem type
Ancient acidophilous beech woodland in the South-eastern hills ecoregion.

Restoration measures, objectives and results

<table>
<thead>
<tr>
<th>Starting conditions</th>
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</thead>
<tbody>
<tr>
<td>Old forest stand called ‘Kersselaerspleyn’, planted in 1775 (15ha).</td>
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</table>

<table>
<thead>
<tr>
<th>Restoration measures</th>
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<tbody>
<tr>
<td>1983-now</td>
</tr>
<tr>
<td>Implementation of non-intervention management</td>
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</table>

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Management measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural forest development.</td>
<td>No intervention except for safety fellings along accessible paths.</td>
</tr>
</tbody>
</table>

Evaluation

Species/communities
It is remarkable to see how quickly the stands from Kersselaerspleyn develop towards a dynamic equilibrium in total living and dead biomass, comparable to natural beech stands. The consequences of this development for species richness and composition of mosses, vascular plants, saproxylic invertebrates and fungi were also studied: 48 plant species, 55 mosses, over 250 species of fungi and over 100 species of saproxylic invertebrates have been registered up to now on the dead wood, including many rare indicator species of valuable old-growth sites (e.g. Stictoleptura scutellata, Carabus auronitens, Lentinellus ursinus, Pluteus umbrosus, Gymnocarpium dryopteris, Nowellia curvifolia and Ptilium pulcherrimum).

Abiotic conditions
Abiotic conditions (thick, severely lessivated, acid loamy topsoil of Quaternary niveo-eolian origin) are only slowly influenced by the new management regime. Decomposition of large amounts of dead wood may lead to better soil conditions thanks to an increase in organic component and a steady release of nutrients. This has already been registered at close distance to the logs, but is not significant yet on a higher scale.

Other lessons learned
The spontaneous development of a man-made forest to a more natural state can be relatively fast, provided that the original stand is old enough, reaching an age where natural decay normally starts to occur. For beech stands, this can be the case starting from 200 year old stands.
Future points of attention for sustainable results

Atmospheric depositions are above critical loads for this forest type. In combination with the strong dominance of beech, this may lead to further acidification of the site, and decline of sensitive plant and fungus species. There is also a lack of regeneration which may cause problems for continuity of the forest stand in the long run.

Public support

The strict reserve was a personal initiative of the local forest manager, and originally only received appreciation from university researchers. Over the years, the principles of strict forest reserves, and the conservation values of dead wood have become gradually accepted also by the general public. Nowadays about 2,000ha of strict forest reserves have been established in Flanders. Still it is not evident to explain the abandonment of large quantities of valuable wood resource, especially high-quality tree stems.

References

Mycena crocata

Pholiota trametes
Evaluation

Species/communities

Although the forest stands here are generally younger, dead wood buildup and natural dynamics are also quite rapidly developing. An average of over 30 m$^3$/ha of dead wood is already present. Research on fungi showed that several rare indicator species were able to colonize the site quickly from the near forest reserve.

Future points of attention for sustainable results

There is a desire to further expand the strict forest reserve to an area of approximately 250ha. This expansion is considered important to secure viable populations of vertebrates dependent on dead wood (woodpeckers, bats,..) and highly specialized (rare) saproxylic organisms.
33. De Doode Bemde - Valley of the Dijle River upstream Leuven (Huldenberg, Oud-Heverlee, Bertem)

Piet De Becker (INBO)

Natura 2000 area: yes

Management authorities: ‘Vrienden van Heverleebos & Meerdaalwoud’ (local NGO) in cooperation with Natuurpunt, Flemish Environment Agency (river manager)

Supporting authorities: EU (LIFE), Agency for Nature and Forests, Flemish Land Agency (land development for nature project), province of Vlaams-Brabant, city of Leuven, municipalities of Oud-Heverlee and Huldenberg

Ecosystem type

(Eutrophic) silty alluvial floodplain and river in the South-eastern hills ecoregion (ecosystem: 1200ha, Doode Bemde 450ha, effectively realised 245ha).

Restoration measures, objectives and results

Starting conditions

The river Dijle, more specifically the river channel itself, is one of the very few Flemish examples of rivers that have never been altered by cutting of meanders or enlarging of its channel.

Restoration measures

| 1990-present | In consultation with the river manager all management activities (mowing of banks, removal of trees and shrubs, in channel removal of sediment deposits) have been stopped since 1990 onwards, allowing the river meanders to move freely. |

Objectives

| Restoration of an alluvial floodplain system including regular flooding; a free meandering river with an unmanaged river channel. |

Management measures

| Absolutely none. |

Evaluation

Species/communities

Due to the increased erosion/sedimentation processes, the number of favourable breeding sites for Kingfisher (Alcedo atthis) have increased enormously. Today some 11 breeding pairs nest along 4km of non-managed river, along with 5 pairs of Grey Wagtail (Motacilla cinerea). Numbers of fish species have increased dramatically from 1 species in 1990 up to 24 species today.

Abiotic conditions

The complete set of consecutive meanders is moving downstream without noticeable changes in amplitude or wavelength with a pace of up to 1.2m per year (see figures). Other characteristics of the river are: base discharge 4-5m³/sec, bank full discharge 20-22 m³/sec, return period of flooding 0.5 years, sinuosity: 1.6-1.8 (river length/bird-flight length [dimensionless]), mean meander amplitude 110m, mean meander wave length 150m.
Ideas on water management have changed during the last decades. Natural erosion and sedimentation processes are allowed in the river Dijle now. Trees and scrub are colonising the banks and are allowed to fall into the river channel. The floodplains of the Dijle are flooding more frequently now and prevent the flooding of the city of Leuven downstream.

The two graphs show the evolution of the exact location of the riverbanks as measured in the different years mentioned. It is clear that there is a lateral downstream (i.e. northward) movement of the complete meander train with a velocity of up to 1.2 meter/year.
### Evaluation

#### Species/companies
For the Dijle ecosystem it seems possible to combine flood damage prevention with restoration of different floodplain communities, although the evaluation period (7 years now) is short. Due to the changes in the water level of the floodplain Arrhenateretum grasslands became fen meadows, fen meadows evolved into tall sedge swamps, in other words vegetation belts are shifting. Fen carr vegetation has been restored including some of its typical breeding birds like Spotted Crake (*Porzana porzana*).

#### Abiotic conditions
In the floodplain there was a rise of the groundwater drainage level of up to 0.6 meter with regular (almost yearly) flooding of floodplain depressions.

### Future points of attention for sustainable results
- Problems are arising with recreation and legal liability of the river manager and the nature conservation organisation in case of serious accidents. The risk of compulsory return to the “old” managing scheme is real.
- Although water quality has improved significantly (i.e. BBI=1 in 1990 to 7-8 in 2006), nutrient levels in the river water have increased and are still increasing very slowly but steadily.
- Beavers have been (illegally) introduced since approx. 2000. They cause no damage in this stretch of the river, but animals are increasingly moving out of the protected areas and causing (flood & felling of trees) damage etc.

### Public support
A strongly polarised and sharp 25 year long discussion was concluded in 1998. In the beginning there was a strong demand for rigid regularisation of the Dijle river and the construction of three storm basins in order to store excess floodwater on a limited surface. We ended up with the inverse: a very wide support for an unmanaged river and a maximisation of the flooded area in order to secure the city downstream.

### Future points of attention for sustainable results
- Flood water quality and maintaining a stable inundation frequency are major concerns.
- Due to the rising of the drainage levels and the regular flooding, management costs at the nature reserve have increased significantly.

### Starting conditions
The Dijle floodplain is situated some 40-60m deep in a silt plateau; the floodplain has a width of approx 1-1.5km. There is a marked micro-topography with elevated natural levees and floodplain depressions or back swamps due to regular flooding since early medieval times. Regular flooding has been prevented since 1945, mainly for agriculture and poplar plantations (c. 2/3 of the floodplain was planted with poplar). This increasingly caused inundations in the downstream city of Leuven.

### Restoration measures

<table>
<thead>
<tr>
<th>1980-present</th>
<th>Since 1980, floodplain restoration has started with the large-scale conversion of fertilised crop- and grasslands and poplar plantations. Since 2000 the connection between the river and the floodplain has been restored.</th>
</tr>
</thead>
</table>

### Objectives
- Natural floodplain landscape with a mosaic of meadows (*Calton, Arrhenaterion*), tall herb fen (*Filipendulion*), tall sedge swamps (*Magnocaricion*), Alder carr and other floodplain forest types (*Alnion & Alno-Padion*).

### Management measures
- Grasslands are mown 1-2x/year, aftermath is grazed by cattle.
Restored *Arrhenatherion* grassland out of poplar plantations after 5 years of mowing management. Flower-rich grasslands are expected to develop after 10–15 years of continued mowing without adding manure or fertilizer.

Parts of the poplar plantations are dying off after leaf fungus infestations and slowly develop towards more natural alluvial forest.
**34. Het Vinne (Zoutleeuw)**

Ingrid Beerens (VLM) & Luc Denys (INBO)

- **Natura 2000 area:** yes
- **Management authority:** province of Vlaams-Brabant
- **Supporting authorities:** Agency for Nature and Forests, Flemish Land Agency (land development for nature project)

**Ecosystem type**

Shallow, moderately eutrophic lake in the South-eastern hills ecoregion.

**Restoration measures, objectives and results**

<table>
<thead>
<tr>
<th>Starting conditions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>This shallow natural lake (up to 3m deep) used to be the largest in Flanders (c. 100ha) and was drained in 1841 for agricultural exploitation and poplar plantation.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Restoration measures</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2005</td>
<td>50ha of old poplars were felled and the drainage pumps were set to restore a lake with a surface of 68ha (in order to avoid flooding of nearby buildings; the original surface could not be attained). Pike was introduced in 2005 (1,400 individuals of 6 weeks old).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Management measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restoration of a shallow, natural moderately eutrophic lake.</td>
<td>Water level management to avoid flooding of buildings; cyclical mowing of reed; artificial nesting rafts for Black Terns were placed in 2008.</td>
</tr>
</tbody>
</table>

Orthophoto from the reclaimed lake planted with poplars before restoration and aerial view after the restoration of the lake (2005).
Evaluation

Species/communities

- Mainly non-rooting aquatic plants established rapidly and became very abundant (lemnids, *Riccia fluitans* and *Utricularia australis*). So far, rooting aquatics remain sparse and limited to a few tolerant species such as *Potamogeton crispus* and *P. pusillus*. Large patches of perennial reed and *Typha latifolia* developed. At this early stage, it is still unclear to what extent the reed vegetation will expand further (now nearly 50% cover of the lake).

- Many reed and marsh birds reappeared. Among the more remarkable breeding birds are *Botaurus stellaris*, *Ixobrychus minutus*, *Podiceps nigricollis* and *Chlidonias hybridus*. *Chlidonias niger* occur in relatively large numbers during migration. A large breeding colony of Black-headed Gull (*Larus ridibundus*; up to presumably 6,000 birds) developed, which may cause a nutrient problem.

- Het Vinne is important to foraging bats as can be seen by the large numbers and the presence of 6 to 8 species, such as *Myotis daubentonii*, *M. nattereri*, *Nyctalus noctula* and *Plecotus* spec.

- The fish community of Het Vinne is still in a pioneer stage and a limited number of species are present: *Pseudorasbora parva*, *Gasterosteus aculeatus*, *Pungitius pungitius*, *Esox lucius* and *Cyprinus carpio*.

- Due to the combination of open water, marsh and fringing woodland, the dragonfly diversity is considerable (38 species), with high densities of common species and populations of a few more specialized species (*Aeschna isosceles*, *Lestes dryas*, *Aeschna juncea* and *Ceriagrion tenellum*).
**Abiotic conditions**

The lake is only fed by rain and ground water; natural fluctuations of the water level may occur, but only up to a maximum height of 25m above mean sea level (flood protection of buildings). The actual depth of the lake at maximum water level is about 1.30m. Chemical analysis of the surface water has shown that the lake is moderately eutrophic in 7 out of 8 sample locations, and hypertrophic in one location (due to former discharge of domestic waste water).

**Other lessons learned**

The use of heavy machines on the peaty soils proved to be very difficult. The poplars were cut without removing stumps and debris, which now offers ample breeding habitat for the Black-headed Gulls and hampers mowing. Decomposition of abundant organic material causes turbidity and oxygen consumption, inducing an outbreak of botulism in 2008.

**Future points of attention for sustainable results**

Besides internal eutrophication, guanotrophication and nutrient inputs through drainage and spillover of stored manure from an adjacent farm are causes of concern. The evolution of the water quality and the growth of reed must be monitored closely.

**Public support**

The area became very popular for local tourism. People can visit the area via attractive wooden tracks through the marsh and bird hides are provided. Local people complain about the increase of mosquitoes and noise from the Black-headed Gulls.

It came as a complete surprise that in the first years after the restoration works a small breeding population of Whiskered Tern (*Chlidonias hybridus*) became established, an extremely rare event in Flanders up to now.
35. Hoegaardse valleien (Hoegaarden)

Robijn Guelinckx (INBO)

Natura 2000 area: no
Management authority: Natuurpunt
Supporting authorities: Flemish Land Agency (land consolidation project), province of Vlaams-Brabant

Ecosystem type

Calcareous fields, grasslands, fringes, thickets and forests in the chalk-loam ecoregion (c. 160ha).

Restoration measures, objectives and results

<table>
<thead>
<tr>
<th>Starting conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensive fields on gradual valley slopes, with slightly alkaline loamy soils.</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Restoration measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996-2008</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Management measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restoration and development of species-rich alkaline <em>Arrhenatherion</em> grasslands, fringes and thickets with gradients from wet to dry.</td>
<td>Mowing in early summer followed by grazing.</td>
</tr>
</tbody>
</table>

Evaluation

Species/communities:

- Grassland vegetation developed quickly on the former arable land. Most of the species colonised the site from verges and parcel edges, and have expanded from there. The first year anemophilous species were strikingly more successful than others. After the second year already, species like *Crepis vesicari*, *Trifolium dubium*, *Leucanthemum vulgare*, *Hypochaeris radicata* and *Anthoxanthum odoratum* had become locally dominant, and species like *Centaurea jacea*, *Origanum vulgare*, *Lathyrus nissolia*, *Lathyrus tuberosus*, *Lathyrus sylvestris*, *Lathyrus pratensis*, *Vicia tetrasperma*, *Agrimonia eupatoria*, *Crepis biennis*, *Tragopogon pratensis*, *Malva alcea*, *Centaurium erythraea* and *Fragaria vesca* appeared.

- The vegetation of particularly the stoniest parcels, that are rich in relief, has quickly developed into species-rich, calcareous *Arrhenatherion* meadowland and was colonised by a number of interesting grassland species like *Ophrys apifera*, *Carex flacca*, *Hieracium vulgatum*, *Lathyrus aphaca*, *Orobanche minor*, *Trifolium medium*, *Saxifraga tridactylites*, *Inula conyzae* and *Ononis repens*.

- Due to spontaneous succession the present fringe vegetations and thickets strongly increased, with a distinct expansion of *Prunus spinosa*, *Rosa tomentosa*, *Clinopodium vulgaris*, *Oriaganum vulgare* and *Clematis vitalba*.

- It was possible to restore a few former wet grasslands that were used intensively as maize fields in the nineties. A large number of species, like *Carex acutiformis*, *Scirpus sylvaticus*, *Carex flacca*, *Juncus inflexus*, *Pulicaria dysenterica*, *Lotus pedunculatus*, *Silene flos-cuculi*, *Cirsium palustre*, *Hypericum tetrapetalum* and *Juncus conglomeratus* turned out to be still present in the seed bank, and *Dactylorhiza majalis* was already able to colonise one of these parcels from the immediate vicinity.

- Large-scale development of intensive agricultural land into extensive meadowland with increased fringes, thickets, tall herb vegetation and forests has clearly benefitted the present fauna. Most noteworthy is the expansion of a number of bird species typical of small-scale agricultural land, such as *Emberiza citrinella*, *Streptopelia turtur* and *Saxicola rubicola*, and the strong increase in a series of common butterflies typical of grasslands, such as *Papilio machaon*, *Maniola jurtina*, *Plebeius argestis* and *Polyommatus icarus*. 
**Abiotic conditions**

The mowing management has reduced particularly the nitrogen content in the soil very quickly. Nitrogen decrease was particularly observed on the stony slopes. The calcareous soil buffers against phosphate, which guarantees a good starting condition and appearance of interesting species.

**Other lessons learned**

- Spontaneous colonisation of bare fields quickly resulted in a flowery and structure-rich aspect, but the botanical development into species-rich grassland usually progresses more slowly than on the *Lolium multiflorum* fields with similar management, where ruderal species (*Cirsium arvense, Artemisia vulgaris*, etc.) and sapling growth of trees and bushes were less abundant.
- Spontaneous succession on bare fields is beneficial to forest expansion.
- Mowing is very important as transitional management to remove nutrients (especially nitrogen) from the former agricultural lands. Without mowing management, afforestation and grass tussock development would soon occur, preventing critical species from germinating and growing.

**Future points of attention for sustainable results**

- A less intensive mowing management would improve the diversity in vegetation structure, which in turn would benefit the fauna.
- Vegetation should be mown (and grazed afterwards) to create suitable growing conditions.

**Public support**

Cooperation with local farmers in management (mowing with hay-making or removal of the cut material and subsequent grazing by cattle).

Former fields on alkaline, loamy soils were sown with *Lolium multiflorum* and are mown. The first years are species-poor.

After a few years the flowers start to come in.

Spontaneous succession of former calcareous fields without sowing of grasses: tall herb vegetation with mainly faunistic interest.
Starting conditions
1.5ha of spruces were planted on a calcareous, stony slope in the 80s.

Restoration measures
2005-2006
Removal of the spruces and the litter layer.

Objectives
Restoration of calcareous Arrenatherion meadowland and limestone thicket.

Management measures
Mowing and grazing after mowing.

Evaluation

Species/communities
- The site was colonised very quickly by a number of interesting species like Hieracium vulgare, Echium vulgare, Ophrys apifera, Cephalanthera damasonium, Fragaria vesca, Centaurea jacea, Origanum vulgare, Galium mollugo, Pimpinella major, Inula conyzae, Orobanche minor and Clinopodium vulgare.
- In an adjoining thorn thicket, plant species like Ophioglossum vulgatum, Cephalanthera damasonium, Listera ovata, Epipactis muelleri, Epipactis helborine, Ophrys apifera and Platanthera bifolia were found.

Other lessons learned
- It is important to completely remove the spruce litter layer.
- Vegetation should be mown (and grazed afterwards) to create suitable growing conditions.

Future points of attention for sustainable results
For some rare fringe and thicket species (e.g. Cephalanthera damasonium) it is important to preserve local thorn thicket.

Cephalanthera damasonium, a very rare orchid in Flanders, was able to colonize a limestone thicket, that was formerly planted with spruces for more than 20 years.
Evaluation

Species/communities

- The fauna has benefited, with, among others, new breeding birds for the area (Circus aeruginosus, Cettia cetti, Luscinia svecica) and dragonflies (Orthetrum coerulescens and Orthetrum brunneum). These were designated as priority species and appeared very shortly after the restoration works. A very strong increase of the damselfly Calopterix splendens was noted, as well as the presence of the Water Shrew (Neomys fodiens).
- There is a relatively large population of the fish Barbatula barbatulus in the area. Possibilities are explored for the introduction of Cottus gobio from a nearby relic population in the same river basin.
- A small population of the snake Natrix natrix occurs in the vicinity, and might colonise the area in the near future.

Other lessons learned

- For dragonflies of flowing water it is important to develop a structure-rich bank zone with open spots. Extensive spring grazing seems an appropriate management measure, creating sufficient foraging and egg-laying spots during the flight period (especially June).
- Water quality is currently the limiting factor with regard to increasing the number of critical priority species.
36. Vallei van de Grensmaas
Kris Van Looy (INBO)

Natura 2000 area: yes
Management authorities: Flemish Waterways Administration ‘De Scheepvaart’, Natuurpunt, Stichting Limburgs Landschap (NGO)

Ecosystem type
Natural river banks and floodplains of the Common Meuse, a large gravel-bed river on the Flemish-Dutch border (Gravel rivers ecoregion).

Restoration measures, objectives and results

<table>
<thead>
<tr>
<th>Starting conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A heavily regulated lowland gravel-bed river with summer and winter dikes and a floodplain with intensive agriculture.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Restoration measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2006</td>
</tr>
<tr>
<td>- Bed widening (1km river length, 5ha gravel bar, 6ha shallow river bed).</td>
</tr>
<tr>
<td>- Bank lowering (2km).</td>
</tr>
<tr>
<td>- New flood channels (4ha).</td>
</tr>
<tr>
<td>- Removal of bank protection (rip rap) (5km).</td>
</tr>
<tr>
<td>- Reshaping gravel pits in a more natural profile (500ha).</td>
</tr>
<tr>
<td>- Restoration of flower-rich floodplain grasslands on former intensively used agricultural land (400ha).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Management measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural riverine landscape of gravel-bed river with wide alluvial plain; special attention for Ranunculion fluitantis vegetations, muddy riverbanks with pioneer vegetations, hydrophilous tall herb fringe communities, lowland hay meadows, xeric sand calcareous grassland and different types of riparian forest.</td>
<td>Natural grazing.</td>
</tr>
</tbody>
</table>

Gravel exploitation is combined with ecological rehabilitation of the Grensmaas and its floodplain.
Evaluation

Species/communities

- The new gravel bars were immediately colonised by the target invertebrate community with characteristic ground beetles (e.g. *Bembidion atrocoeruleum*, *B. punctulatum* and *Lionychus quadrillum*) and spiders (e.g. *Arctosa cinerea*).

- Floodplain meadows and dry river grasslands recovered with typical plant species such as *Rhinanthus alectorolophus*, *Medicago falcata* and *Anthyllis vulneraria*.

- Forest development of softwood and hardwood forest types was quickly replenished by typical plant species (e.g. *Salix purpurea*, *Galanthus nivalis* and *Chrysosplenium oppositifolium*).

- Different target species successfully recolonised the area: e.g. the dragonfly *Gomphus flavipes* and bird species such as *Crex crex*, *Nycticorax nycticorax* and *Actitis hypoleucos*. Other species were successfully reintroduced: e.g. Beaver (*Castor fiber*) and Black Poplar (*Populus nigra*).

- Influx of species and connectivity induced by flooding are extremely high. Successful recolonisation after flooding by some target species was investigated for species like *Origanum vulgare* and *Sisymbrium austriacum*, as well as the dragonfly *Gomphus vulgarissimus*.

Abiotic conditions

- The reconnection of flood contact appeared to be very important for the restoration and rehabilitation of typical riverine habitat types, especially xeric sand calcareous grassland and for the dispersal of seeds and riparian invertebrates. The exceptional recolonisation, habitat generation and geomorphological restoration were initiated by the extreme peak flows of 1993 and 1995, and further enhanced by the flooding of 2001-2002.

- Groundwater lowering due to a too deep bed incision can be restored by bed widening, as the bed re-equilibrates at a higher level.
Future points of attention for sustainable results

Realisation of entire floodplain restoration: still large agricultural areas are present in the floodplain, disconnecting the natural areas.

Public support

As it is a combined project for safety against floods, the acceptance is good. It was further promoted by a good attitude of the nature organisations to public entrance, education, fishing, etc. Ecotourism is a blooming business in the region, benefiting from the project.

References

On the Dutch side of the river a similar, even larger restoration project is ongoing: www.maaswerken.nl

The natural dynamics of the stream are the driving force for a 'living' floodplain landscape with high morphological and ecological diversity. During the extreme peak flows of 1993 and 1995 large parts of former agricultural land in the winter bed of the Grensmaas were reshaped. The floods also play an important role in the dispersal of riverine species.

The Beaver has been successfully introduced along the Grensmaas.
37. Altenbroek (Voeren)

Jan Van Uytvanck (INBO) & Joost Dewyspelaere (Natuurpunt)

Natura 2000 area: yes
Management authority: Natuurpunt

Ecosystem type
Mosaic of mesophilous forests, heathland relicts, former arable land and intensively used grasslands on loamy soils in the chalk ecoregion (c. 130ha).

Restoration measures, objectives and results

<table>
<thead>
<tr>
<th>Starting conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low productive grasslands on thermophilous hill slopes were planted with Picea abies and Populus x canadensis.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Restoration measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter 2000</td>
</tr>
<tr>
<td>Restoration measures consisted of the clearcutting of c. 27ha of these dense, about 50 years old plantations, without removal of the litter layer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restoration of (thermophilous) low productive grasslands, in a gradient from acid to alkaline</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock grazing with sheep during a week in June and October; seasonal grazing by cattle in a grazing block of c. 15ha (1.5 AU/ha from April-December).</td>
</tr>
</tbody>
</table>

Evaluation

Species/communities
Mainly mesotrophic flower-rich grassland communities established with Leucanthemum vulgare, Pimpinella major, Daucus carota and Primula veris. Establishment of thermophilous target species on steep slope sides is slow. Locally Cytisus scoparius, Campanula rotundifolia, Ononis repens, Sanguisorba minor, Thymus pulegioides, Carex caryophyllaea, Carex pilulifera and Carex divulsa subsp. leersii colonised the slope. Butterflies such as Lasiommata megera and Lycaena phlaeas benefit from the restored thermophilous conditions.

Abiotic conditions
Thermophilous conditions were restored on substantial parts of the slope.

Other lessons learned
Restoration is decelerated due to the slow decomposition rate of the thick layer of Picea needles. Mainly Rubus species dominate the vegetation and need to be mowed repeatedly to keep the area open.
The soils in the nature reserve vary from alkaline to acid. Low productive, thermophilous grassland is restored here out of spruce plantations.

### Starting conditions

C. 30ha of intensively used arable land on acid and alkaline soils were abandoned.

### Restoration measures

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>The area was included in low intensity grazing blocks (no topsoil removal).</td>
</tr>
</tbody>
</table>

### Objectives and Management measures

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Management measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation of open woodland and species-rich grasslands</td>
<td>Low intensity grazing (0.25 AU/ha) by a small cattle herd. Occasional removal of tree seedlings in species-rich grassland.</td>
</tr>
</tbody>
</table>

### Evaluation

### Species/communities

On stony alkaline soils, a fast colonisation by target species occurred from the adjacent verges of a sunken road, such as *Oreganum vulgare*, *Clinopodium vulgare*, *Picris hieracioides*, *Crepis biennis*, *Knautia arvensis*, *Inula conyzae*, *Campanula persicifolia*, *Sherardia arvensis*, *Ononis repens*, *Pimpinella saxifraga* and *Agrimonia eupatoria*.

On acid-neutral soils, initially high productive tall herb and ruderal vegetations developed, followed by massive tree establishment of *Acer campestris*, *Salix caprea* and *Betula pendula*. The last of these three species, being unpalatable for cattle, remained and dominates ten years later in a rather dense wood. Some forest ground species have already settled in the young forest: *Lysimachia nemorum*, *Melica uniflora*, *Lonicera periclymenum*, *Brachypodium sylvaticum* and *Geum urbanum*. Apart from tall herbs, short grazed grassland patches also developed in open woodland: some are species-rich with *Stellaria graminea*, *Hypocharis radicata*, *Centaurea jacea*, *Prunella vulgaris* and *Leucanthemum vulgare*. 
**Abiotic conditions**

Only in those (few) cases where a low productive vegetation developed, species-rich grasslands were found. All these sites were limited in nitrogen. Extractable phosphorus concentrations were high in all sites. On alkaline soils, where most target species were found, this seemed to be a minor problem. Comparable high phosphorus concentrations were found in species-rich reference grasslands nearby.

**Other lessons learned**

Species-rich road verges can be very important in providing source populations for the colonisation of restoration projects.

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Pioneer vegetation of tall herbs during the first years of spontaneous succession of former arable land on alkaline, loamy soil. In the background clearcutting for the restoration of thermophilous grassland.

*Ononis repens*
38. Ecological restoration in military areas with Natura 2000 statute in Flanders

LIFE project team 'DANAH' (ANB)

Natura 2000 area: yes
Management authority: Agency for Nature and Forests
Supporting authorities: EU (LIFE), Ministry of Defence

Ecosystem type

Mosaic of about 9,400ha of brook valleys, oligotrophic fens, land dunes and dry and wet heaths on 12 military areas scattered all over Flanders. For many habitat types the best reference areas in Flanders (both in quality and quantity) are all located in these military areas, which make them of crucial importance if Flanders wants to maintain its biodiversity. Because of the multitude of gradients, water types, topographical differences, soil characteristics and still active processes of moor formation or land dune dynamics these military areas provide suitable habitat for an impressive number of red list species.

Restoration measures, objectives and results

<table>
<thead>
<tr>
<th>Restoration measures</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2003-2009</strong></td>
<td>Striving for a good conservation state of the typical biotopes in the areas, with special focus on large open heathlands, land dunes, oligotrophic waters and moors, Nardus grasslands, brook valley communities and acidophilous oak woods. Habitats are restored for a large number of target species amongst birds, plants, fish, amphibians, reptiles, butterflies and dragonflies, especially those protected by the Birds and Habitats Directives.</td>
</tr>
<tr>
<td>Areas with military use and management are combined with a large scale LIFE project for nature management and restoration. Major restoration measures include:</td>
<td>- Management measures</td>
</tr>
<tr>
<td>- Restoration of permanent dystrophic and oligotrophic fens (42ha) by draining them and removal of Juncus effusus vegetations and muddy underwater soils.</td>
<td>Mainly sheep grazing (4,000ha). Additionally: mowing of heathland (175ha) and grasslands (515ha), burning of heathland followed by grazing (130ha) or spontaneous development.</td>
</tr>
<tr>
<td>- 160ha of sod cutting</td>
<td></td>
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<tr>
<td>- Restoration of wet heathland by removing shrubs and trees over 1,250ha.</td>
<td></td>
</tr>
<tr>
<td>- 'Shock-grazing' by sheep (in fences on a small area) to provide better germination conditions for heathland plants.</td>
<td></td>
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<tr>
<td>- Removal of the invasive species Prunus serotina over 1,350ha.</td>
<td></td>
</tr>
<tr>
<td>- Re-meandering of the brook Weerijsbeek over 300m on the shooting range of Brasschaat.</td>
<td></td>
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</tbody>
</table>

Evaluation

Species/communities

Because most of the measures have only recently been executed and due to the scale and diversity of the measures, only few results can be discussed here. It is expected that the measures will be beneficial for the following species and their habitats:
- Amongst the herpetofauna important populations are present of Bufo calamita, Anguis fragilis, Coronella austriaca, Rana arvalis, Triturus cristatus next to the largest viable Flemish population of Vipera berus.
- In some military fortresses different bat-species hibernate. The total area is an important feeding ground for these mammals.
- Several target plant species of heather, fen and moor vegetations are present, such as Dactylorhiza sphagnicola, and regionally important threatened species such as Lycopodiella inundata, Lycopodium clavatum, Drosera species and Gentiana pneumonan-
Other important plants are *Orchis maculata*, *Erica cinerea*, *Drosera intermedia*, *Pilularia globulifera*, *Carex spec.*, *Succisa pratensis*, *Erica tetralix*, *Genista anglica*, *Pedicularis sylvatica*, *Sphagnum* species and *Eriophorum angustifolium*.

- Very important populations of threatened dragonflies and butterflies are present, such as *Maculinea alcon* (6 of 11 Flemish populations on military area) and *Pyrgus malvae* (only 4 populations in Flanders). Other insect species with important populations include *Limenitis camilla*, *Callophrys rubi*, *Hipparchia semele*, *Plebejus argus*, *Quercusia quercus*, *Carterocephalus silvicola*, *Nordmannia ilicis*, *Hesperia comma* and *Somatochlora metallica*.

- Many birds of the Annex I are present as migrants or breeders, such as *Caprimulgus europaeus*, *Botaurus stellaris*, *Lullula arborea* and *Dryocopus martius*. The only remaining Flemish breeding location of *Circus pygargus* exists on the shooting range of the military area of Helchteren. Other important species are *Phoenicurus phoenicurus* and *Oriolus oriolus*. In the past the last breeding pairs in Flanders of *Tetrao tetrix* and *Anthus campestris* existed on these areas, next to some of the most threatened breeding birds like *Oenanthe oenanthe* and *Lanius colurio*.

- A target fish species of Annex II present in Kamp Beverlo is *Lampetra planeri*.

**Abiotic conditions**

Typically, the military areas are characterised by poor sandy soils with acidic conditions, combined with moorland and small river valleys. These conditions are special in Flanders because they retain a strong potential for large scale restoration. The landscape value of these vast areas is evident in an otherwise fragmented Flemish landscape. Together with these sandy plains, a complex mixture of heathland is present. Some areas are renowned for their sand dunes, for which they range in the top 10 for Europe. One of the best conserved river valleys within the Benelux, the Zwarte beek, runs partly through the military area Kamp Beverlo. Furthermore, most areas have an important hydrological role as source for several rivers. Unique for all these areas is that the morphological conditions are still intact, and all abiotic gradients are present. This multitude of gradients, water types, topographical differences, soil characteristics and active processes of moor formation make the military areas into valuable ecosystems.

**Other lessons learned**

- Large-scale nature management of this size was unseen in Flanders, and strongly affected market prices. Costs for standard measures vary enormously within Flanders, which has to be taken into account in the planning phase.

- Burning of heathland on shooting ranges of military areas is a cheap, fast and safe measure (especially on sites with live ammunition). The action itself is the ideal occasion for networking with local fireman-squads, army personnel and the local public.

- Nature management has to be in accordance with the local military needs, to obtain sustainable nature management. Conflicts between these uses have to be dealt with as much as possible in the management plans.

- Large areas ask for large scale measures. Large-scale restoration is therefore top priority in LIFE project DANAH. Questions arising from large-scale measures (deforestation for example), have to be addressed with adapted communication towards the public.
Future points of attention for sustainable results

- A balance needs to be found between nature conservation and the military use. On the basis of this integration possible third party land use can be discussed and zoned.

- A detailed inventory, management and monitoring plan for each area are prepared within the LIFE project and will be published in 2009.

- Intensive agricultural use in the surroundings of the military areas causes eutrophication and draining causes drought of different sensitive oligotrophic habitat types. Tackling these threats in the management plan is essential for their sustainable conservation.

- Education concerning the reasons and background for large-scale management in the surroundings of these military areas is very important. An example is the removal of exotic species that remain dominant in the areas next to the military areas. When the surrounding landowners are aware of the possible threats of these species, the management will gain efficiency.

- A special fund managed by the two project partners is to contain the revenue of biomass and wood from these large areas. Costs for future management can be carried by this fund, after approval by a regional commission.
**Public support**

A protocol for nature management was signed between the Ministry of Defence and the Agency for Nature and Forests. Within this protocol the LIFE project (called ‘DANAH’) could be granted in 2003 for large scale nature management for a period of 5 years. Nevertheless, a sensitization program was set up for the military personnel, aiming for a higher commitment from within the Ministry of Defence. A communication plan for both internal and external stakeholders is executed to provide information about the natural values of these areas and the ongoing large-scale restoration and management measures.

**References**

www.danah.be

Due to a lack of management, large parts of the heathlands are dominated by *Molinia* or became afforested. The objective of the LIFE project ‘DANAH’ is to improve the conservation status of the different Natura 2000 habitats and species, in close collaboration with the Ministry of Defence. On this aerial view a mosaic pattern of deforestation and sod cutting measures in the military area of Houthalen-Helchteren is illustrated.

Grizzled skipper (*Pyrgus malvae*), a threatened butterfly in Flanders, is one of the many target species of the restoration project DANAH.
After Ireland and Denmark Flanders has the lowest proportion of forest cover in Europe. Moreover the forest area is very much fragmented and the ecological quality is generally poor (large proportion of conifer and poplar plantations, forest drainage, nitrogen deposition, intensive management with low proportion of dead wood and so on).

Since the 90s forest protection policy has become more stringent in Flanders. Nevertheless, between 1990 and 2000 the Flemish forest area declined by 6,000ha. Permits for deforestation were mainly given for housing and expansion of industrial areas. In 2000 the total forest area in Flanders was estimated at 146,381ha with 70% of this area in private property.

By Flemish law the persons or organisations responsible for loss of forest need to compensate this by the creation of new forest elsewhere or by paying a tax to the ‘forest compensation fund’, which is used to buy land for afforestation by the government or to encourage forest planting by others. Exceptions on this forest loss moratorium are possible for private stakeholders if the deforestation is part of an approved nature management plan (e.g. to restore heathland). Moreover, Flemish policy aims at a net increase of the forest area by 10,000ha of so-called ‘ecological forest’ before 2010, with 1994 as reference year.

In 2005 planting by the government and incentives towards planting by other stakeholders have resulted in an increase of 205 ha/year over the last 10 years. Taking the annual loss in forest area into account, the net forest expansion is limited to 79 ha/year only (data: Agency for Nature and Forests). It is therefore unlikely that the target of 10,000ha of net forest increase in Flanders by 2010 will be met (fig.1 & 2). The main reasons for this are the high competition for land (with high ground prices as a consequence), the lack of supportive spatial planning and the inefficiency of facilitating legal procedures.
Forest quality is represented in fig. 3 according to an ‘authenticity index’, based on the Flemish forest survey (1997-2000). This index is calculated on the basis of data on vertical structure, amount of dead wood and composition of tree, scrub and herb layer in a large number of random plots in Flemish forests. The index can be used as a measure for the natural character of Flemish forests and thus the potential biodiversity and forest quality. The mean score for the index amounts to a poor 25.9 and only 4 plots have a score larger than 50 on a scale from 1 to 100.

To improve the ecological condition of Flemish forests the Flemish government has taken different incentives:
- By law all forests needs to be valued for their multiple functions, so the economic function can no longer be the single function.
- It is encouraged that all forests have a proper management plan ensuring sustainable use and taking into account ecological values. In 2006 29% of the Flemish forest area had an approved management plan. The ecological ambitions for public forests are set higher than for private forests (for instance on criteria such as amount of dead wood and proportion of native tree species).
- Private forest owners are encouraged to form so-called ‘forest groups’ on a regional basis, which should enable a more professional forest management planning and execution.
- Professional forestry operators are stimulated to obtain an official recognition status by the government, which includes an obliged training on the ecological values and management of forests. Exploitation of public forests is restricted to these recognised operators.
- By 2008 2,554ha were designated as forest reserves with the highest level of ecological ambition.

![Fig. 3: Natural character of forests in Flanders (authenticity index).](image-url)

References:
- [www.natuurindicatoren.be](http://www.natuurindicatoren.be)
- [www.biodiversityindicators.be](http://www.biodiversityindicators.be)
40. Ecological restoration in the Schelde estuary: a process of integrated policy

Laurent Vanden Abeele, Lieven Nachtergale, Dominiek Decleyre, Elias Verbanck, Katrien Weyn, Iris Verelst, Evelien de Munter, Wim Mertens, Kenny Hessel, Dominiek Barbier-Madou, Björn Deduytsche & Geert Flamand (ANB)

Natura 2000 area: yes

Ecosystem type
Brackish and freshwater tidal mudflats and marshes, deep water with natural shores, wet meadows and reedmashes in the Schelde estuary (Polders en tidal Schelde ecoregion).

Introduction
The tidal zone of the river Schelde is situated partly in Belgium and in the Netherlands. For a length of 160km it is characterised by the presence of a complete salinity gradient and a free tidal amplitude, reflected in the spatial sequence of the ecosystem types. It is one of the biggest estuaries of North-West Europe and therefore an important compound of the Natura 2000-network with several SPA's of the Birds and Habitats Directives. The typical ecosystem types are brackish and freshwater tidal mudflats and marshes, deep water with natural shores, wet meadows, reedmarshes and alluvial forests.

Despite the high ecological value and the protection of large zones as SPA and/or Flemish ecological network, it is a fact that the ecoregion of the tidal Schelde and its polders is subject to many anthropogenic impacts such as harbour expansion, dredging activities, embankments, tourism, rural expansion and intensive agriculture. These impacts have led to the deterioration and destruction of characteristic habitats and ecosystem processes. At present the ecological state of the river Schelde is considered as far below the minimal level.

As a consequence of the high need for further socio-economic development in this region and the highly vulnerable state of the SPA, many conflicts have arisen leading to obstruction of important projects. To avoid such conflicts a new approach of integrated projects has been chosen. In essence these projects all try to combine socio-economical growth with ecosystem restoration in order to make the Schelde and its surrounding wetlands more resilient against disturbances.

Policy of integration
According to the Birds and Habitats Directives socio-economical activities are possible in Natura 2000 sites, as long as the integrity of the site is preserved. The integrity of the sites involves their ecological functions. As regards the connotation or meaning of 'integrity', this can be considered as a quality or condition of being whole or complete. In a dynamic ecological context, such as the Schelde estuary, it can also be considered as having the meaning of resilience and ability to evolve in ways that are favourable to conservation.

The 'integrity of the site' has been usefully defined as 'the coherence of the site's ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified'. A site can be described as having a high degree of integrity where the inherent potential for meeting site conservation objectives is realised, the capacity for self-repair and self-renewal under dynamic conditions is maintained, and a minimum of external management support is required.

In order to find a sustainable balance between socio-economic and ecological needs in the Schelde estuary, a policy is required that integrates the different needs with respect for the integrity of the Natura 2000 sites.

Along the Schelde, this policy was successfully applied in two important projects.

The first project is the Long Term Vision for the Schelde estuary (LTVS) where Flanders and the Netherlands worked out and agreed on a Dutch-Flemish estuary management plan. The three priorities of this plan are accessibility of the ports, flood protection and nature conservation. The planning horizon is 2030 when a safe, accessible and ecologically sound estuary should be achieved in both Flanders and the Netherlands.

As a first step of this long term vision a joint development plan for the Schelde estuary with timing horizon 2010 was voted, known as the 2010 Development Plan (OS2010).

In Flanders, the aspects of flood control and nature restoration of this OS2010 were combined in the so called Updated Sigmaplan, decided in July 2005 and April 2006 by the Flemish government. This Updated Sigmaplan realises flood protection by dike consolidation and by construction of controlled flooding areas.
By realising nature conservation objectives within the flood control areas, robust nature sites can be created and the amount of extra, purely nature development areas could be kept to a minimum. This is especially crucial in a densely populated region as Flanders where land is a scarce good. By using the right engineering techniques for the sluices of the flooding areas, both tidal and purely wetland ecosystems can be developed in the controlled flooding areas.

The Updated Sigmaplan enhances a list of nature restoration projects with a timing up to 2030 at which point an ecological sound situation should be achieved. This ecological sound situation was formulated on different ecosystem levels: the system level (or ecosystem functioning expressed in terms of nutrient cycling, hydro-morphological characteristics, etc.), the habitat level (both qualitative and quantitative) and the species level (number of breeding pairs or families, numbers of wintering birds, characteristics of fish communities, etc.).

This list of projects was discussed and optimised in intense consultation of representatives of both the environmental and the agricultural organisations. For the agricultural sector, an elaborate program of social guidance was developed and to a smaller extent also for the recreational sector.

Eventually, the Flemish government has decided to start with a first group of restoration projects of about 1,800ha of brackish and freshwater tidal mudflats and marshes, deep water, wet meadows and reedmarshes.

Another important integrated restoration project is the Strategic Planning Process of the Port of Antwerp (SPPA).

For further port development a strategic planning is required in order to find solutions for different issues as mobility issues and environmental issues such as viability of the nearby communities and nature conservation. The port lies within SPPAs of the Birds and Habitats Directive. Further development of the port is only possible in Natura 2000 sites as long as the integrity is preserved. The compensation plan for the Deurganckdok project is in this context a good example. In the frame of the SPPA further port development is made possible by creating robust nature sites that can guarantee that the integrity of the Natura 2000 sites is preserved in a sustainable way.

Overview of the most important policy processes for ecological restoration in the Schelde estuary: LTVS (Long Term Vision for the Schelde estuary), SPPA (Strategic Planning Process of the Port of Antwerp) and the Updated Sigmaplan.
Conclusion

Approaches that combine ecological restoration and socio-economic development such as the LTVS, the Updated Sigmaplan and the SPPA prove to be effective strategies to deal with Natura 2000 Directives in regions with multiple claims. Consultation and collaboration of the different stakeholders is required though often not easy. By collaborating with different partners and participating in integrated processes it is possible to leave conflict models in favour of win-win situations.

For a length of 160km the estuary of the Schelde is characterised by the presence of a complete salinity gradient and a free tidal amplitude, reflected in the spatial sequence of the ecosystem types. The challenge is to combine different functions: shipping, port expansion, flood protection, nature, agriculture and recreation.

References:

MANAGING NATURA 2000 SITES:
The provisions of Article 6 of the ‘Habitats’ Directive 92/43/EEC
References

Most publications on the restoration projects discussed in this book are in Dutch. The following list of references includes publications in English or with an English summary. More details on the different restoration projects can always be obtained from the authors (see contact addresses in the annex).


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Ruben Walleyn: p. 122
Introduction to the major players in ecological restoration in Flanders

Agency for Nature and Forests (ANB)

ANB more and better

Flanders has wonderful nature, forests and parks. However, these green oases are under a lot of pressure. The Agency for Nature and Forests works every day to conserve, protect and develop these nature areas, forests and parks.

The Agency not only works towards more nature, more green areas and more forests. We also focus on quality: valuable nature, varied green areas and rich forests with a large variety of animals and plants.

The Agency for Nature and Forests thus builds a sustainable future, one with livable towns, a charming countryside and places where nature can be itself.

ANB surprisingly close

The forests, nature areas and parks managed by the Agency for Nature and Forests, obviously appeal most to the imagination. The Agency does so much more than that, however: advising, planning, developing, subsidising, protecting animal and plant species, coordinating game management and fisheries, organising campaigns and activities to increase the support for nature.

The Agency for Nature and Forests has its feet firmly in society and does not operate on its own initiative. The ANB invests in sustainable policy and supports partners who work on more and better nature.

Welcome to our nature!

The Agency for Nature and Forests manages more than 37,000 hectares of parks, forests and nature areas. The ANB opens most of the forest and nature areas and parks to the public. Signposted paths and information signs guide the visitors. Many areas have paths for cyclists or horsemen, or provide the possibility to discover nature in the wake of a guide who expertly conducts visitors through the area. Moreover, several areas have been made accessible to people with limited mobility.

Furthermore, in their capacity of gateways to nature, the Flemish visitors centres and forest museums are the ideal points of departure for a day of relaxation in nature.

The Agency for Nature and Forests is part of the Flemish government.

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Who are we?
As an agency of the Flemish government, the Flemish Land Agency is responsible for the development of open space and the control of manure surpluses in Flanders. Additionally, we give shape to rural development policy in Flanders. Our field of activity covers rural areas as well as open space in the conurbation in Flanders.
VLM operates in the department of Environment, Nature and Energy. Land development, rural development and manure bank are our core activities. In addition to the head office in Brussels, the Flemish Land Agency consists of five local offices in each of the provinces of Flanders. These six locations allow people who want to use our services to reach and visit us in the whole of Flanders.

Our mission:
Arrange open space to be sustainable
Open space becomes increasingly scarce in Flanders. The safeguarding and development of open space has always been one of the VLM’s main activities.
On request of and in collaboration with others the VLM sets up projects to maintain and develop the quality of the open space in accordance with the characteristics of the region. Our policy is to tend to the wishes of the partners and the locals concerned.

Land consolidation, land development for nature and land development are key instruments in protecting the open space. Land banking is an instrument to support land development projects or projects with a high impact on rural space, like e.g. harbour development.
For a specific region we take into account the strengths and needs of the region and we examine where and how land development, land consolidation, land development for nature, land banking or agri-environmental agreements can be useful to solve the problems at hand. We use our toolbox of instruments with regard to and respect for the identity of the region.

Keep the countryside alive
The countryside is host to a mixture of functions: agriculture, economic activity, nature, recreation, tourism, cultural heritage… It needs impulses to enable all of its functions to develop and at the same time maintain its important values for the future.
Together with our partners of all policy domains and government levels we give shape to an integrated rural development. Our Rural Development department acts as trigger and catalyst of a lot of projects in rural areas by offering our know-how and support in dialogue with all players in the region. We organize meetings with our rural partners and form partnerships so that every partner can take up responsibility for the development of a sustainable high quality countryside.
We closely follow the European legislation and actively look for European (co)financing possibilities for our rural projects in Flanders. We are also a member of the European Leader+ programme and the Programming document for Rural development.

Protect the environment against eutrophication
Our division of the Manure Bank (Mestbank) is responsible for reducing the manure surpluses in Flanders. By realizing the objectives of the nitrate directive, executing the ammoniac reduction programme and providing environment-friendly and affordable manure processing, we try to solve the manure problem.
We advise and assist farmers and raise awareness on environmental issues.

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The Research Institute for Nature and Forest (INBO) is the Flemish research and knowledge centre for nature and its sustainable management and use. INBO conducts research and supplies knowledge to all those who prepare or make the policies or are interested in them.

As a leading scientific institute, INBO works for the Flemish government primarily, but also supplies information for international reporting and deals with questions from local authorities. In addition, INBO supports organisations for nature management, forestry, agriculture, hunting and fisheries. INBO is a member of national and European research networks. It makes its findings available to the general public.

INBO employs some 250 staff, mainly researchers and technicians. Besides its Brussels head office, INBO has branches in Geraardsbergen, Groenendaal and Linkebeek.

**Research subjects**

*Distribution and populations of terrestrial species*
This research focuses on land-dwelling species of plants and animals. It includes mainly basic ecology, surveys and monitoring. We offer support for the implementation of Flemish and international reporting obligations, with special attention for the European Habitat and Bird Directives. We also follow the relations between species and environmental factors, as well as the use of certain species as biological indicators for the evaluation of management measures.

*Distribution and populations of aquatic species*
This subject bundles survey and monitoring of water courses and stagnant waters. It also looks into the ecological quality of water courses and stagnant waters by means of fish research. We offer support for the implementation of the European Water Framework Directive, among others.

*Species management and restoration*
These research projects focus on conservation and restoration of native species, with attention to species restoration projects and possible (re)introduction, among others. Research on population genetics, breeding techniques and restoration of native fish species takes up an important part.

*Game management and invasive species*
This subject includes, among others, research on sustainable use and management of game, evaluation of game management plans, and policy recommendations on game management units. Additional research is carried out on control methods for vertebrate animals like rats, and on prevention of the damages they cause. Finally, control of exotic and invasive species is also examined.

*Sustainable use of trees and shrub*
These research projects study the genetic make-up of trees and shrub, which is the basis of the biological variation. We survey the native genetic variety, guard the original genetic material and develop new gene banks. We create superior basic material for economically valuable tree species, and provide cultivation material.

*Ecohydrology and water systems*
This includes research on aquatic systems. We support the actors who are involved with the integration of nature and water management in the environs.

*Edaphology*
Current expertise mainly includes the suitability of habitats for forest ecosystems, and the choice of tree species in forest expansion projects. We survey and analyze forest soils, and carry out research on carbon storage and the presence of heavy metals in forest ecosystems.

*Ecosystem disturbance and restoration*
This subject mainly includes research on the influence of air pollution on forest soils and forest vitality. The idea is to expand this to other ecosystems. The INBO has also gained expertise on biotic damage. Future attention will also be directed at the effects of climate change.

*Distribution and typology*
The main focus is on monitoring here: determining the status and trends in ecosystems, and evaluating them. This is done as part of governmental obligations, such as the (Flemish) Biological Valuation Map, the Habitat Directive and the Water Framework
Directive (both European). In addition, typology, identification and spatial distribution of ecosystems are also included.

**Nature and forest management**
We carry out research on the sustainable use and management of nature areas and forests. We also develop, among others, methods for management monitoring of nature reserves.

**Ecological networks and policy instruments**
This subject includes the continuous support and consultancy for policy people of the Department of Environment, Nature and Energy and other organizations, especially in matters of spatial planning and the elaboration of ecological objectives for land and water management in the Flemish countryside.

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Natuurpunt

Natuurpunt ("Nature Point") is the largest and most important nature conservation NGO in Flanders with many active volunteers. It was created in 2002 as a merger between two former nature conservation organisations, 'Natuurreservaten' and 'De Wielewaal'. Natuurpunt now has over 80,000 members. Its has over 160 local divisions all over Flanders and 80 working and thematic groups.

The mission of Natuurpunt is to increase biodiversity, by having more and better nature areas, to make nature areas accessible for the public and to improve the overall environmental quality. The activities of Natuurpunt include the management of nature reserves, nature study, nature education and nature policy. This is done through a professional team (which amounts to over 200 people) in collaboration with a considerable amount of volunteers.

An important part of the activities of the organisation concern the acquisition and management of nature reserves. The organisation manages 16,500ha of nature reserves. The management work ranges from hay making, cleaning refuse, cutting reed and scrub and polling willows to planting trees. With its large network of volunteers Natuurpunt makes its own policy for its reserves and generates knowledge on the management of these reserves.

The local divisions and working groups are active in nature study and education, such as birdwatching and the organisation of guided tours. Some of the working groups play a key role in the study of nature, acting as knowledge centres for taxonomical identification and the registration of species distribution. Local divisions are also active on local policy issues and are represented in local environmental and spatial planning advisory boards. The national policy division of Natuurpunt acts as a lobby group, represents nature conservation interests in Flemish policy circles and advisory boards and supports the policy work of the local divisions.

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Inverde is the market leader in Flanders/Belgium in trainings on forestry, nature conservation and green space management, with 10,000 trainees annually. The key task of the centre is providing training and educational information. The wide variety of courses involves both theoretical and practical trainings. We operate as a non profit organisation.

The centre's trainees are mainly professionals, such as municipalities, companies and associations. But also private owners, volunteers of nature conservation groups, students and individuals who are interested in forestry, nature, park and green space management without being professionally active in those areas, are included among Inverde's target groups. Many of these people are actively involved in Natura 2000 sites that are managed by ngo's, government or private owners. By providing nature education to these groups, Inverde participates in the conservation and ecological restoration of those sites.

Furthermore, Inverde is in charge of the permanent training (lifelong learning programme) of the full staff of the Agency for Nature and Forests (ANB) of the Flemish government. Training programmes are developed for both the uncertified worker and the managing biologist and engineer.

Finally, Inverde has developed projects for European programmes such as
- **ESF**: Groen Geleerd, development of a training programme for long-time unemployed and lowly-trained women who chose to be trained as a nature or forest worker (www.inverde.be)
- **Grundtvig/Socrates**: Taking Learning outdoors, development of directions for teaching staff to make use of nature and forest areas as powerful teaching environments for children and young people (www.learningoutdoors.be)
- **Leonardo**: Learn for work, development of a European competency profile for forest workers, including tests (www.learnforwork.org)
- **Leonardo**: Distance Learning, development of tools and a methodology to offer forestry trainings via the internet to forest workers and forest owners (www.forestweb.eu)

Through these projects Inverde developed a wide partnership of training centres throughout Europe. The organisation hopes that this publication will help find project partners in the field of the management of natural sites.

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