Restoration of *Unio crassus* rivers in the Luxemburgish Ardennes

2012-2019

LIFE11 NAT/LU/857

LifeUNIO

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FONDATION
HËLLEF FIR D'NATUR

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Natura 2000 : introducing the world's biggest network of protected areas

Natura 2000 is an interlocking network of nature protection and conservation areas within the European Union. Its basis is the two EU Directives: one on fauna and flora, the other on birds.

These set out the species and habitats that Member States are required to protect. The underlying philosophy is to ensure the sustainable use of nature — not the outlawing of human activities.

The two directives and the Natura 2000 network give the Member States a legal basis for halting any further loss of biodiversity.

Luxembourg's Nature Protection Law transposes the EU Directives into national law. Luxembourg's Natura 2000 areas currently cover 701 km², i.e. 27.13 % of the country's surface area.

LifeUNIO

The project in a nutshell

Reference number:
LIFE11 NAT/LU/857

Abbreviated title:
LIFE Resto-Unio

Target species:
Thick-shelled river mussel, *Unio crassus*

Aim:
To improve the quality of mussel-bearing watercourses

Area covered:
River Our and Upper Sûre valleys

Project period:
2012-2019

Budget:
€ 2.057.068

Financing:
50% European Union, 48% government co-funding, 2% n&ë Fondation Hëllef fir d'Natur own resources

LIFE : L'Instrument Financier pour l'Environnement

LIFE Nature is an instrument for funding sustainable projects within the Natura 2000 network.

LIFE projects are concerned with implementing practical conservation measures, and with testing new methods and strategies to be shared with partner organisations throughout Europe.

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Front cover: River Our

Back cover : River Sûre

Co-funding:

LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère du Développement durable
et des Infrastructures
Département de l'environnement

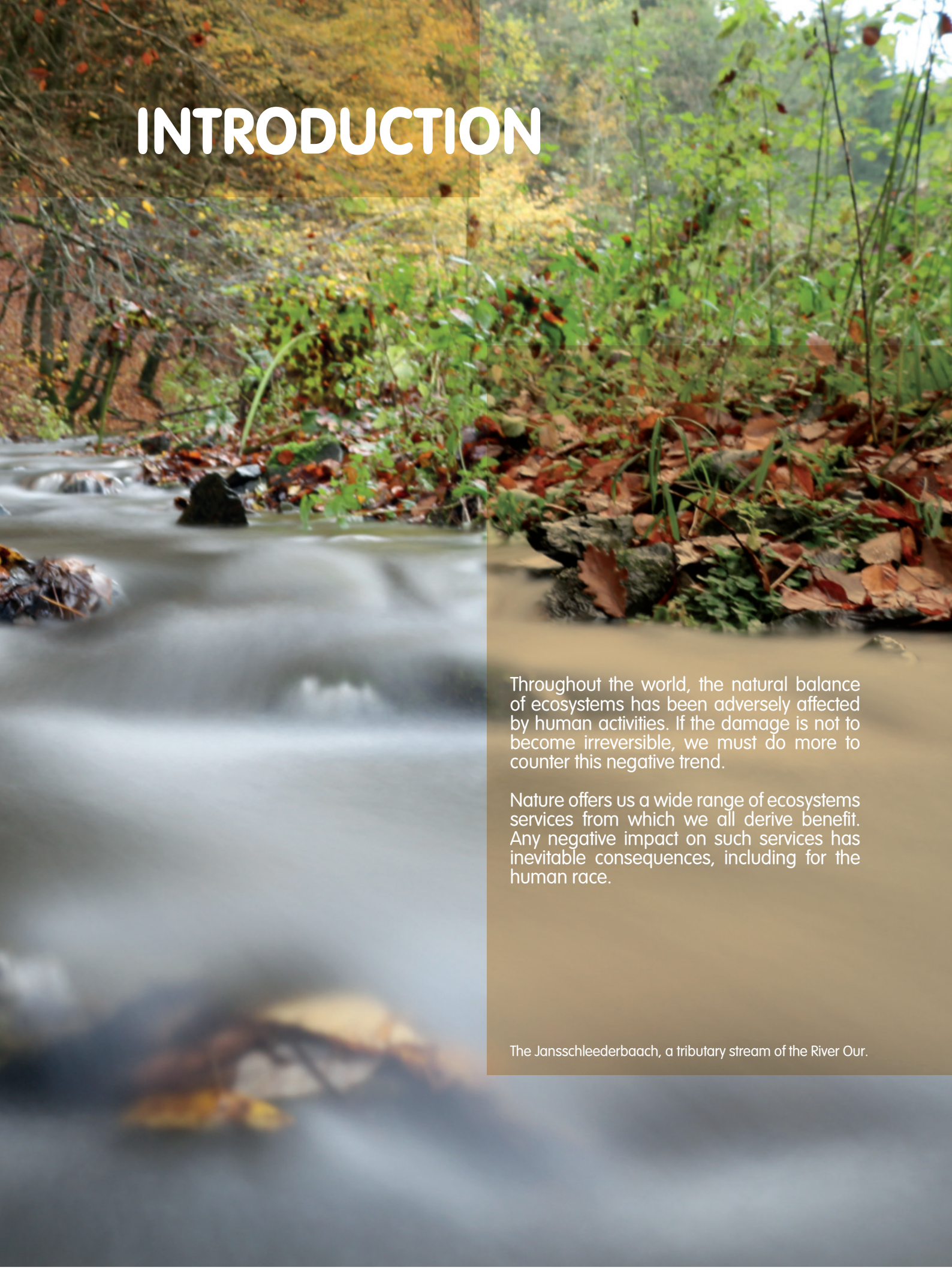
LE GOUVERNEMENT
DU GRAND-DUCHÉ DE LUXEMBOURG
Ministère de l'Agriculture,
de la Viticulture et de la
Protection des consommateurs

Methodological partner:

CHAMBRE
D'AGRICULTURE
LUXEMBOURG

Additional support:
Administration de la nature et des forêts,
Administration de la gestion de l'eau,
Administration des services techniques de l'agriculture,
Community of Weiswampach, Cliärref,
Parc Hosingen, Rammerich, Bauschelt,
Nature Park Our und Öewersauer,
Luxembourg Institute of Science and Technology,
HSBC Luxembourg SA,
Sources Rosport SA, RTL Group

INTRODUCTION



Throughout the world, the natural balance of ecosystems has been adversely affected by human activities. If the damage is not to become irreversible, we must do more to counter this negative trend.

Nature offers us a wide range of ecosystems services from which we all derive benefit. Any negative impact on such services has inevitable consequences, including for the human race.

The Jansschleederbaach, a tributary stream of the River Our.

If we protect the mussels, the mussels will reciprocate by giving us clean water

Healthy mussels = **Healthy rivers** = **Healthy people**

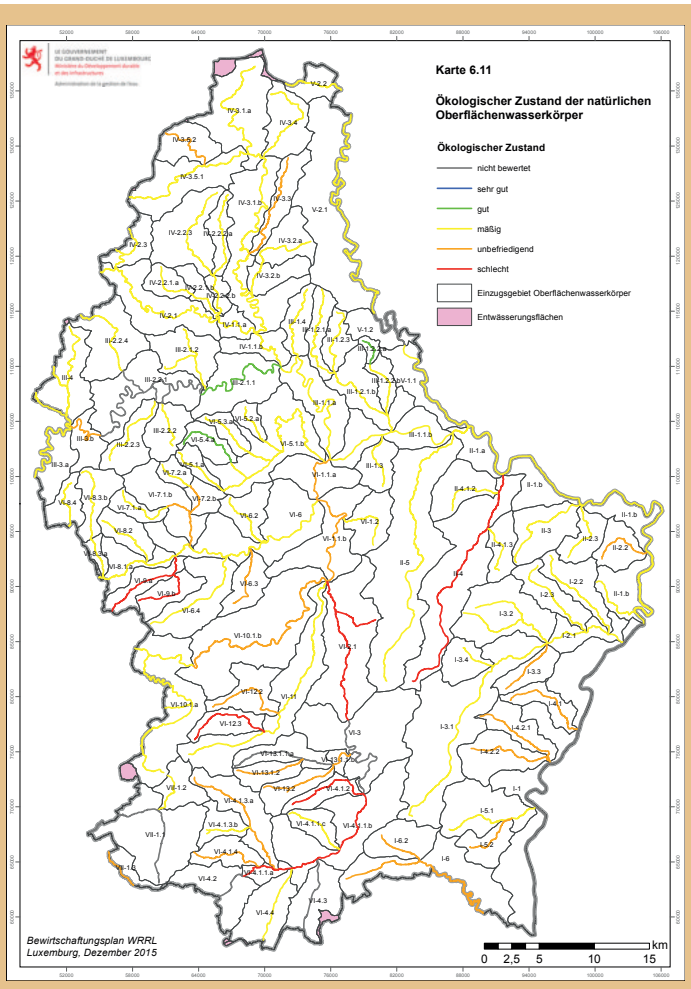
It is by now undeniable that maintaining biodiversity and the environmental services that spring from biodiversity is not just a moral act, but also an economic necessity. It is high time we stop exploiting our planet's natural resources and start conserving habitats and their essential functions for future generations.

The practical measures that have been implemented between 2012 and 2019 under the LIFE Unio project feed into the work of improving the ecological state of watercourses in the Luxembourg Ardennes.

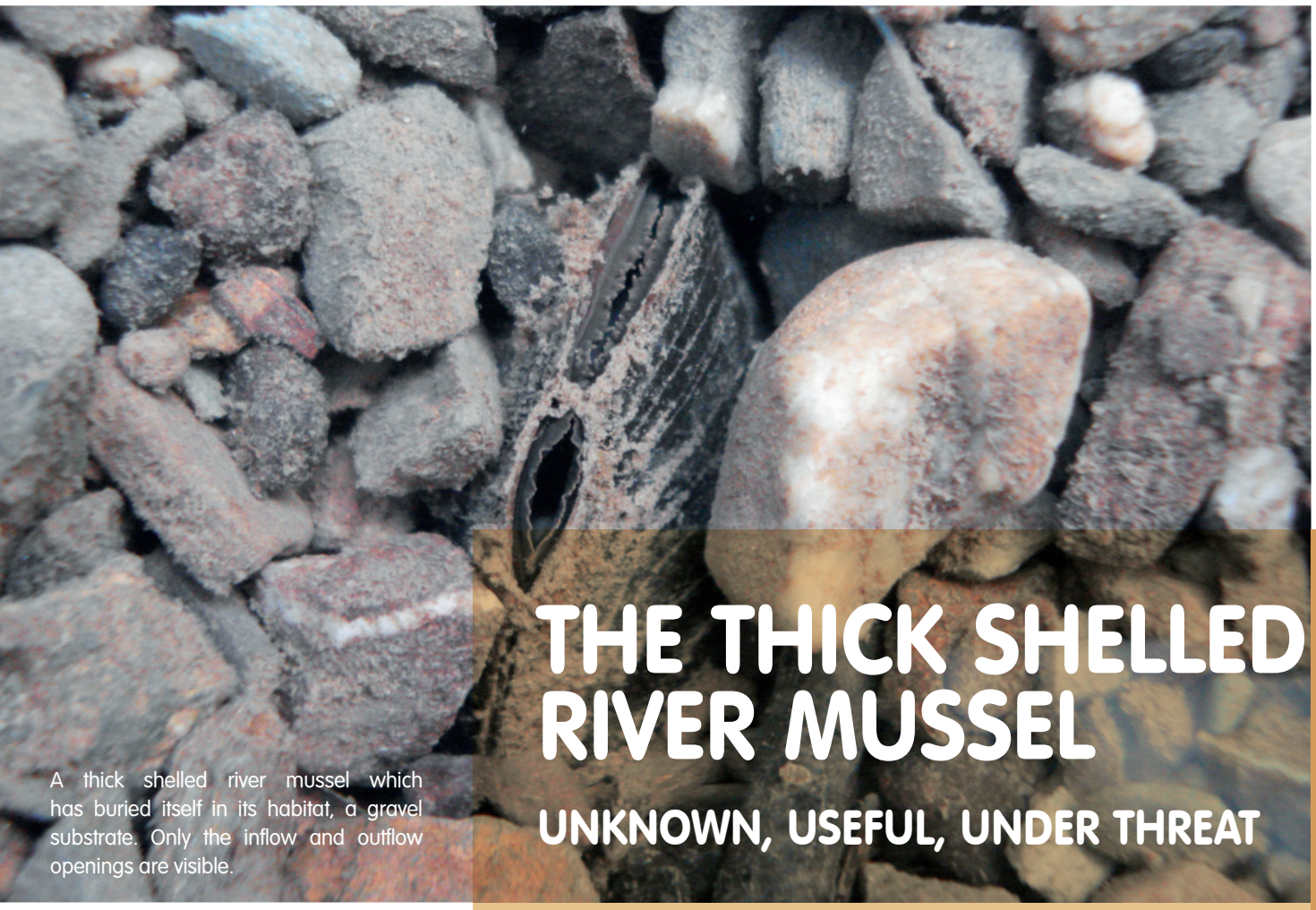
According to the management plan which was drawn up in 2015 under transposition work on the European Water Framework Directive (2000/60/EC), Luxembourg's watercourses are around 1.220 km in length, and most of them are in a "mediocre" state.

Only 3% of Luxembourg's rivers and streams are "good" in terms of ecological status; none are "very good". Europe-wide, only northern Germany, Belgium and the Netherlands are in a similarly poor state.

What is particularly worrying is that between 2009 and 2015, both the biological and the ecological status of the Our river declined further. A lot remains to be done then.



Ecological status of natural surface water bodies in Luxembourg (2015)



A thick shelled river mussel which has buried itself in its habitat, a gravel substrate. Only the inflow and outflow openings are visible.

THE THICK SHELLED RIVER MUSSEL

UNKNOWN, USEFUL, UNDER THREAT

Thick shelled river mussels are filtration champions

Thick-shelled river mussels (for convenience, referred to in this report as "freshwater mussels") have a bulging, egg-shaped, two-part shell. They can be up to 10 cm long and 5 cm broad. They can live for around 25 years, becoming sexually mature at the age of 4 to 5 years. They are equipped with a muscular foot, which they use to dig themselves into the river bed so far that in most cases, only the opening is visible.

The larger of the two openings allows water to penetrate to the gills. Up to 40 litres of water per day per mussel gets filtered in this way, helping to keep watercourses clean in a perfectly natural way.

Thick shelled river mussels are choosy

Freshwater mussels live in brooks, streams and even sizeable rivers. Their habitat requirement is sandy, gravelly areas of the river bed.
In larger rivers, they inhabitat places close to the river bank.

The Upper Sûre

Thick shelled river mussels are an indicator species

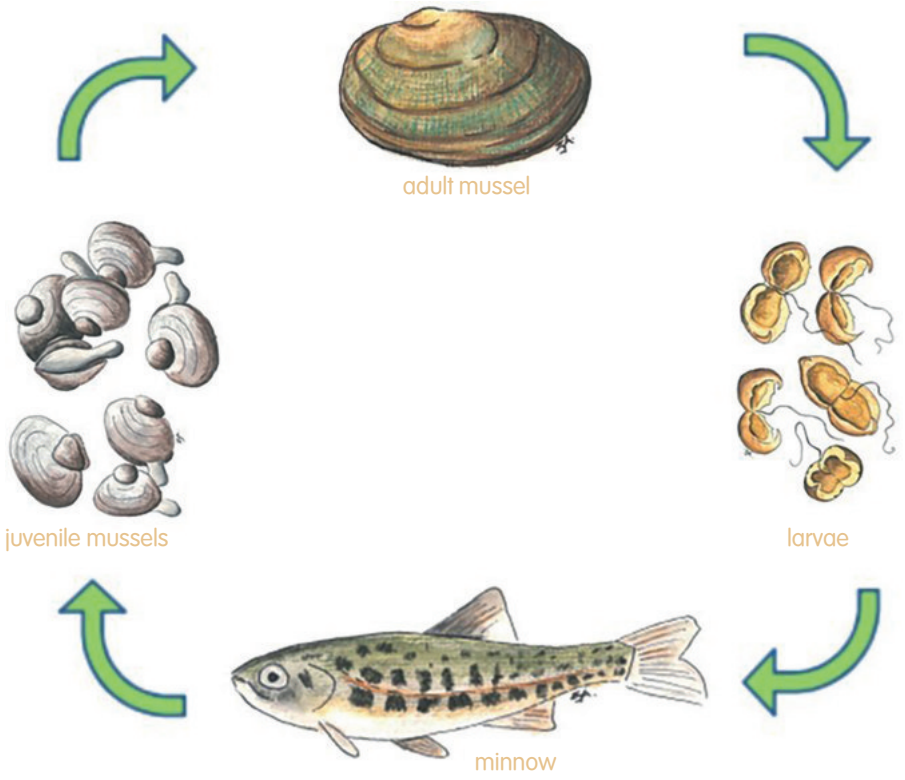
Freshwater mussels are highly sensitive to water and gravel quality. If a river or stream has mussels of all age categories, this is a sign that its ecological status is good.

Thick-shelled river mussels

Thick shelled river mussels are parasites

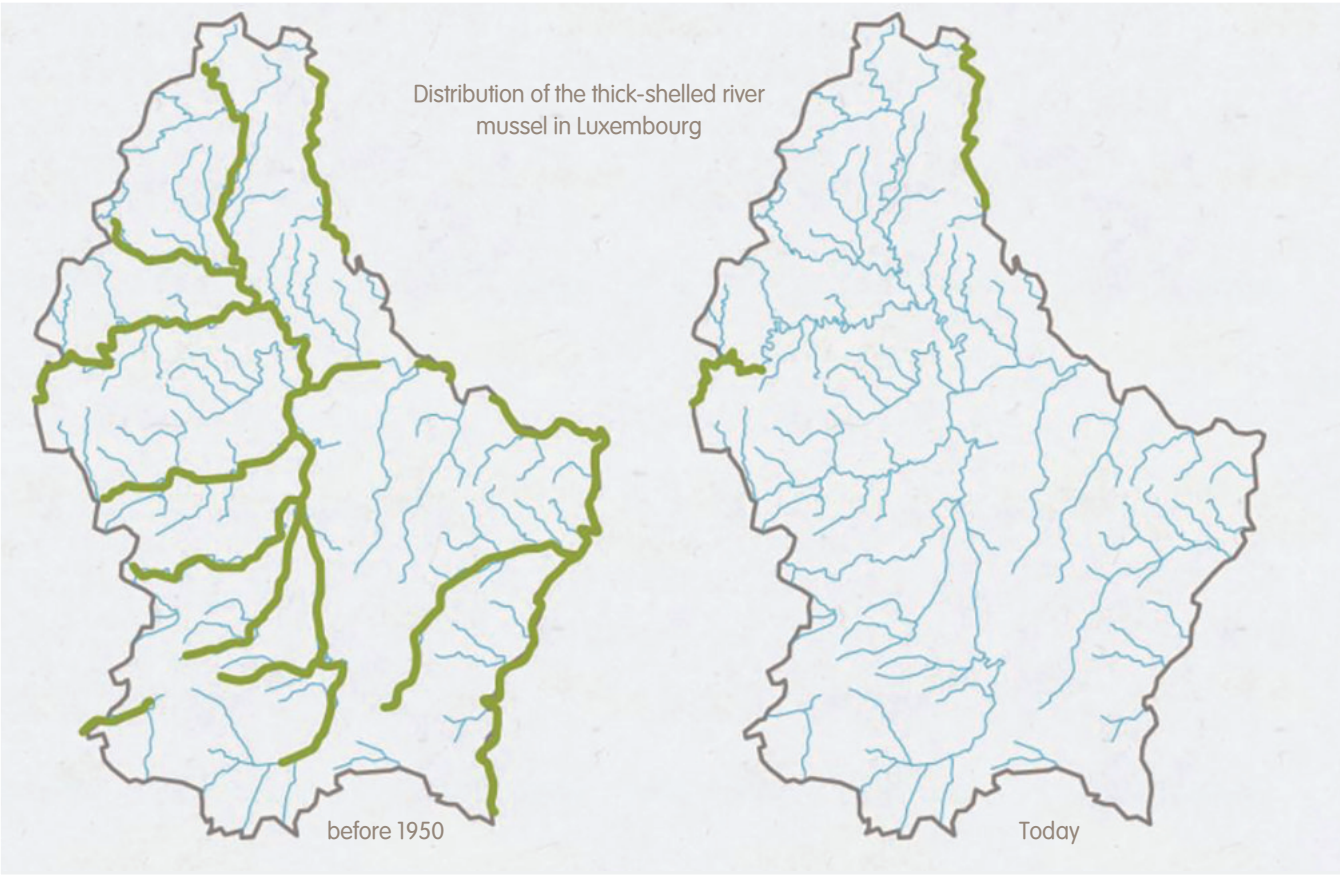
Freshwater mussels need a host fish in order to reproduce. In May or June, the female mussels eject their fertilised larvae, known as glochidia, into the water. Each glochidia measures no more than a fifth of a millimeter and has two days to attach itself to the gills of the host fish (in the main, minnow, chub or bullhead).

Depending on the water temperature, the larvae need between 10 and 35 days to develop into juvenile mussels.



The thick shelled river mussel's life cycle

DRAMATIC DECLINE IN FRESHWATER MUSSEL NUMBERS



The thick-shelled river mussel used to be widely distributed in Luxembourg (and was consequently known as the Common mussel). Nowadays, it is extremely rare. Throughout Europe, the population decline has reached alarming proportions.

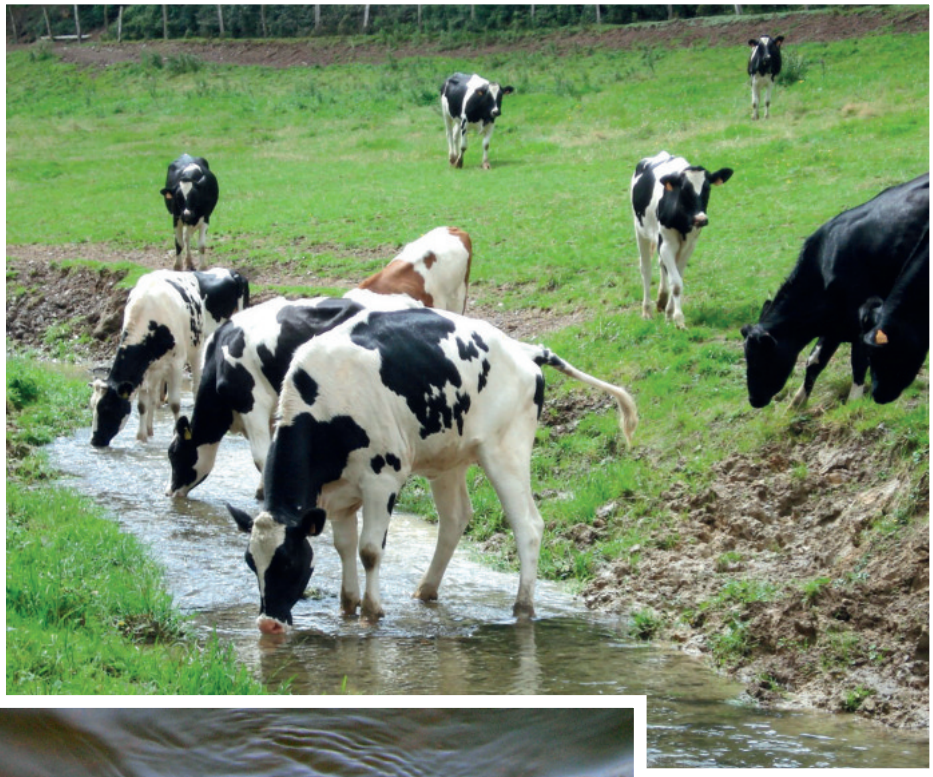
Before 1950, freshwater mussels were found in more than 450 km of Luxembourg's watercourses; today, the population is restricted to 50 km.

There are several reasons for this decline.

Erosion and nutrient input are silting up the river and stream beds and altering the physical and chemical parameters of the gravel system.

Invasive animal and plant species (e.g. muskrat, signal crayfish, raccoon, Himalayan balsam) add to the predation risk or alter the riverine environment.

Migration obstacles for fish prevent them to reach their spawning grounds for reproduction.



Cattle muddy the streams

Muskrat *(P.B.)*

Soil erosion on farmland

THE LAST RESORT IN CONSERVING THE FRESHWATER MUSSEL: ARTIFICIAL CULTIVATION

1

Electrofishing for host fish

In early April, the requisite host fish, minnows (*Phoxinus phoxinus*) are caught in the river and transferred to basins.

2

Adult mussels for breeding

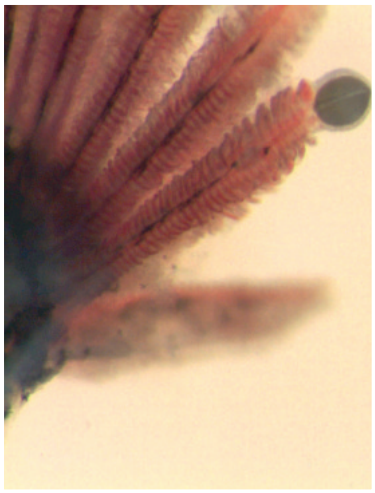
Likewise, at the beginning of April, some 50-100 adult mussels are collected from the two rivers Our and Sûre and transferred to the breeding centre at Kalborn Mill. The mussels are kept in baskets with river water throughput.

3

Glochidia larvae

Early May, the mussels release mature larvae (glochidia). These are pipetted and counted. The target parasitisation rate is around 500 glochidia per minnow.

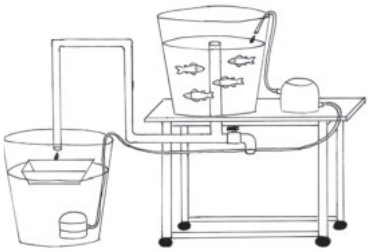
With a view to boosting the residual population of freshwater mussels in the Our and Sûre rivers, juvenile mussels are being cultivated at the Kalborn Mill breeding station. There are a number of steps in this process.



4

Infestation of the host fish

The requisite number of minnows are brought into contact with the glochidia in 15-litre buckets. The minnows remain in the oxygenated water for around 30-45 minutes. During this period, most of the glochidia attach themselves to the gills of the host fish.



5

Mussel collecting installation

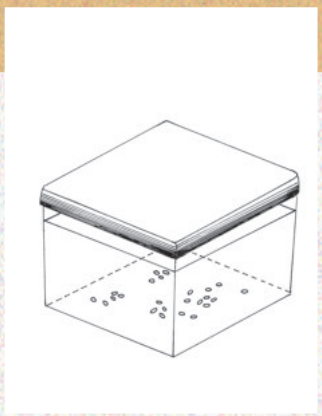
The minnows and their parasite larvae are placed in breeding tanks, where the fish spend their time swimming in a continuous feed of fresh, clear, clean well-water. The outflow is equipped with a fine mesh sieve of 0.063 mm clearance.

6

Juvenile freshwater mussels

By early June, the juvenile mussels have attained 0.2 mm. They then detach themselves from the host fish and are caught in the sieve. Subsequently they are cleaned and counted.

7 In the next growth stage, the juvenile mussels progress through different cultivation systems:



7a

7b

7c

7d

Detritus box

The juveniles spend the first few months in "detritus boxes", where 500 ml river water is supplemented by algae food and microscopic organic particles (the "detritus"). After about three months, the mussels have grown from 0.2 mm to around 1 mm.

Aquarium

Some of the juveniles are transferred directly to 20-litre aquariums with a sand substrate; others move from the detritus boxes to the sand aquariums. In the aquarium, the mussels receive daily feeds of microalgae, and a pump ensures that there is constantly circulating water. After a year, the mussels in the aquariums have grown to around 7-10 mm.

Breeding channel

At 7-10 mm in size, the mussels are transferred to channels that receive a direct inflow of river water. Supplemental feeding ceases, and the mussels are exposed to the ambient temperature of the river. By the end of a year in the channel, the 2-year-old mussels have grown to around 20 mm.

Sediment box in breeding ditch

Some of the mussels from the aquariums are transferred to gravel boxes in the breeding ditch. Here too, the mussels are exposed to the river's ambient conditions; and here too, they have grown to around 20 mm by the end of their 2nd year.

Tagged mussels

8

Release into the natural environment

Once they are 20 mm in size, the mussels are marked with a numbered sticker and are brought back to their natal rivers the Our or the Sûre. They dig themselves into the gravel bed and start filtering the river water.

The following underwater film shows how the juvenile mussels dig themselves into the river substrate.

https://bit.ly/2y6gTQG

Kalborn Mill

Mussel breeding ditch

PRACTICAL CONSERVATION MEASURES TO HELP IMPROVE FRESHWATER MUSSEL HABITATS

Cultivation alone will not save the freshwater mussel population. What is needed, is to improve their habitat, so that the released mussels have a good chance of surviving and reproducing sustainably.

Dermicht, the source of the Schwärzerbaach brook near Bigonville

1

1 **Areas** immediately adjacent to watercourses are particularly sensitive. It is important from the point of view of nature conservation that these areas are managed under a low-input regime, and that the original riverbank vegetation is conserved or restored. For this reason, these areas are being bought up wherever possible and brought under sustainable management regimes.

2 A healthy fish population is immensely important for the aquatic ecosystem. Many fish migrate along watercourses to reach their optimum spawning grounds. But in many small streams there are culverted sections which are a barrier to any further migration. These are therefore being replaced by **bridges**.

2

Work in progress to eliminate barriers to migrating fish populations

3 **Fences** along watercourses are important to ensure that cattle do not destroy the waterside vegetation. This will enable the natural vegetation to regenerate, stop erosion and prevent stream beds from being washed away.

4 **Watering systems**, e.g. nose pumps, allow farmers to graze their stock and protect watercourses.

5 **Gravel** is hugely important for fish, insects and mussels alike. Years of gravel abstraction for construction purposes have had a damaging effect on river and stream bottoms. Mill weirs likewise play a part in preventing gravel movement in rivers. Gravel is therefore being brought in at various places along the Our and Sûre rivers to compensate for this damage.


Fencing to help riverbank strips to regenerate

3


Nose pumps to replace direct watercourse access for cattle

4


Gravel depot

5

6 Globalisation, climate change and the proliferation of **invasive species** are causing imbalances in the feeding chain and a decline in indigenous species of animals and plants.

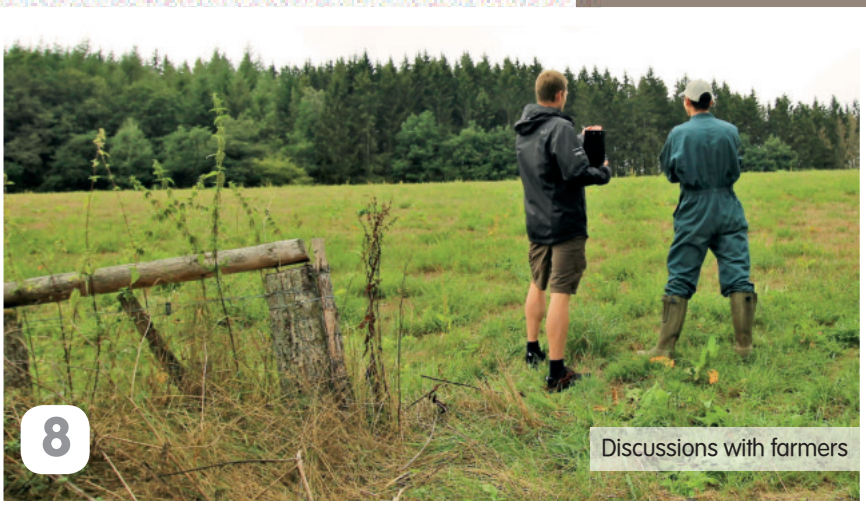
One of the chief culprits is the muskrat, which feeds on mussels (among other things) and whose breeding "fortresses" destabilise the riverbanks. Signal crayfish would also appear to feed on mussels. Steps are being taken to control or eradicate both species.

Signal crayfish

7 Rainwater running down forest logging and access tracks creates deep rivulets and carries lots of sediment into the nearest watercourse. One of the remedies is to build in **gullies** across the tracks to channel the water into the adjacent fields or woodland.

8 There are a range of **agri-environmental measures** designed to ensure that land in the Our and Sûre catchments is farmed sustainably.

The quality of the watercourses can only benefit from measures like: reduced manuring intensity and pesticide input; innovative soil management techniques; and nature-friendly field and riverbank margins.



Discussions with farmers


Forest track rainwater gully

SCIENTIFIC MONITORING

Freshwater mussel monitoring

Without detailed knowledge of **population numbers** in the Our and Sûre rivers, it is impossible to formulate measures to protect the freshwater mussels. In the areas covered by the project, all parts of the two rivers were walked and mapped.

Various mussel banks were also documented in detail and checked each year.

The **fish population** is one of the indicators of ecosystem quality, while certain species of fish play an essential role in the mussels' reproductive process.

Fish stocks in the Our and Sûre rivers and their various tributaries were monitored. Following the removal of migration barriers, like culverts, and their replacement by bridges, fish were once again present in the newly opened stretches of the rivers.

Brown trout

SCIENTIFIC MONITORING OF HABITATS AND THEIR FLORA AND FAUNA GIVES AN INDICATION OF CURRENT STATUS AND OF FUTURE PROSPECTS.

Gravel monitoring

What often happens is that large volumes of fine sediment overlays the gravel at the bottom of watercourses and prevents the water from flowing normally across and through the stream bed.

Supplementary gravel is therefore brought in to provide a habitat for insects and fish. It is important to ensure that the new gravel layer is not itself choked by sediment.

Oxygenation and water flow rates of the river bed are measured with a redox sensor.

It is of extreme importance for the gravel stream bed, that the sediment too can move freely; this is a function both of the water flow rate and of the composition of the sediment. **Sediment transportation** is monitored using sediment traps.

Good **water quality** is the basis of any healthy aquatic ecosystem. The water in the Our and Sûre rivers is monitored at various points to give an indication of the situation in the various catchments and to show at which points any direct or indirect pollution incidents occur.

Water quality monitoring

INFORMATION AND PUBLIC AWARENESS

Successes and setbacks are made public, because it is only by providing information and stimulating public awareness that we can achieve a long-term improvement in the freshwater mussel's habitat and ensure its survival.

Farmers from the area were invited to a total of five information sessions to discuss such matters as water protection, erosion, soil structure and pesticides.

These discussions gave rise to a manual for farmers which was distributed to all farmers in the river catchments.

Representatives of public authorities, natural parks and **sewage treatment consortia** in the two river catchments attended international forums at the beginning and end of the project.

There were annual meetings with the authorities and partner organisations more closely concerned with the LIFE Unio project. The European Commission organised a number of in-situ project visits.

In the course of various conferences, seminars and workshops, contacts with fellow experts and specialists led to **important interaction** on ways and means of cultivating, conserving and protecting freshwater mussels.

The LIFE Unio team organised two international scientifc seminars, and attended and gave presentations at a number of other scientific events.

Public awareness is an essential element of any LIFE project, and LIFE Resto Unio was no exception.

The team produced **information panels** for indoor and outside use.

There is a **project leaflet** in three languages.

The LIFE Unio team had a **mobile information stand** and attended all kinds of festivals and other events in the neighbourhood.

School classes and **groups** of adults were regular visitors to the breeding station at Kalborn Mill.

One highlight in terms of public awareness work has undoubtedly been the **Natura 2000 room** at the Kalborn Mill, which is packed with interesting information.

The 10-minute **film** "Thick shelled river mussel - unknown, useful, under threat" gives viewers an insight into the ecological importance of the freshwater mussel.

"Thick shelled river mussel - unknown, useful, under threat"
https://bit.ly/2N03J18
(Change subtitles in your preferences)

At the beginning and end of the project, there were **public information meetings** in the Our and Sûre catchment areas.

THE PROJECT IN NUMBERS

1.916
cultivated mussels released

7.074
freshwater mussels found in their natural environment

11
events organised

8
barriers to fish migration replaced

2.650 m²
gravel banks created

1
Natura 2000 exhibition room set up

3.752
water samples analysed

9,6 km
watercourses made fish-accessible

520 m
watercourses re-naturalised

2
Natura 2000 management plans co-authored

1.220
trees planted

1
pilot project with farmers to reduce nutrient input

8
cattle watering stations installed

7.944
visitors received

34
electrofishing sessions

13,96 ha
land purchased. 6.59 ha otherwise secured

38
exchanges with international experts

146,3 ha
agri-environment and biodiversity contracts negotiated with farmers

63
rainwater run-off gullies installed in forest tracks

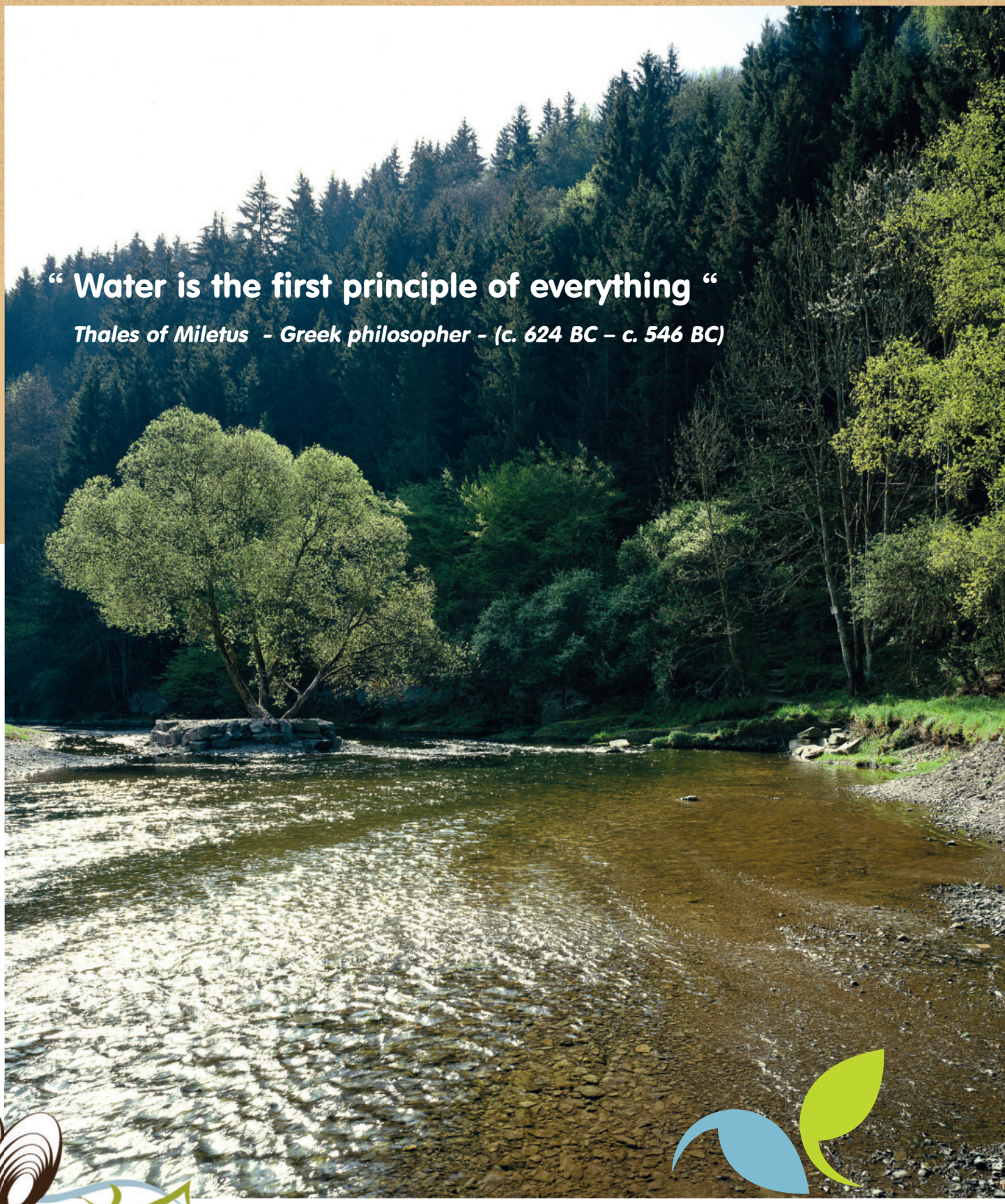
4
cattle overpasses built

97 km
rivers and streams searched for mussels

2
scientific colloquia organised

473
sediment samples evaluated

2.000 m
fencing installed



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