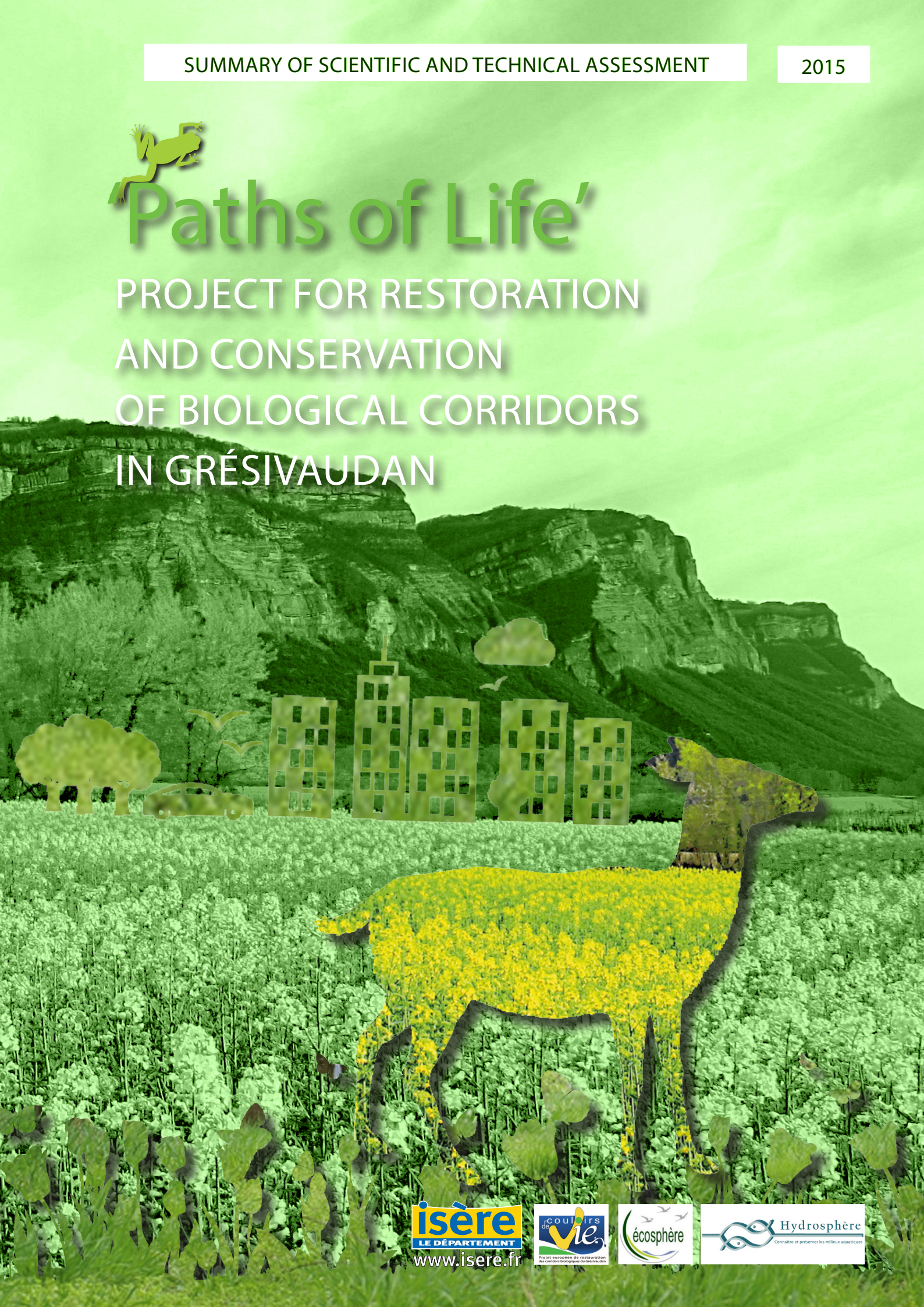
SUMMARY OF SCIENTIFIC AND TECHNICAL ASSESSMENT

2015

'Paths of Life'

PROJECT FOR RESTORATION AND CONSERVATION OF BIOLOGICAL CORRIDORS IN GRÉSIVAUDAN



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couloirs de vie
Projet européen de restauration des corridors biologiques du Grésivaudan

écosphère

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Connaître et préserver les milieux aquatiques

FOREWORD

The Paths of Life project, sponsored by the Isère département, was completed between 2009 and 2015 for the purpose of restoring ecological corridors in the Grésivaudan. This report is a summary of the scientific and technical assessment of this project. This work is also the subject of a complete report which presents the methodologies used in greater detail.

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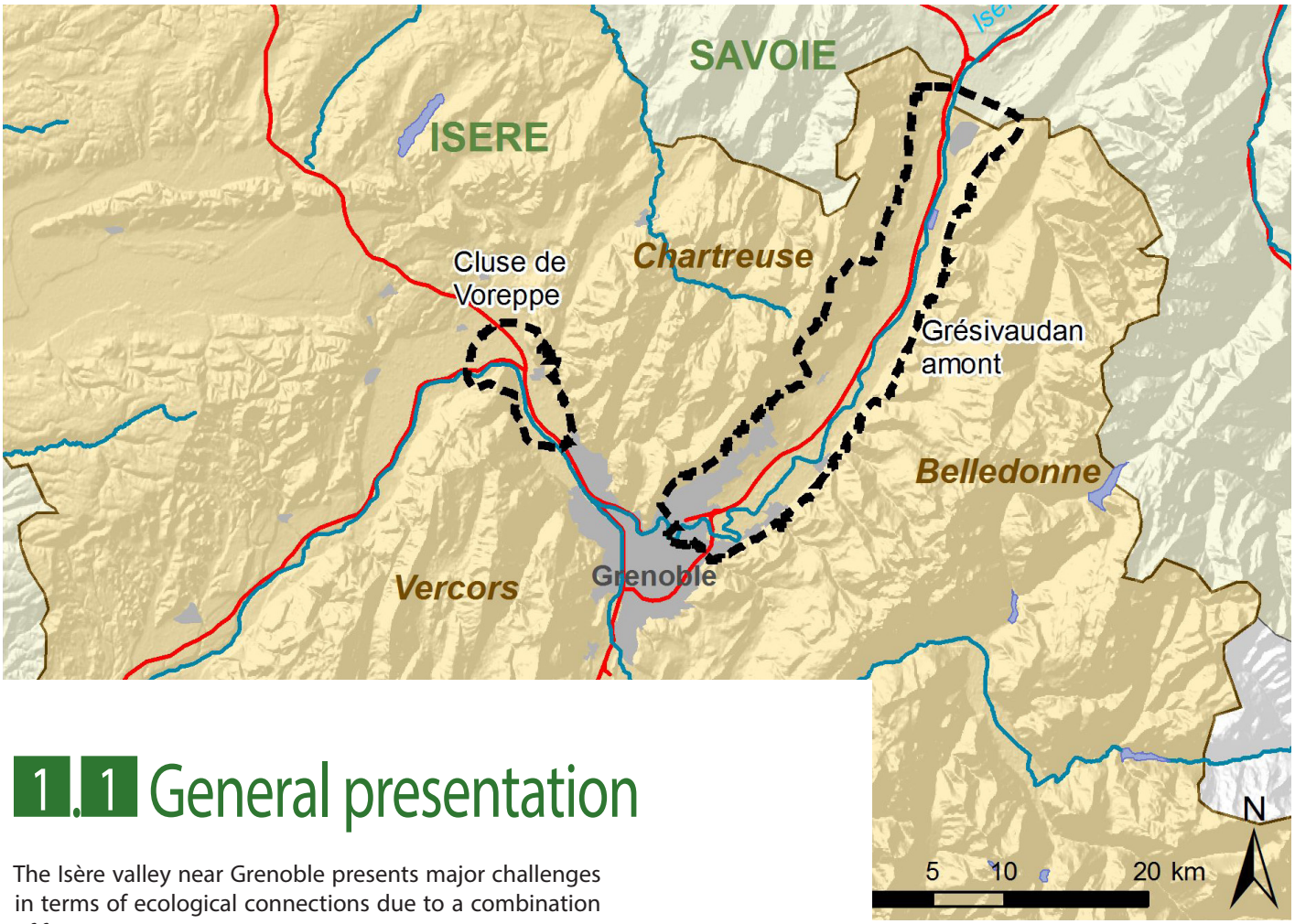
1 THE PATHS OF LIFE PROJECT...



Above : Sectors concerned by the Paths of Life project. Figure: Isère département.

1.1 General presentation

The Isère valley near Grenoble presents major challenges in terms of ecological connections due to a combination of factors:

- Presence of remarkable biodiversity;
- Situation between largely preserved mountain ranges;
- Considerable anthropological pressures (planning, linear infrastructure etc.). In the longer term it is conceivable that the valley between Grenoble and Chambéry will be completely artificialized, preventing most ecological connections between the mountain ranges of Chartreuse, Belledonne and Vercors.

The Isère department identified these challenges when mapping its REDI (Réseau Ecologique Départemental Isérois) in 2001 (below: map of priority sectors of the département in terms of ecological corridors). After this diagnosis phase it sought to create an ambitious programme to protect and restore biological corridors. This dynamic gave rise to a European project called 'Paths of Life' under the stewardship of Isère département, alongside numerous financial and technical partners (Europe, Region, AREA, AURG, RMC water agency, local authorities, associations etc.). The project covers the Isère valley (Grésivaudan) from the borders of Savoie upstream down to the Cluse de Voreppe downstream in Grenoble, i.e. around 70 kilometres.

'The main purpose of this project is to implement a globally coordinated programme for protection and restoration covering the last six biological corridors in the Grésivaudan, which would allow the free circulation of fauna and flora between the subalpine ranges of Vercors, Chartreuse, Belledonne and Bauges' (source FEDER funding application, 2006)..

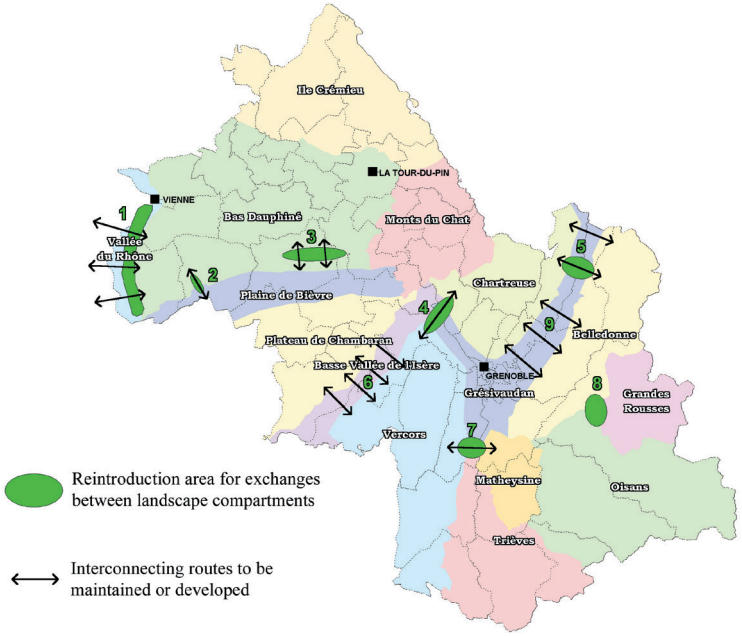
Additional objectives have been identified: 'to improve the quality of life of Isère inhabitants by preserving spaces subject to high urban pressure', 'to reduce the risks of ac-

cidents concerning infrastructure and pollution in agricultural areas'.

This was an experimental project, to the extent that this type of operation had never been performed before in France. It is also a regional planning project: beyond intervention on a small number of priority sites, the idea is to launch an overall dynamic concerning the whole of the area, designed to last for a long time.

The project was completed between 2008 and 2015 and can be broken down into three operational themes:

- Elimination of the main trouble spots;
- Suitable management of 'corridor' spaces;
- Coordination, communication, scientific assessment and learning from experience



Above: priority sectors in Isère in terms of ecological corridors. Figure: Isère département.

1.2 Actions

ELIMINATING OBSTACLES

The circulation of fauna in the Grésivaudan valley is substantially disrupted by linear or occasional obstacles: motorway, road and rail infrastructure, weirs and dams. Actions intended to eliminate the majority of these trouble spots :

- Modification of lower and upper passages of hydraulic structures on road and motorway infrastructures in order to facilitate their use by fauna;
- Creation of a passage for minor fauna on a B-road that cuts across a major amphibian migration route (Le Cheylas);
- Creation of a structure for crossing a motorway in Cluse de Voreppe;
- Introduction of fauna detection systems on B-roads with a view to reducing animal mortality and accidents (collisions);
- Restoration of aquatic corridors where the movement of fish along tributaries of the Isère (Bréda and Ruisset) is blocked by weirs.

IMPROVING THE QUALITY OF 'CORRIDOR' SPACES»

Other actions relate to the management of the whole of the territory; these seek to preserve natural areas and promote the creation or restoration of local ecological corridors, such as hedges:

- Introduction of spatial protection measures;
- Application of a system of management for agricultural test sites;
- Creation of vegetation guide structures (hedges), restoration of the banks of the Coisetan, a highly artificialized watercourse;
- Differentiated management of spaces around transport infrastructure.

Above: Location of the main actions.

1.3 Assessment

The Paths of Life project was the subject of three complementary assessments:

- Sociological assessment carried out by l'Observatoire Social de Lyon (OSL, 2013)
- Scientific and technical assessment completed by ECOSPHERE with the help of HYDROSPHERE
- Administrative and financial assessment carried out by the département itself

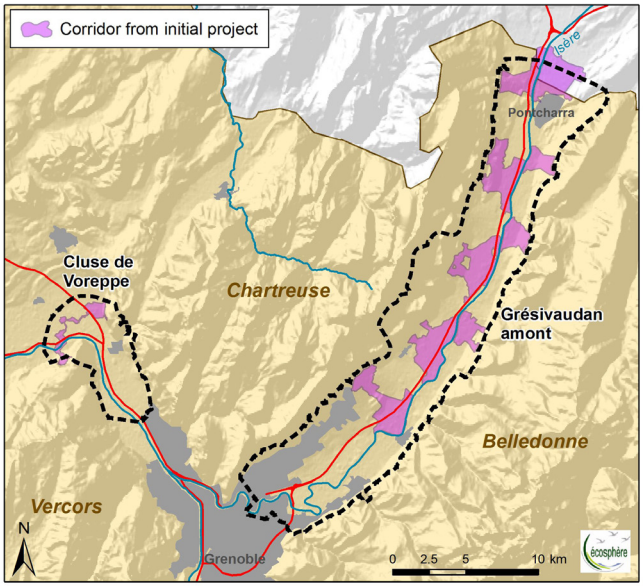
The scientific and technical assessment was performed between December 2010 and the spring of 2015. The work was performed by ECOSPHERE consultancy, in constant collaboration with the Paths of Life. Fish ladders were assessed by the firm HYDROSPHERE, in collaboration with l'ONEMA and the Isère fishing federation. This work was performed with the participation of numerous partners, including meeting within a scientific committee: associations, the hunting and fishing world, research bodies…

Above: The Cluse de Voreppe (in the center, the Vercors)

Above: the Grésivaudan amont (at the bottom: Belledonne)

The study area for this assessment was defined at the beginning of the mission. The Paths of Life project concerned 6 biological corridors defined several years ago (appearing as pink areas on this map). In order to have an overall vision of how the area works it was decided that work on a larger scale was required, across two entities:

- Grésivaudan amont: 25 600 hectares
- Cluse de Voreppe: 3 610 hectares



The specifications for the assessment defined the two objectives of this work: the functionality of the corridor space and the project actions. The work performed is presented according to these two themes.

2 FUNCTIONALITY OF THE AREA

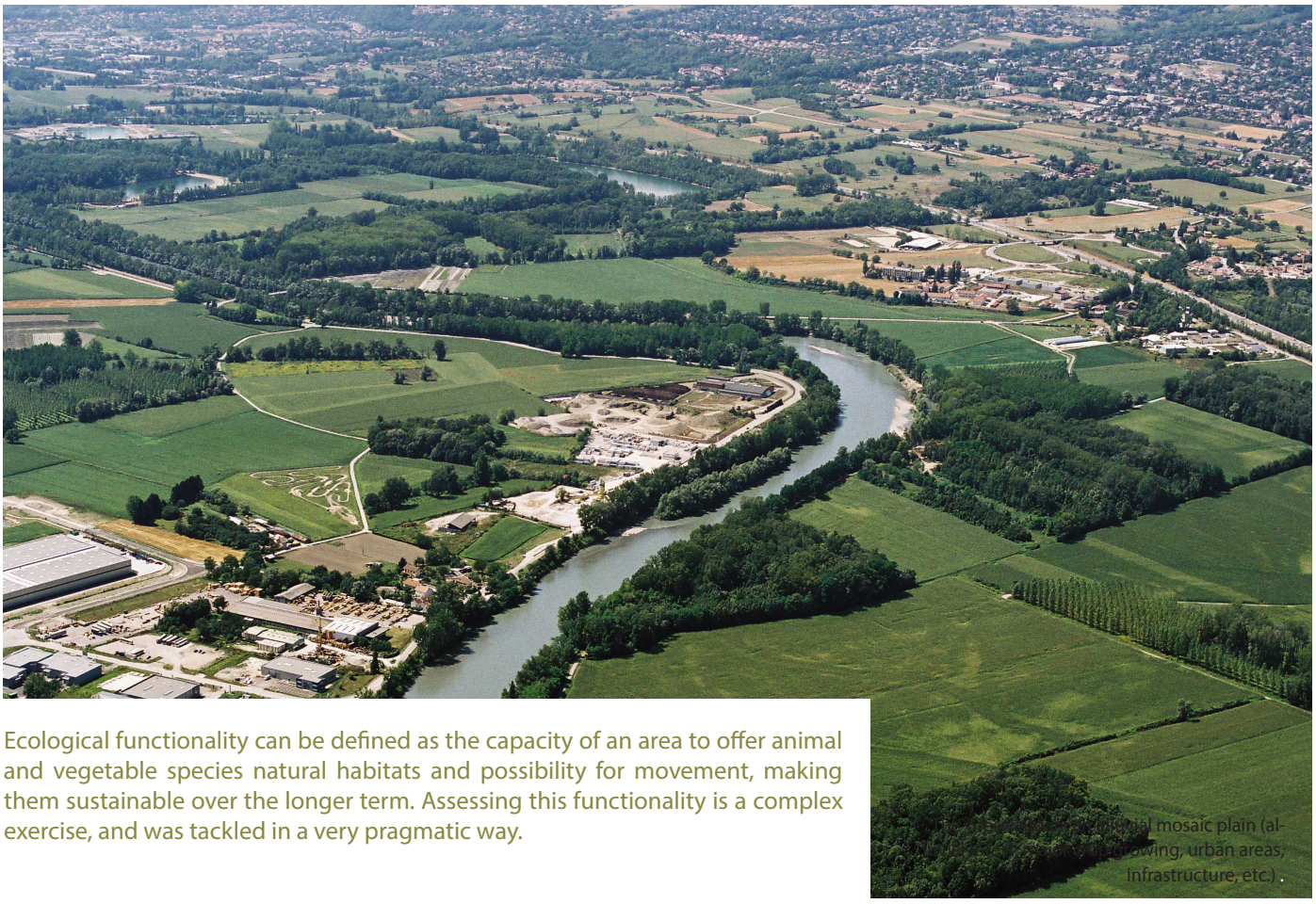


Photo : © AD Drac Romanche

Ecological functionality can be defined as the capacity of an area to offer animal and vegetable species natural habitats and possibility for movement, making them sustainable over the longer term. Assessing this functionality is a complex exercise, and was tackled in a very pragmatic way.

2.1 A brief look at the Grésivaudan

2.1.1 A REMARKABLE NATURAL AREA…

The Grésivaudan presents great geographical diversity:
- Diversity of altitude
- Exposure
- Geology: limestone (Vercors and Chartreuse), crystalline (Belledonne), sedimentary (valley)
- Diversified watercourses – stream, torrents and a large river

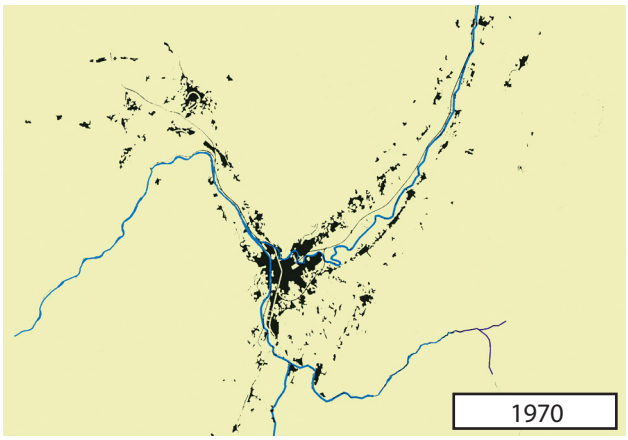
This context explains the presence of a very large number of animal and vegetable species. In the atlas of nesting birds in the Rhône-Alpes (CORA, 2003), the Maille de Crolles showed the greatest wealth throughout the region (130 species), thanks to the coexistence within a small area of very varied types of ecological conditions: lowland and mountain species linked to different environments (forests, wet zones, watercourses, cliffs, meadows etc.) of southern or rather northern influence, and so on – and the same applies to the other animal and vegetable groups.

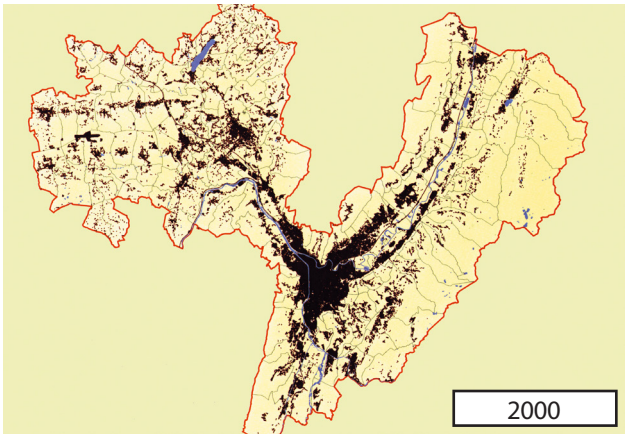
2.1.2 …PARTIALLY PROTECTED…

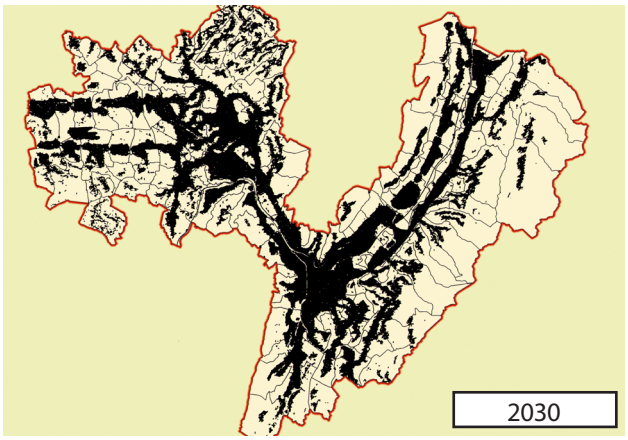
This heritage required the protection of certain remarkable sites, thus prefectural rulings for biotope protection were signed with relation to the marshes of Montfort and la Frette, the woods of Pramiane and other sites.
The département is a key actor through its Natural Sensitive Areas (ENS: Espaces Naturels Sensibles) policy. Following several smaller sites (la Rolande, le Bois de la Bâtie, l'Eterpa, la boucle de la Tailla etc.) a vast departmental ENS (almost 400 hectares) is currently being drawn up in for alluvial forests in Isère département.

The proportion of protected area does however remain less than the département average (around 10% compared to 20% of the whole Isère département), which is a sign of the artificialization of the valley.

2.1.3 … BUT SUBJECT TO EXTENSIVE PRESSURES







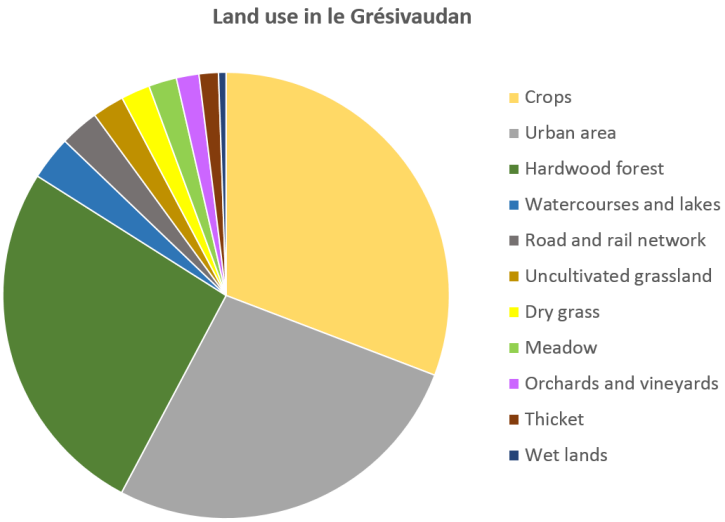
The environmental attributes have for several centuries allowed the development of human activity: agriculture, industry, and traffic of goods and people. This dynamic trend resulted in considerable pressure on natural areas: damming of the Isère in the 19th century, the development of intensive farming (dominated by maize), the replacement of alluvial forests with poplar forests and so on. For several decades urban planning has developed rapidly (an increase in urbanised areas in the Grenoble region of 88% between 1975 and 2000 – source: Scot), to the detriment of natural or agricultural areas.

The land use plan drawn up as part of the assessment gives a picture of the current situation for the study area. It shows the predominance of crop areas (30%) and urban areas (27%).

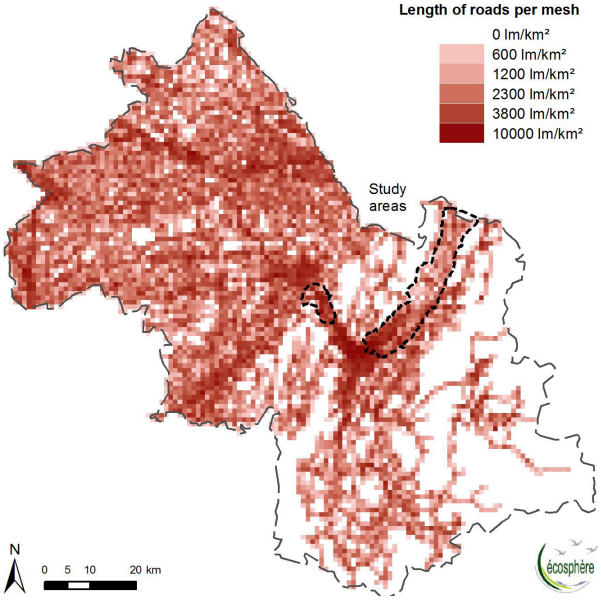
In this context natural spaces are in a precarious predicament. Meadows, which were common in the past, have become particularly rare (2%).

Certain notable animal and vegetable species have disappeared over recent decades and many others are only present in very isolated areas.

Transport infrastructure is concentrated on the lowlands: two motorways, a railway, B-roads and so on. The map below shows road density for the whole of the département. The Grésivaudan valley comes out as a densely networked sector with figures that are comparable with Grenoble, the



Rhône valley or indeed the Chambéry-Lyon corridor. This density, which is particularly high near Grenoble, falls off somewhat as you move further north.



2.2 How to operate with fauna and flora ?

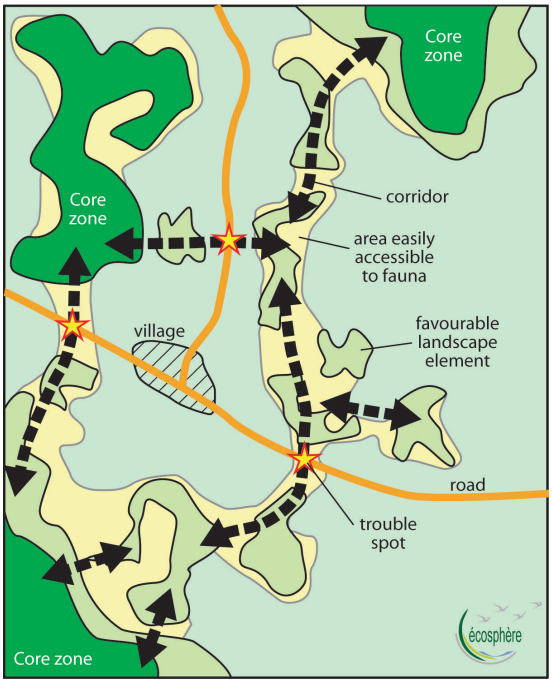
2.2.1 THE NEEDS OF SPECIES

It is worth recalling the principles underlying the Paths of Life project and more generally policies of the green and blue habitat networks.
Any animal species has several requirements of the space in which it lives:

- On a daily basis, finding shelter and food, which often requires regular travel;
- Throughout the year, significant travel can occur to follow the evolution of food sources or for reproduction;
- During their lives, more substantial travel may be necessary for the survival of the species. Certain individuals (generally the young) are highly dispersed and go beyond the normal living areas; these pioneers enable genetic exchanges between populations, colonization of new territories and recolonization of areas from where the species had previously disappeared;
- Certain external events can lead to a progressive or sudden modification in the distribution of individuals: meteorological catastrophe, climate change, human activity etc

The term 'ecological corridor' refers to privileged routes used for species movement; these are areas that meet the needs of a large number of species and which combine larger units – core zones (or biodiversity reservoirs – natural areas comprising the main natural habitat of species). The corridors correspond, for example, to rivers and their wooded banks, to networks of hedges, non-urbanised areas, and so on.

Whilst the principles are general there is a major disparity between species in terms of their ability to move, the areas they use and their social behaviour. Plants also move, in particular, via pollen grains or seeds transported by the wind, water, animals and men.
The whole operation has a fractal aspect: large mobile species (Red Deer, for example) need vast reservoirs and long corridors, whilst smaller sedentary animals (beetles, for example) use the same type of structures, but on the scale of a garden or a wood.



Above: The various elements of an ecological network.

Human activity has major consequences on this organization. It reduces the surface area of natural sites, leading to the disappearance of species that need large continuous surfaces. It creates obstacles for fauna, which sometimes cannot be crossed (for example, dams for fish) or are often difficult and dangerous to cross (roads etc.). On the other hand, man today is a major factor in the scattering of species, through voluntary transport (fish releases, horticultural planting) or involuntary transport (seeds stuck to cars etc.).

Scientists have realised that the conservation of biodiversity cannot be based only on the protection of natural sites that are notable, but which are small and isolated. It requires overall action aimed at the whole region, preserving areas favourable to fauna which cover the whole region and which are connected to one another. This is the 'Green and Blue habitat networks' concept, today laid down in law.

2.2.2 NETWORKS OF FAUNA AND FLORA IN THE GRÉSIVAUDAN

Like the whole region the Grésivaudan attracts certain species with particular means of travel, in response to the specific characteristics of the environment and the impact of human activities. Broadly speaking, a number of major issues can be distinguished.

LOWLAND-DEPENDENT SPECIES: A VERY DELICATE SITUATION

In any sector certain species are only present on lowlands because they cannot find suitable conditions in the mountains. This is the case, for example, for insects and amphibians. These species live the whole year round in the Grésivaudan; their journeys are all local. These species are particularly sensitive because they live in a constrained and fragmented environment; their natural habitat units are small, and are separated from one another by dangerous obstacles (roads, urban areas). The curlew and the corn crake have already disappeared from the Grésivaudan through lack of natural habitats. The Isère River and its banks are a major vector for movement for these species.

A SENSITIVE SPECIES: THE FALSE RINGLET BUTTERFLY (COENONYMPHA OEDIPPUS)

• This protected butterfly is present in the Montfort marshes, one of only three localities in the Rhône-Alpes region. This species suffers from the disappearance of its natural habitat; thus two populations that were known in 1964 in the Grésivaudan have since disappeared. In the Montfort marshes monitoring by marking showed that these animals move around really very little (on average 60 metres during the summer and a maximum of 283 metres). Under these conditions the colonization of new territories or exchanges with closer populations (Chautagne-Lavours, around 70 kilometres away) is very random. The conservation of this population therefore means preserving and managing very subtly its relictual habitats and improving its ability to move around at a very local level (vegetation more than two metres high is an obstacle for this insect).

Photo: © Laurent Spanneut

Source : Belour S. 2014

GENERALIST SPECIES: EXCHANGES BETWEEN LOWLANDS AND MOUNTAIN RANGES

Some species can live in varied environments at different altitudes; this is the case for numerous mammals: Fox, Roe Deer, Wild Boar, Badger and so on. These species are present throughout the year in the Grésivaudan. Their movement between mountains and lowlands is substantial: in the spring the large animals come down from the slopes onto the lowlands looking for grass, (re)colonizing the lowland areas. This group of animals is the least challenged because the mountain ranges are major and high quality reservoirs. It is however sensitive to road collisions, because the roads often cut across their paths. Wild Boar also raise the problem of damage to agricultural areas.

THE RETURN OF DISAPPEARED SPECIES

• The distribution of species is not fixed in stone. Some species (Otter, Beaver etc.) have colonized and will colonize the Grésivaudan and the surrounding mountain ranges because their populations have increased as a result of, for example, regulated protection. Others will find new more favourable environments, in particular within the framework of climate change (eg, species with an affinity for Mediterranean areas, such as certain insects). It is important to maintain a high quality ecological network so that these species can find or retrieve their place within the region.

The Wildcat is currently undergoing a favourable dynamic in the north of the Rhône-Alpes regions; it seems to be recolonizing the Grésivaudan and the surrounding areas. We have photographed a Wildcat type cat* on a known ecological corridor, Chapareillan. (*Identification of this species is difficult, especially as there are hybrids between wildcats and domestic cats.)

MOUNTAIN SPECIES, MORE OR LESS CONFINED TO MOUNTAIN RANGES

Above: antelope killed by a car on the A41 in Meylan (December 2013)

Certain mountain-dependent species (Mountain Hare, Alpine Marmot, etc.) seem to have been occupying isolates for a very long time, except when they have been transported by humans. Other species are today restricted to the mountains, not for ecological reasons, but because the mountain ranges offer sufficiently large and quiet natural habitats (Red Deer, Chamois, Lynx, etc.). These species do not live on the lowlands throughout the year, but may go there temporarily to find food or even to move from mountain range to mountain range. Red Deer and Chamois are a case in point; lowland sightings have multiplied over recent years with an increase in their populations. For these species the Grésivaudan is a natural obstacle to movement, considerably reinforced by human activity. It is important to maintain corridors between mountain ranges so as to allow these exchanges to take place.

THE CHARTREUSE CHAMOIS: A LONG HISTORY OF ISOLATION


Photo: ©J. Carlin

• The Chartreuse Chamois has for a long time been known for its physical specificities, to the extent that it was considered as a separate species. Today we know this is not the case, but genetic studies have allowed us to compile the history of the species. Europe went through several waves of colonization from its eastern bastions. Primitive populations were replaces by new colonizers. The Pyrenees, the Italian Abruzzes and the Chartreuse kept population of Chamois which were less influenced by these new comers. These studies show therefore that to a certain extent the Chartreuse has been naturally isolated for thousands of years; this geographical reality does not temper the excessive impact of human activity and the need for ecological connections between isolated micro-populations.

AQUATIC ANIMALS


Photo : ©Hydrosphère

Above: Isère trout

The Isère River is a living environment and a route for the movement of numerous species: fish, aquatic invertebrates, Beaver, Otter, etc. Tributaries are inhabited by specialized species. There is complementarity between the Isère River and its tributaries, for example, for the Brown Trout, which finds an interesting natural habitat for adults in the Isère River and attractive reproduction areas in the tributaries. This network is degraded by the existence of numerous weirs and dams.

AIRBORNE SPECIES

Certain species have great capacity to move by flight, to the extent that they are not affected by obstacles on the plain: the Golden Eagle moves from range to range, the Common Swift migrates between the towns of the Grésivaudan and Africa. Other species are substantially more sensitive because their natural lowland habitats are becoming degraded (disappearance of meadows, for example) or because their movement – even in the air – is linked to the landscape. This is particularly the case for bats, certain species of which (the Lesser Horseshoe Bat, for example) very much prefer hedges, which are increasingly rare on the lowlands. Also, such travel may be subject to substantial mortality because of collisions along electrical lines and roads, and with building windows.

DARK CORRIDORS

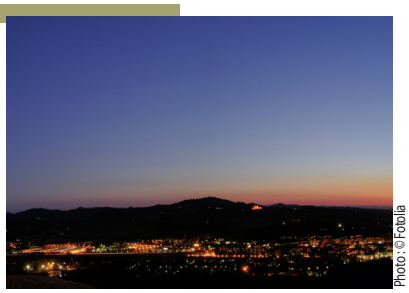


Photo : ©Fotolia

Certain night species, in particular certain bats, need dark areas in which to live and move around; they are in a difficult situation in the Grenoble area where urban lighting can represent a major constraint.

…AND PLANTS?

Plants are in a similar situation to animals, even though conserving the quality of natural habitats seems to be better in the short term for maintaining populations than the existence of possibilities of exchanges between populations. In the longer term these ecological corridors are however necessary, especially as the Grésivaudan has a number of relictual isolated stations (Aphyllanthes monspeliensis in hot dry environments, numerous marshes species etc.).

COLONIZATION AND BIOLOGICAL INVASION

Above: The banks of the Isère being overrun by Japanese Knotweed.

• Numerous animal and vegetable species from far away have been able to colonize the Grésivaudan via different mechanisms: seed flows along watercourses, involuntary transport on vehicles, spontaneous colonization from the arrival of humans and so on. These pioneer species find favourable habitats in this artificialized area, which is rich in ground open to colonization (worksites, roadsides, the banks of Isère River, etc.). We should remember that only a small portion of these species will be in the region over the long haul, and only some of them pose real ecological or health problems (Japanese Knotweed, Common Ragweed, etc.).

ECOLOGICAL NETWORKS LINKED TO THE TYPE OF ENVIRONMENT

Species use the countryside differently depending on the natural habitats they use. On the basis of land use it was possible to computer map the main sub-habitats using the simulated migration method (cf p13).

• Dry, open-environment sub-habitats

Meadows are rare in the Grésivaudan; some do remain on certain slopes (dry grass) and at a number of points on the plain (the airfield at Versoud, for example). Ecological corridors are the banks of rivers and ditches, as well as the sides of roads and motorways.

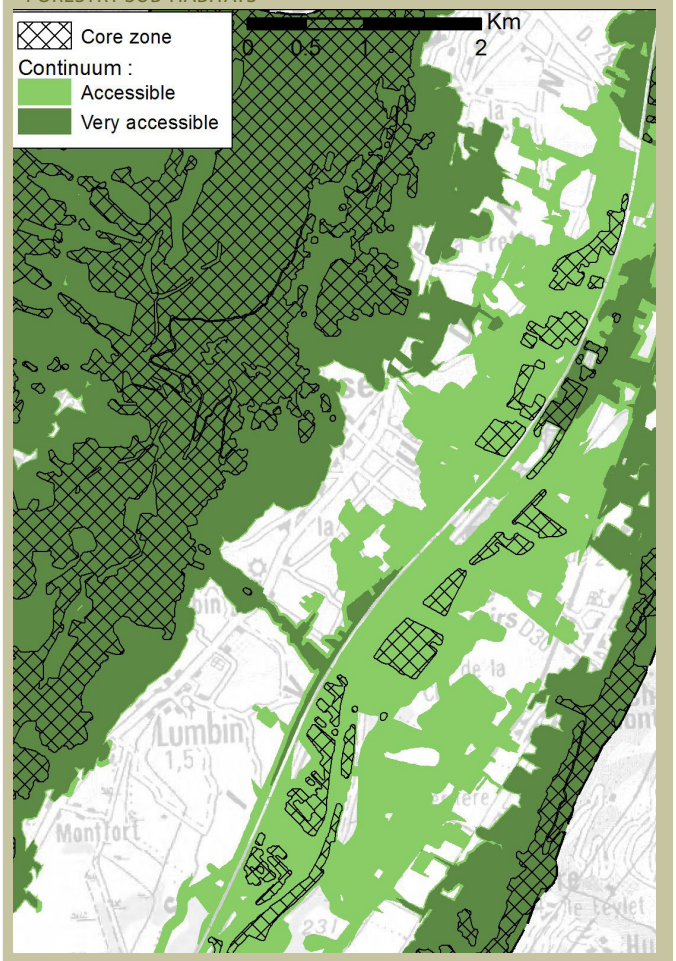
•Wetland sub-habitats

Wetlands are located next to the Isère River and here and there at other points on the plain. Connections between sites correspond to the hydrographic network, rivers and "chantournes" (ditches, of which there are many on the plain).

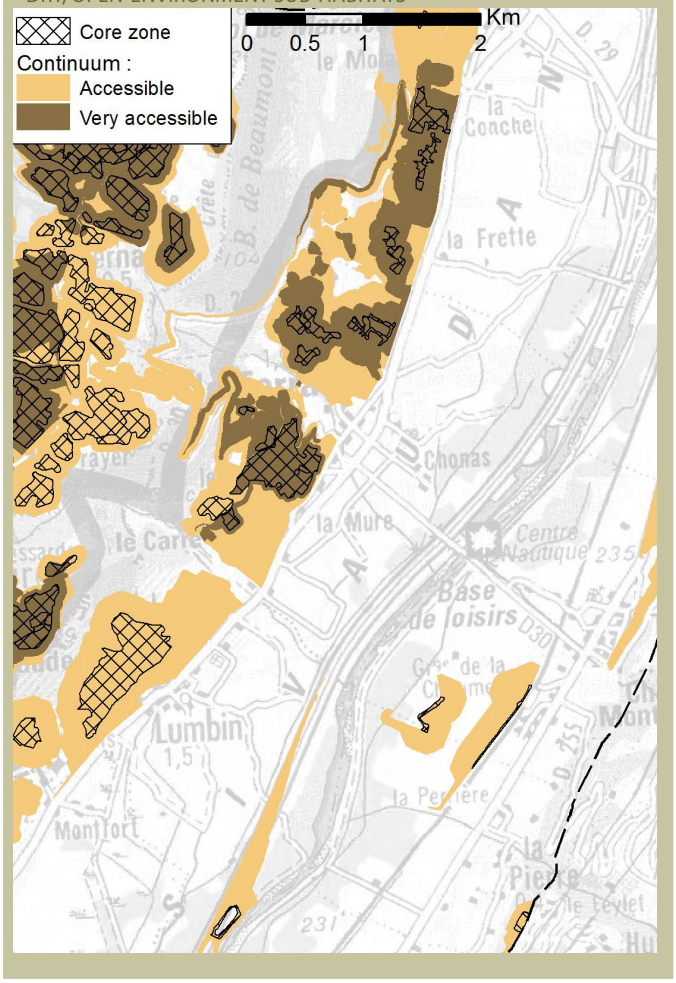
• Forestry sub-habitats

The major reservoirs for these species correspond to mountain ranges and to a lesser extent to the alluvial forest of the Isère. Ecological corridors are primarily the banks of watercourses (Isère River and its tributaries), and hedges where they are present.

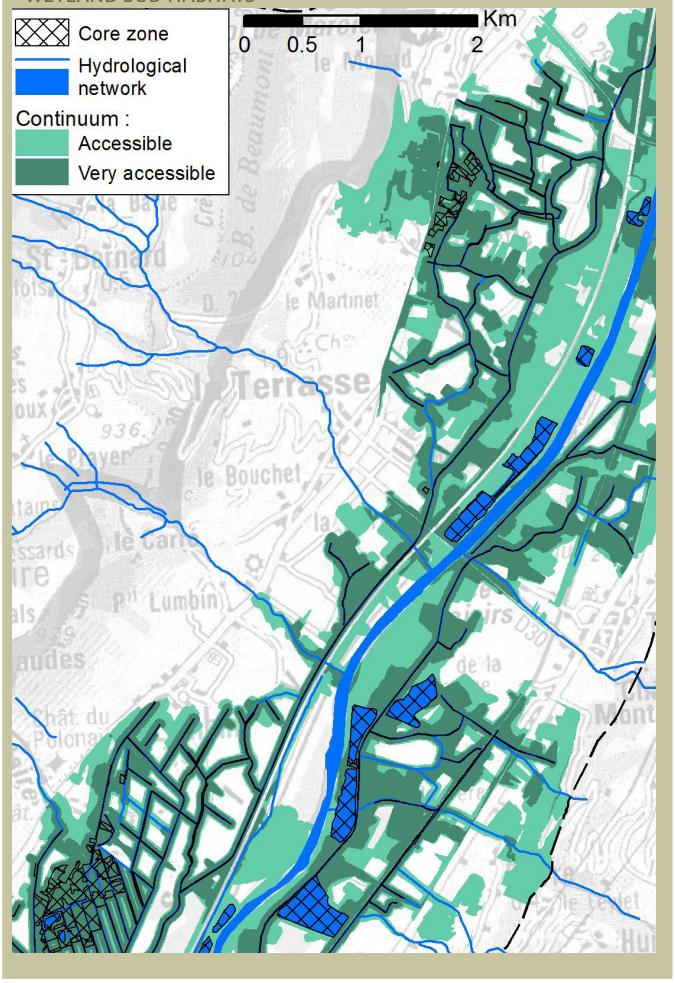
FORESTRY SUB-HABITATS



DRY, OPEN-ENVIRONMENT SUB-HABITATS



WETLAND SUB-HABITATS



2.3 Modelling ecological networks in order to understand and preserve them

It is a good idea to be able to map ecological networks, in order to be able to protect them and restore them. Because of its complexity this relatively new discipline still finds itself within the realm of experimentation and scientific research. The Grésivaudan is a particularly interesting experimental area in this respect for the variety of approaches that have been adopted.

2.3.1 AN APPROACH TO THE FUNCTIONALITY OF THE AREA

The method used within the framework of the assessment had two objectives: on the one hand to help understand and represent the ecological functionality of the valley, and on the other, to contribute to assessing the suitability of the actions implemented.

• A tool for understanding the movement of species: method of 'simulated migration areas'

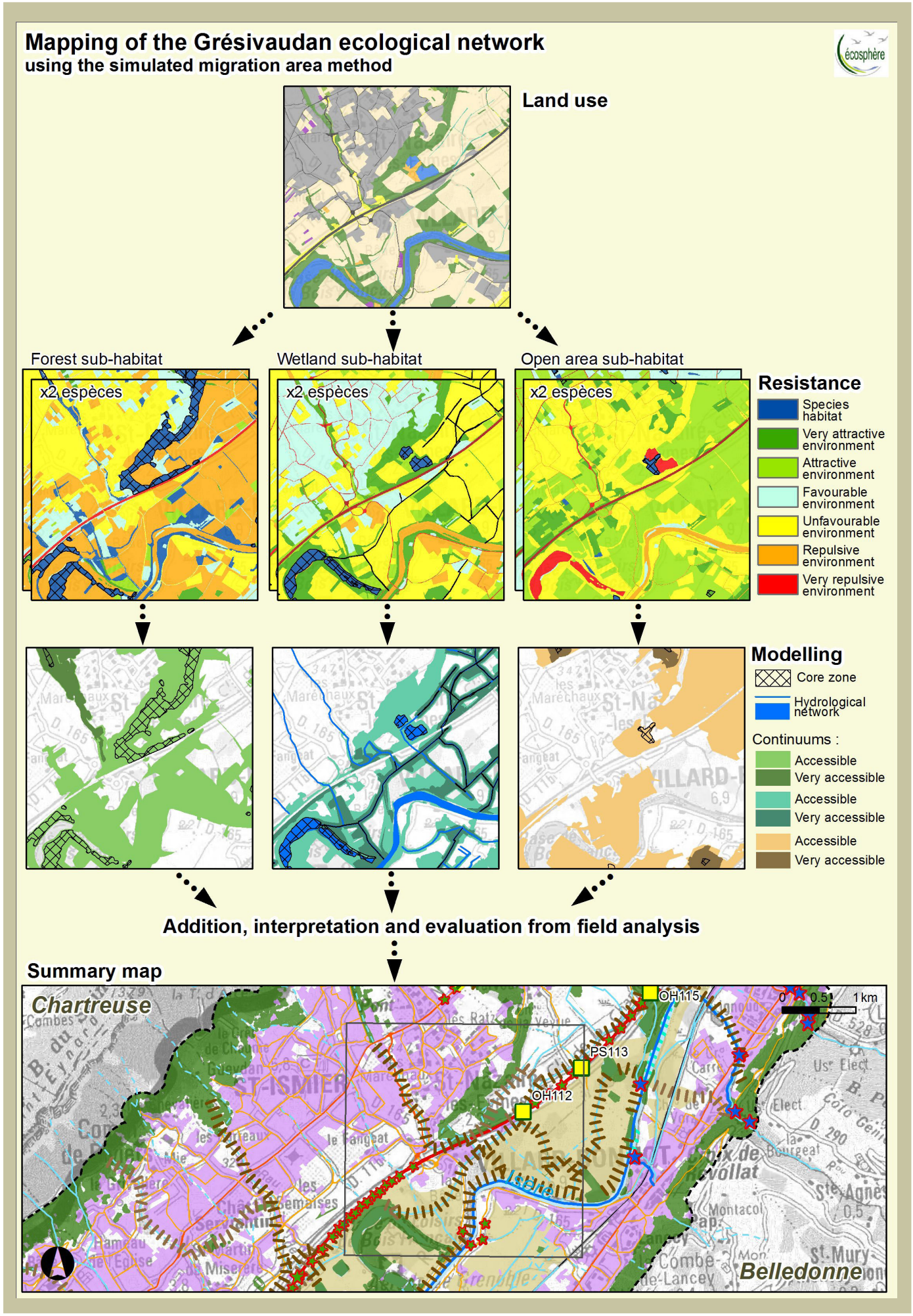
The principle of this method is to simulate in computer format the movement of fauna within the area.
This requires a high quality land use plan drawn up within the framework of the assessment by cross-referencing different information sources, verified on the ground and through the interpretation of aerial photographs (scale 1/25000°, 37 types of environments identified).
A level of 'resistance' is attributed to each type of area mapped; this represents both the capacity of animals to move around and the physiological cost that crossing that area involves. In other words resistance is a result of the more or less favourable (or even very unfavourable) nature of movement of individuals from each environment (thus a forest animal is able to move around easily in the forest, less amongst crops and even less so in the urban context).

Modelling simulates the maximum distance (the notional migration area) that an individual is capable of achieving, starting from its 'natural species habitats', which represent the most favourable habitats for that species. Modelling is performed in three sub-habitats: forests, open areas and wetlands. For each sub-habitat simulation is performed on two species with contrasting movement capabilities (for example, the Common Toad and the Large Copper butterfly for wetlands). This work was performed using a geographic information system (ArcGis Spatial Analyst module).

• …cross-referenced with field knowledge

These sub-habitats are then analysed; the results of the modelling must be interpreted in order to identify the preferred axes of movement, the famous biological corridors. The 'trouble spots' (obstacles to the fauna moving around, crash zones) are identified and synthesized in the Réseau Ecologique du Département de l'Isère (REDI), the Schéma Régional de Cohérence Ecologique (SRCE), whose Référentiel des Obstacles à l'Ecoulement (ROE) data have also been added to the map. Crash data from the motorway operator AREA has been added.
The result allows us to rank the different elements of the landscape according to their role in the ecological network.

The following page presents the different stages of this mapping process.


Mapping of the Grésivaudan ecological network
using the simulated migration area method
écosphère
Land use
Forest sub-habitat
Wetland sub-habitat
Open area sub-habitat
x2 espèces
x2 espèces
x2 espèces
Resistance
Species habitat
Very attractive environment
Attractive environment
Favourable environment
Unfavourable environment
Repulsive environment
Very repulsive environment
Modelling
Core zone
Hydrological network
Continuums :
Accessible
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Accessible
Very accessible
Accessible
Very accessible
Addition, interpretation and evaluation from field analysis
Summary map
Chartreuse
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PS113
OH112
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0.5
1 km
Belledonne

2.3.2 - A SUMMARY MAP TO REPRESENT THE GRESIVAUDAN

The creation of the summary map of the Grésivaudan ecological networks is aligned with the following principles:

- The core zone results from the addition of three sub-habitats: on the one hand the zones identified by the land use (habitat and minimum surface type criteria), on the other classified watercourses. These areas include very different natural elements: they are the most appealing sites for the three sub-habitats and may also be wetlands, fairly large forests, meadow areas etc.

- The corridors correspond to a selection of the main sub-habitat corridors. They are separated into two levels, representing their degree of importance.

- 'Easily accessible spaces' represent corridors which are not linear: the movement of species can be achieved in all directions and not only along a single path. These areas are filled with a high density of natural or agricultural areas and a low level of urbanization.

- 'Preferential zones for crossing the Isère River' are also mapped: these are the easiest points of crossing for large animals.

- Trouble spots (obstacles for fauna) are the result of different inventories performed by SRCE, ROE and AREA.

- Infrastructure and urban areas appear on the map because they represent possible obstacles to the movement of species..

- The work performed as part of the Paths of Life project is also shown on this map.

• Understanding the limits of this representation

Ecological network maps are complex to compile because they must represent as many elements as possible whilst prioritizing ease of interpretation. Certain simplifications are necessary and it is sometimes useful to return to the sub-habitat maps in order to find more precise information.

The elements identified (core zone, corridor) concern all species present in the Grésivaudan, and includes all species except airborne species.

The areas which remain "white" – i.e. outside the core areas, areas which are easily accessible or corridors – are less accessible from core zones. These zones, like urban areas, are not biological deserts; they can allow passage or even offer habitat to certain species.

• How can this map be used?

This map was made as part of the Paths of Life project assessment. It is designed to better understand the sectors ecological network, so as to assess the overall functionality of the area and resituate actions performed in their context

It is not intended to be applied directly within a regulatory framework, such as creating a local urbanization plan (PLU) or performing an impact study. Application on a local scale requires more detailed mapping on the basis of more field work.

Summary map of green and blue habitat networks

Core zones

Core zones of green and blue habitat networks

List 1* watercourse
List 2* watercourse
} Watercourse classified in both lists

* Classification of watercourses – article L.214/7 of the Environment Code

Biological corridors

Primary
Secondary

Area that is easily accessible for fauna
This is a diffuse corridor

Preferential crossing points of the Isère River

Blue habitat network specific corridors

Permanent watercourses
Intermittent watercourses
Lakes and wide watercourses

Obstacles to movement

Trouble spots

Terrestrial (crushing of animals etc.)
Accident trouble spot line
Aquatic (weirs etc.)

Infrastructure

Motorway
Busy road
Road
Railway
Urban/artificialized area

Work performed

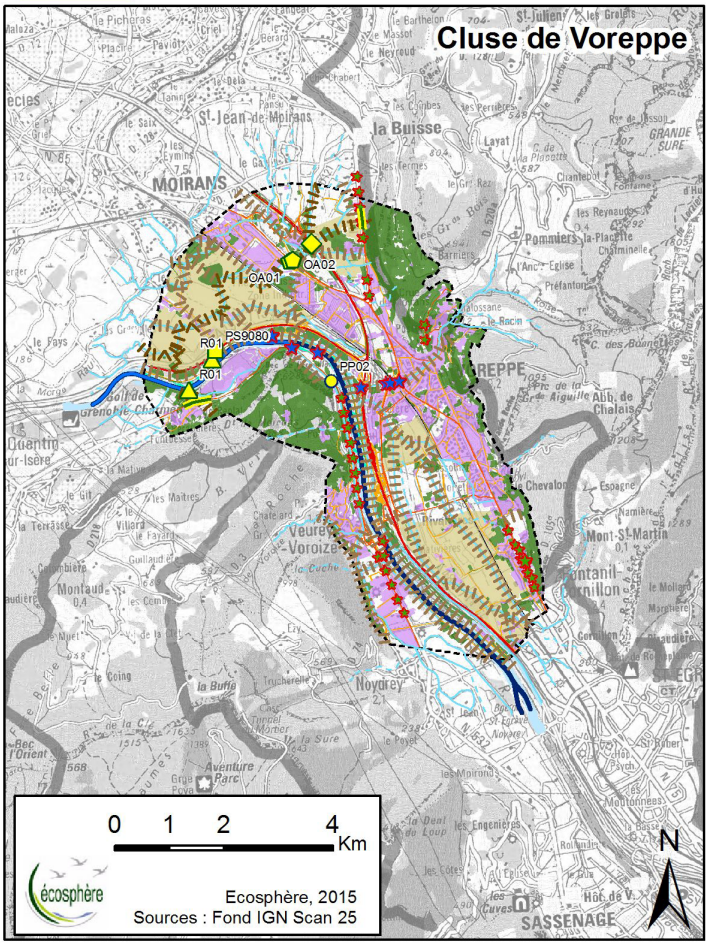
Structure modified (motorway and railway): OH, PI or PS
Ecobridge project: PS
Passage of small animals (road): PF
Access ramp for fauna: R
Restoration of Coisetan banks
Fauna detector
Fish ladder

Légende :
OH : Hydraulic structure
OA : Bridge or tunnel
PF : Fauna passage
PPF : Small fauna passage
PI : Lower passage
PS : Overpass
PP : Fish ladder
R : Ramp

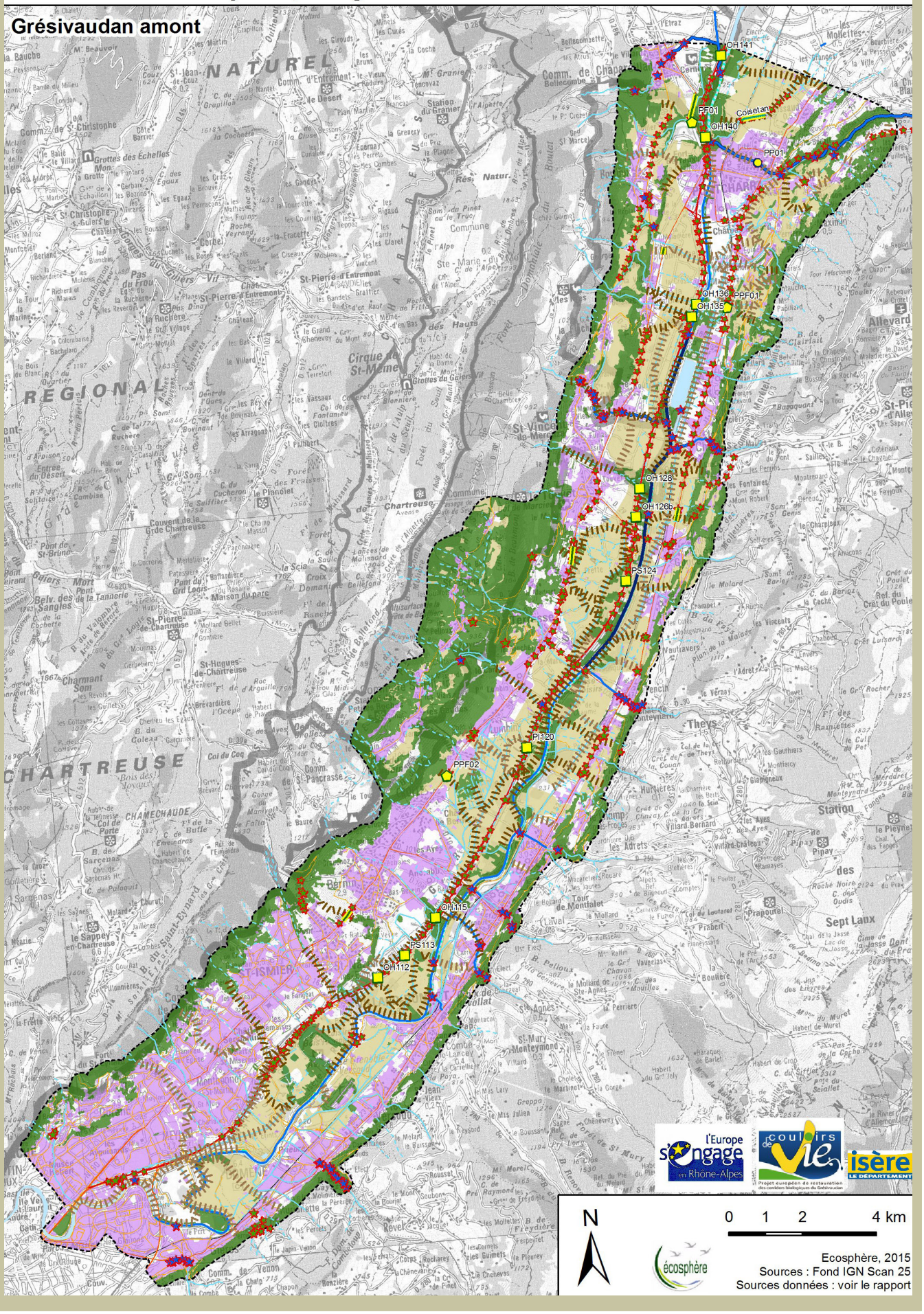
NB: each structure carries a double digit code after its type

Miscellaneous

Study area



Summary map of green and blue habitat networks



2.3.3 AN EXPERIMENTAL TERRITORY IN TERMS OF MAPPING

The Grésivaudan is one of the few sectors in France where different ecological network mapping tests can be performed. The assessment here represents the main works (other studies have also been carried out by researchers on a given species or natural habitat). The fractal vision of the ecological network is clear when you compare the results obtained at different levels.

Mapping	Method used, scale	Actors, dates
REDI (Isère ecological network)	département level simulated migration areas (approximately 1/100 000°)	ECONAT / Isère département, 2001
Mapping of Grésivaudan ecological corridors (for the Paths of Life project)	Definition of main corridors using REDI and a consultation with communes (around 1/50 000°)	AURG / Isère département, 2006
Ecological corridors of the Isère upstream project	Precise mapping (1/25 000°) based on a naturalist approach: photo interpretation and field visits	Ecosphère / SYMBHI, 2007
SRCE (Regional ecological coherence scheme)	Regional mapping (1/100 000°) resulting from a cross-referencing of technical data and consultation	Agences d'urbanisme / State - Rhône-Alpes region, 2014
FUP (Urban fragmentation and disruption)	Buffer zones around urban areas (around 1/50 000°)	LPO Isère, 2012-2013
Graphab	Application of graph theory on the basis of land use maps (broader Grésivaudan scale)	Besançon University, 2014-2015
Mapping of the Paths of Life project assessment	Simulated migration areas + photo interpretation (around 1/25 000°)	Ecosphère / Département de l'Isère, 2015

• Comparing methods allows a number of observations to be made:

→ Biodiversity reservoirs are generally similar from one method to another: this is explained by the highly stark distinction of types of landscape in the valley, with a nature/urban area passage, which is almost seamless.

→ The corridors identified are broadly the same from one method to another, mostly because the urban areas do not leave species many options for movement.

→ According to the scale used, the elements are identified with varying degrees of precision: they sometimes shift spatially upstream or downstream.

→ In the large scale methods, bridges and tunnels crossing road or rail infrastructure are not localized: the corridors are theoretical and do not correspond to what is actually going on on the ground.

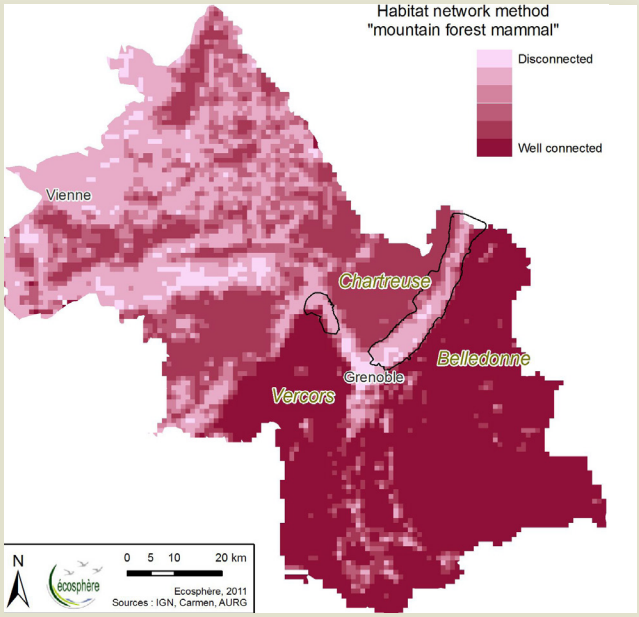
→ In several methods, the corridors do not create a link between two reservoirs and can stop at an obstacle: continuity is therefore not a reality on the ground (the case of Villard-Bonnot in particular).

→ In general, longitudinal corridors are not sufficiently well identified and taken into account, even though they explain to a large extent possible movements in the valley: only the banks of the Isère River are identified as corridors, whilst there is clearly a role played by other wooded areas of the valley as 'relay zones'.

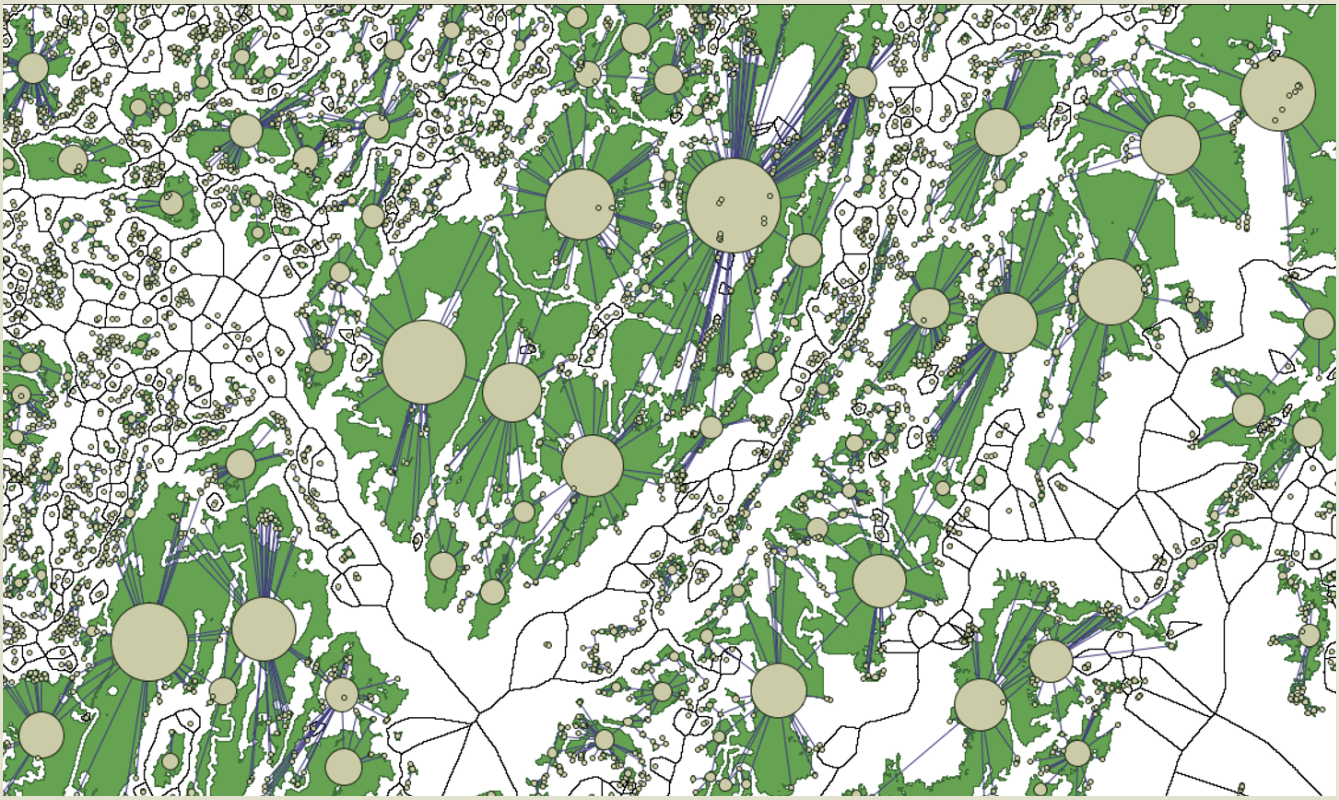
In the end there is no 'good' methodology for mapping ecological networks, but fairly comparable methods in terms of the broad results they obtain, whose differences correspond more than anything to scale and whether there is a negotiation or not between actors.

THE HABITAT NETWORK: A FRAGMENTATION ANALYSIS METHOD

• The habitat network (Jaeger 2000) allows us to estimate the probability that two randomly chosen points in a study area are connected (whether or not they're separated by roads, for example). On the basis of land use data and mapping of road networks, it is possible to map the appeal of a territory by networks for different species with different ecological needs. The map here is based on that method and applies it to chamois for the Isère département; it shows the effect of the cuts through the alpine valleys, but also the existence of ecological corridors in north Isère. It helps explain the multiplication of observations of Chamois on the lowlands of the north Isère (right down to Vienne) over recent years; these animals could come from the Chartreuse area.



GRAPHAB: A SCIENTIFIC RESEARCH PROJECT



• As part of the ITTECOP programme (2012–2015), the ThéMA laboratory (UMR 6049) in Besançon looked at the contribution of spatial modelling using landscape graphs on the area covered by the Paths of Life project. This work, which is part of the Graphab 2 project, was financed by the Ministry for Ecology, Sustainable Development and Energy. This innovative mapping method for ecological networks provides some interest in terms of ranking corridors and simulation actions. In the Grésivaudan it identified, on the basis of the study of two scenario studies into infrastructure and permeability, possible locations for animal crossings on the A41 and A48 motorways.

From the 14 species tested, the figure below gives an example of a graph modelling the ecological network of the 'small forest mammals' group in terms of their day-to-day movement: the core areas are shown in the form of 'nodes' and the corridors in the form of lines. It clearly illustrates the functioning of the species where small wooded areas can serve as a habitat and for whom journeys are made in stages.

For more information: PHD work by Anne Mimet, supervised by Céline Clauzel and Jean-Christophe Foltête at the ThéMA laboratory.

2.4 Synthesis test on the functioning of the area

The work on the ecological functionality assessment of the area allowed us to put together a table of the situation in the Grésivaudan.

• A highly constrained area

All the analyses confirm the supposition that the Grésivaudan is an area of constraint, subject to considerable anthropological pressure.

Natural habitats have suffered and continue to suffer a high level of pressure linked to urbanization, infrastructure, agriculture and other human activity. The most notable natural sites have been relatively well protected, in particular thanks to the ENS policy, but the landscape matrix (hedges, meadows and isolated woods), where numerous species live, continues to become degraded.

Ecological connections are made vulnerable by multiple obstacles (roads, urban areas etc.). This fragmentation is not developing in the right direction, in particular because of the increase in road traffic and the continued artificialization of these environments.

• A diversity of operation beyond corridors between mountain ranges

The ecological network is particularly complex because it combines the needs of thousands of species. The Grésivaudan is home to living communities with particularly diversified needs.

With what we know today it is possible to consider the major objective of the Paths of Life project – the free circulation of fauna between subalpine mountain ranges – was somewhat reduced since it only covered a small number of the ecological challenges this area faces. However, highlighting these corridors was justified: they are fragile because they cross a large number of infrastructures and other obstacles, and they are interesting because of their emblematic nature for the public and on account of the 'umbrella' role. Protecting these corridors helps not only mountain species, but also all species living on the lowlands.

The six ecological corridors of the initial project were not just simple routes linking mountain ranges together; they were vast non-urban areas. Our mapping of the ecological network confirms their benefits; these areas are interesting because they bring together a large percentage of the connectivity challenges faced by the sector, but they can't be considered in a limiting way: numerous biological exchanges are performed outside these borders. This remark is particularly true for the Cluse de Voreppe, where ecological connectivity must be taken into account for the whole area.

• The Grésivaudan, an element within a larger network

The Grésivaudan is not an isolated area; it has substantial external connections. Conservation of the ecological network requires certain major corridors located outside the study area to be taken into account:

→ The south Grenoble area. The ecological link between the Vercors and Belledonne mountain ranges is secured less via the Grésivaudan valley than by the south Grenoble area, which is also connected to l'Oisans mountain range;

→ The north of the Chartreuse. The north of the Chartreuse, which is in Savoie, is hardly more favourable than the south; it is isolated from the other mountain ranges by sections of valley which are no more natural than those of the Isère;

→ The Chartreuse low countries. The Chartreuse appears very isolated from the other mountain ranges because of the artificialization of the alpine valleys; it is a little more open towards the west thanks to the presence of fairly well preserved wooded hill sectors.

→ The structuring role of the hydrographic network. The Isère River, which is the backbone of the Grésivaudan ecological network, appears more than ever as one element of a vast system. Recent sightings of otters tend to confirm the link with populations from the Ardèche via the lower Grésivaudan; the existence of a major renovation project of the Isère in Combe de Savoie shows the importance of taking ecological connectivity into account from an overall perspective.

3 PROJECT ACTIONS

3.1 List of actions

The Paths of Life project gathers together diverse types of action: works to eliminate obstacles, improvement of land use, public information.
The operational actions and their results are described over the following pages.

	Name of measure	Description
Modification to underpasses or overpasses on infrastructure		
	Motorway works	
	Works on OH (hydraulic structure) 141	Works on strips of earth along a canalized stream within the structure
	Works on OH140	Planting and modification of fences at the entrance to the structure
	Works on OH 135-136	Replacement of low walls by slopes
	Works on OH 128	Dry ground bank at the edge of the stream
	Works on OH126b	Installation of tree trunks and earth around a funnel pipe
	Works OH 115	Creation of an access ramp to the structure
	Works on OH 112	Corbelling and passageway to a structure which is often flooded
	Works on underpass (PI) 120	Creation of strips of earth in the structure
	Works on overpass (PS) 124	Creation of grassy walkways
	Works on PS 113	Opacification of an overpass
	Works on PS 9080	Opacification of an overpass
	Eco-bridge at the Cluse de Voreppe	Over-motorway bridge solely for fauna, planned for 2016
	Road works	
	Works on PI under RD 1085 and 121a	Creation of two fauna passages
	Works on OH PF01	Creation of a gangway above a weir barring passage
	Works on OH PPF02 in Crolles	Creation of a wall concealing access to a passage.
Creation of passages for small animals		
	Creation of small animal passages in Cheylas	Creation of a two-way passage, 7 x 2 tubes, designed in particular for amphibians with the introduction of side sill structure to encourage the use of the passage by tree frogs
Introduction of fauna detection systems		
	Introduction of fauna detection systems	Introduction of 7 fauna detection systems to reduce the risk of collisions
Restoration of aquatic corridors (watercourses and banks)		
	Isère ramps	Creation of 2 gently sloped ramps on the banks of the Isère River in Cluse de Voreppe to facilitate fauna crossing
	Restoration of the banks of the Coisetan	Renaturing of the banks of the Coisetan stream to reinforce its role as corridor
	Rehabilitation of the Ruisset confluence	Restoration of a confluence with creation of a weir crossable by fish
	Rehabilitation of the Bréda confluence	Creation of a fish ladder next to a weir
Trees and hedges in agricultural land		
Awareness raising of actors concerned		

3.2 Monitoring and assessment methods

3.2.1 GENERAL PRESENTATION

We attempted to assess each action on the basis of objective data from a follow-up, complemented by more qualitative observations.
This assessment can be relatively simple, thanks to the existence of tried and tested methods. This is the case, for example, with a small animal passage that can be monitored by traps capturing the animals that use it.
In other cases we had to develop more innovative techniques, which required time for development and experimentation. Monitoring the efficiency of fish ladders was not routinely practised, which led us to create two fairly complex methods.
Finally, other factors made it complicated to monitor certain actions: technical and ecological complexity (fauna detectors) and slow responses from species to actions (planting of hedges), making short-term assessment difficult.

3.2.2 PHOTO-TRAPPING

Above: Self-triggering camera

A fairly substantial portion of monitoring was based on photo-trapping, which allowed us to observe medium and large sized animals crossing structures with comparisons before and after the work was done. A number of experiments were also carried out on monitoring of track traps, ink traps and genetics; these were not continued since they did not produce convincing results.

Monitoring, therefore, relied on photo-trapping methods. Devices (Moultrie and Reconnyx brands) for automatic detection (thermal/infrared) were installed under the structure or nearby; with craftsmen we had to develop a system of fixing that was adapted to the structures themselves. The devices were positioned at heights of less than one metre for good detection of the animals. Monitoring relied on sessions lasting around 3 weeks; monitoring before the works concerned at best a whole season; monitoring after the works covered 3 to 4 weeks. In all around 2,500 photo-trapping nights took place.

This monitoring was disrupted by different acts of theft and vandalism of the equipment.

The method used allowed us to note the presence of 13 wild mammal species beneath the structures. We also photographed birds, domestic animals (cats, dogs) … and very many humans.

Photo-trapping was also used in our assessment of other actions: small animal crossings in Cheylas, fauna detectors, ramps of the Isère and so on.
The results of this monitoring are presented later in this document.

The observation of tracks allowed us to obtain additional information in addition to the photo-trapping.
To the left marten/pine marten, to the right, badger

3.2.3 PRESENTATION PER STRUCTURE

Groundworks on OH141

CONTEXT AND OBJECTIVES

This structure under the motorway is located in a natural context (alluvial woods). It is a large hydraulic structure in which there is a concrete channel that is used to guide the Glandon stream when waters are low. During stormy weather, water can rise by one metre inside the structure.

When it was built large blocks were used to block the bottom of the structure between the concrete canal and the walls of the structure.

The objective of the works was to facilitate the movement of animals by offering them a more suitable ground, in particular by laying loose soil down there.

WORKS PERFORMED

The works were performed in 2011. This involved covering with earth the large stone blocks that had previously represented an obstacle to the movement of certain animals. The works were completed with the installation of large blocks at one entrance to the structure and a 'fuse'-type wooden gangway to allow small animals to cross the canal. However, this was quickly washed away by rising water levels.

Above: the structure after the works

ASSESSMENT

Of the structures worked on, the OH141 is the one we where we photographed the most species. Thus it was the only hydraulic structure in which we noted the presence of roe deer and beavers (photo below to the left).

With a frequency of 0.56 animal passages per day it was the third most frequented structure we monitored by fauna in the Grésivaudan.

Even though it is not possible to obtain figures for before the works it is highly probable that the works performed offered an additional attraction for fauna.

However the structure is unfortunately used for purposes which are disruptive for fauna use. It was thus that we were able to take a photo of situations that were as unexpected as they were irresponsible (photo below, cars on the bed of the stream).

Above: beaver crossing the structure

Above: 4X4 in the concrete canal structure

	Before works	After works
Passage / 24 hours	No monitoring	0.556
Species		6 (Fox, Badger, Roe Deer, Beaver, Coypu, Red Squirrel)

SUMMARY: GOOD USE BY FAUNA WHICH CAN BE IMPROVED

The structure seems fairly functional as it is and presents a real appeal for fauna. It would be possible to improve it still further by preventing access to motor vehicles. Rockfill to prevent entry to the structure would be certainly a good start.

Works on fences and planting on OH140

CONTEXT AND OBJECTIVES

This structure under the motorway is located in a highly restricted environment, with on one hand the Isère River and on the other a quarry and a main road. The structure is long, but the entrance is not very big. It is located near a major and well identified corridor created by the Furet stream. The objective of the works was to improve the functionality of the passage for fauna by planting vegetation around the structure to occlude car headlights.

WORKS PERFORMED

The works were performed during the autumn of 2011; they involved planting bushes within the motorway zone at the two entrance points to the passage. The fence line was modified to allow these works to be done.

Above: Structure after the works

ASSESSMENT

Because of vandalism, monitoring of this structure had to be abandoned; we weren't able to show any effects of the works performed. It is important however to state that the plants were still too young to block vehicle headlights.
According to the local game-keeper, there has never been any evidence of tracks of Wild Boar or Roe Deer in the structure, even though they're very often seen outside.
It is possible to suggest that the situation of the structure, which is highly restricted by the main road and the quarry, is one of the causes of this situation. The presence of motor vehicles during the day and night is undoubtedly an aggravating factor.

Above: This structure is located in a major ecological corridor, as demonstrated by the presence of this red deer, photographed beside the motorway.

Above: Quad bike in the structure

SUMMARY: DISAPPOINTMENT

In theory this structure, which is located on a major ecological corridor, has real potential. The works performed showed no result, but it is not yet possible to suggest that it was a failure. The appeal of the structure should improve once the young plants have grown, but it is probable that if nothing is done to limit motor vehicle traffic in the passage during the day and at night the functionality of the structure will not improve much.

	Before works	After works
Passage / 24 hours	0	0
Species		

Works on the two hydraulic structures OH135, OH136

CONTEXT AND OBJECTIVES

These two structures close to each other allow the Granges and Ville streams to pass under the motorway. These are torrential type streams that quickly increase in volume when the rain is heavy on the Chartreuse mountain range. They are located in an agricultural context, but benefit from continuous woods along the two banks and right up to the Chartreuse foothills.

Before the works access for fauna was difficult because of the presence of low walls. The works were designed to facilitate the passage of animals by removing those walls.

WORKS PERFORMED

The works were performed in 2011 and involved initially removing the low walls and then creating a slope out of soil. The two structures benefitted from the same works. Inside the pipes a natural sand bank was built.

Above: Structure after works

ASSESSMENT

It wasn't possible to perform monitoring before the works, but it is probable that given the obstacle there was low fauna traffic. It is notable that these are the only two structures worked on under the Paths of Life project through which wild boar pass. Indeed with frequency rates close to 0.5 passages per day, they are amongst the most functional structures for fauna that we monitored.

Above: Wild Boar

Above: A badger encounters a Fox

SUMMARY: A REAL BENEFIT TO BE SECURED OVER THE LONG TERM

The works on OH 135 and 136 obviously helped certain species (the case of the wild boar, for example). In order to strengthen its functionality it is important to ensure that the riverside wooded areas of the two streams are preserved or even strengthened. Also, it would be good to check the condition of the two structures because the materials carried there often form jams that can represent an obstacle to animal traffic.

	Before	After works
Passage / 24 hours	No monitoring (probably very low traffic)	OH135: 0.488
Species		5 (Fox, Badger, Wild Boar, Brown Rat, Beech Marten or Pine Marten)

Dry ground bank on OH128

CONTEXT AND OBJECTIVES

This structure under the motorway is located in a natural context (wooded area) near a pond (a former gravel pit). It is fairly big, and so should be good for fauna traffic. Unfortunately it is flooded a good part of the year and therefore unusable. Indeed it allows the Bresson stream to expand to torrential status. The cutting that constitutes this stream forms an almost continuous corridor right through to the Bresson forest on the Chartreuse foothills.

The project intended to create a bank of dry ground and planting at the two ends of the structure, and to obscure the passage access areas.

WORKS PERFORMED

The works were performed during the autumn of 2011; this involved creating a bank made of rocks and silt at one end of the structure, and the planting of bushes at the entrances to the passage.

ASSESSMENT

Because of vandalism monitoring this structure only lasted a year. However, no passage of large animals, like Red Deer or Wild Boar such as we might have expected, was detected.

It is possible this under-frequentation by animals is linked to human traffic, in particular during spring (access to the pond for fishing and swimming).

However, we do know that the bank is used by animals during high water periods. In addition, 4X4s that used the passage illegally can no longer do so. It is therefore possible to suggest that the works have improved the functionality of the structure for small and medium-sized animals.

Above: Structure after works

Above: Illegal use of the structure before works

Above: Fox in the structure

SUMMARY: A STRUCTURE THAT LACKS TRANQUILLITY

The works on OH 128 don't seem sufficient to achieve good frequency of animal passage. High human presence, whether on foot or in motor vehicles seems to diminish its functionality. It would be interesting to study the possibility of reducing leisure activities which are most damaging to the tranquillity of the structure, like quads and motorbikes.

	Before	After works
Passage / 24 hours	0.097	0.138*
Species	1 (Fox)	3 (Fox, Badger and Brown Rat)

* insignificant difference – insufficient data beforehand

Works on a funnel on OH 126b

CONTEXT AND OBJECTIVES

This hydraulic discharge structure is located in a natural wooded environment; it comprises 6 rectangular concrete tubes. The vehicles pass in a single tunnel. The very artificial appearance of this structure meant it did not express its potential for fauna. The works were intended to facilitate the passage of small and medium sized animals under the motorway in a pipe located at the far north of the structure.

WORKS PERFORMED

The works were performed in March 2011. They involved placing large trunks and topsoil over the whole of the surface of the funnel.

ASSESSMENT

It was not possible to monitor this structure before the works and the large scale of the structure made it difficult to monitor after the works. However, it seems that this structure does allow certain species to cross and therefore that the works done on it were beneficial to small mammals.
Larger animals (deer) were detected outside the funnel without visibly crossing the structure; this situation is perhaps linked to insufficient monitoring or real difficulties for these animals in getting across.

Above: The exterior of the structure

Above: Rehibilatated pipe

Above: Brown Rat

Above: Roe Deer passing by the outside of the opening

SUMMARY: AN INTERESTING PROJECT TO BE COMPLETED

The works on this funnel obviously had an appealing impact on fauna and in particular small animals which hid under the trunks (insects, micromammals). It would be a good idea to complete the action: laying branches and stones on the ground, drilling holes in the trunks (micro shelters for insects etc.).

	Before	After works
Passage / 24 hour	No monitoring	0.023
Species	No monitoring	2 (Fox, Brown Rat)

Access ramp to a hydraulic structure 0H115

CONTEXT AND OBJECTIVES

This hydraulic structure is interesting for fauna because of its great width and the natural environment in which it is located (alluvial forest). Before the works, access for fauna to this structure was difficult because of very steep slopes downstream. The project intended to reduce these slopes to facilitate use of the structure by fauna.

WORKS PERFORMED

The works were performed during the summer of 2011; they involved making the slope more gentle for access to the structure (below right hand photo).

Above: Inside the structure

Above: Reducing the slope of the bank

ASSESSMENT

Before the works only foxes and probably brown rats were detected; no mammal was detected after the works. Anecdotally a grey heron was frequently observed (at the hunting area) in the structure (photo below).

This result is surprising given the extent that this structure seems to present good potential. It may be explained by a high water level in the pipe and also by frequent passing of motor vehicles (which is, however, forbidden). Another hypothesis would be that the structure is too isolated from the Manival corridor (main roads, surrounding fences, company buildings etc).

Above: Grey Heron in the structure

Above: A trial bike in the structure

SUMMARY: AN APPARENT FAILURE

The works on OH115 do not seem to have improved fauna traffic. It would probably be a good idea to complete the works with planting making assess to the structure more attractive, or even the creation of a dry passage on one side of the structure for small and medium-sized fauna.

	Before works	After works
Passage / 24 hours	0,167	0
Species	(Fox, Brown rat)	

Corbelling under a hydraulic structure: OH 112

CONTEXT AND OBJECTIVES

This hydraulic structure under the A41 motorway was inaccessible for terrestrial animals for the most of the year because it is frequently flooded. It plays a particularly interesting role for fauna because it is located in the ditches network on the central axis of the Manival cone.

WORKS PERFORMED

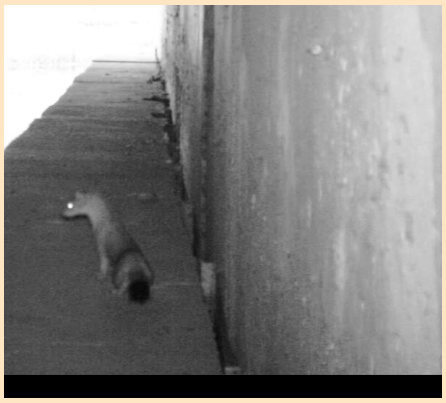
The works were performed during the winter of 2011. This involved fixing a corbel (a sort of cornice) in concrete under the structure (around 80 centimetres wide). The system was then completed by a wooden gangway on the neighbouring ditch, which had to be crossed to access the passage.

Above: Corbelling for fauna

Above: Wooden gangway on the ditch

ASSESSMENT

Monitoring is not representative because monitoring before the works was performed during a time when the structure was dry, i.e. when the animals could cross the structure without any specific works. However, it does show that corbelling is used by different species including ermine, a species which is not often sighted on lowlands. We also note that some people use this structure in spite of its narrowness (sometimes even on bikes!).



Above: Stoat using the cornice

Above: Mountain bike on the cornice

SUMMARY: AN INTERESTING, THOUGH RESTRICTED PROJECT

OH 112 presents a limited width and major hydraulic constraints. The works done are of limited interest because of the narrowness of the corbelling, but they do allow certain animals to pass. In this context it may be considered positive in terms of the functionality of the structure.

	Before works	After works
Passages / 24 hours	0.241	0.045*
Species	2 (Fox, Coypu)	4 (Fox, Coypu, Stoat, Beech Marten probably)

*non-substantial difference – non-representative data before workstravaux

Rehabilitated pavements on PI 120

CONTEXT AND OBJECTIVES

This passage is located in an agricultural location with an agricultural setting to the west and forestry setting (plantations) to the east. Relatively isolated, the structure is wide and the track which uses it is made of clay. It is therefore in principle appealing for fauna traffic. The project sought to improve access for small animals

WORKS PERFORMED

The works were performed in September 2011; they involved installing two walkways covered with earth with some rocks laid here and there.

Above: Exterior view of the lower passage

Above: Rehabilitated walkway

ASSESSMENT

Photo-trapping did not detect any animals crossing the passage before or after the works. No trace of animals was observed.

This result is surprising because we would imagine greater fauna traffic. It may be that the absence of guide hedges to the west on the agricultural plain would partially explain these results. Another hypothesis is that recent graffiti shows that this structure has a life (and particularly a night life) that is quite different from the one we might expect. Frequent disruption at night could be a determining factor.

	Avant aménagement	Après aménagement
Passages / 24 heures	0	0
Espèces	-	-

SUMMARY: ADDITIONAL ACTIONS WHICH MAY BE POSSIBLE TO PRODUCE A REAL BENEFIT

Traffic of fauna in structure PI120 seems to be dead. The works did not improve the passage of medium and large animals. It is more difficult to draw any conclusions for small animals because the monitoring technique is less reliable for small mammals.

Greater traffic could result from an ambitious guide hedge reconstruction project on the nearby agricultural land.

Traffic of small animals in the structure could be improved by laying down more hiding places (tree trunks).

Opacification of an overpass- PS 9080

CONTEXT AND OBJECTIVES

This overpass is located on the A49 motorway in the direction of Valence, in a natural (wooded and agricultural) environment close to the Isère River. It is near to riverside routes that are subject to intensive leisure use (cyclists, joggers etc.). Indeed the bridge is used by bicycles during the day as well as by a number of vehicles travelling to nearby ponds.

The objective of the works was to hide vehicle headlights on the motorway to reduce disruption to animals crossing the passage.

WORKS PERFORMED

The works were performed during the winter of 2010/2011. A wooden barrier around 2 metres tall was installed with strengthening elements on the existing handrail.

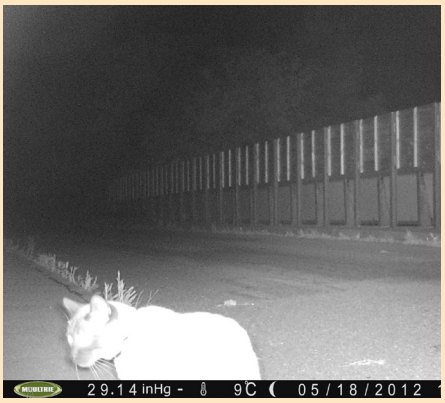
Above: Overview of the structure

Above: View of the structure from the A49 motorway

ASSESSMENT

It wasn't possible to perform monitoring before the works, and monitoring of this structure was abandoned because of vandalism. The absence of data before the works prevents us from drawing any real conclusions as to the effectiveness of the works performed, but the passage of a Roe Deer is a good sign for the functionality of the structure. It is highly probable that other species use the bridge because we have noted regular passes of Wild Boar not far away on the banks of the Isère River.

Above: A deer crossing the bridge at night



Above: domestic cat

SUMMARY: A PROJECT WITH A FUTURE

It is certainly probable that the rehabilitation of the structure has improved the functionality of the corridor space. This type of works, which is well known on other motorways, is a bonus in terms of animal traffic. It would still be possible to improve the crossing by working on the barriers that are located at the entrance to the bridge. Indeed they don't seem to be very useful and seem to partition the bridge too much, especially as cars don't use this dead-end road.

	Before	After works
Passage / 24 hours	No monitoring	0.064
Species		3 (Fox, Roe Deer, Red Squirrel)

Opacification of protective barriers on PS 113

CONTEXT AND OBJECTIVES

This overpass is interesting because it is located in an extension to the Manival cone, in a very natural environment that suggests that an improvement to its functionality could be beneficial for fauna. Used by cars, cyclists and joggers during the day it is fairly quiet at night. The planned works were intended to occlude the lights of cars travelling on the motorway to reduce the scare factor for animals crossing the passage.

WORKS PERFORMED

The works were performed in July 2011; they involved a metal occultation on the existing barriers. To avoid being caught in the wind the system comprises strips of metal which allow air to get through, but which block light coming from the motorway.

Above: A view of the passage from the plain

Above: Blackout panels

ASSESSMENT

This structure is one of the passages that we were able to monitor for long enough before the works to have significant results. Monitoring shows a significant and positive effect of the work done. However, the number of species which use it remains low, with only two fairly common species within the Grésivaudan. From a visual point of view (communication with public), it would probably have been better to install a wood panel rather than a green metal panel.

	Before works	After works
Passage / 24 hours	0.000	0.172*
Species	0	2 (Fox, Badger)

* statistically significant difference

SUMMARY: WORKS THAT COULD USEFULLY BE SUPPLEMENTED

It would be worth making additional adjustments to PS 113, providing grassy paths to allow small and medium size animals to use the passage. The system could be complemented with the installation of hiding places (trunks and rocks) which would allow small mammals as well as insects, to use the crossing.

Grassy paths on PS 124

CONTEXT AND OBJECTIVES

This overpass crosses the motorway in a natural environment where there are few people present during the day and practically nobody at night. Thus the structure seems quite appropriate for animal passage. The project sought to improve traffic of small animals (micro-mammals, insects).

WORKS PERFORMED

The works were performed in September 2011; they involved creating grassy strips. In order to do this concrete borders were added on each side of the overpass and planted with grass.

ASSESSMENT

Monitoring by photo-trapping was too limited in time before the works in order to be representative. After the works there was moderate frequentation, with the notable presence of hares.

The grassy strips were ecologically surveyed. 53 vegetable species were identified, which denotes interesting colonization by vegetable species, even though ten or so species were planted during the works and 7 were exogenic (including Johnson grass). In terms of fauna we noted the presence of micro-mammals (Common Vole, Beech Marten or Stoat). Other small animals use this strip for movement or even reproduction; common wall Lizard, orthopterans (Bow-winged, Sharp-tailed and Woodland grasshoppers, Dark-bush Cricket) and butterflies (Common Blue, Holly Blue).

Above: View of the entrance to the overpass

Above : View of grassy paths

	Before works	After works
Passage / 24 hours	0.056	0.085*
Species	1 (Fox)	4 (Hare, Fox, Badger, Beech Marten)

*non-significant difference – insufficient data beforehand

Above: European hare

Above: Sharp-tailed Grasshopper

SUMMARY: AN INTERESTING OPERATION WHICH COULD BE SUPPLEMENTED

The creation of grassy strips is obviously a success, making it easy for small animals and flora to cross the motorway; this is probably appealing for larger animals. It would be interesting to complete this action by occluding the bridge; our photos show, for example, a wild boar that decides not to cross the structure because he is disturbed by the headlights on the motorway.

Above: Bird's foot Treefoil

Occultation and protective barriers on PPF02 – RD1090

CONTEXT AND OBJECTIVES

This small hydraulic structure is under the B-road D1090, in the commune of Crolles, in a natural environment that is tending towards urbanization. This small pipe frame of small diameter is located between the Montfort mashes (a sensitive natural area of the département) and the foothills of the Chartreuse. At this precise location the road is very busy both day and night.

The purpose of the works was to encourage small and medium size animals to use the structure by reducing the impact of vehicle headlights on animals, and guiding animals towards the structure.

WORKS PERFORMED

The works were performed during the winter of 2001. They involved installing occulting panels upstream from the structure and wooden safety barriers (with motorbike screens). On this section it was also planned that the commune of Crolles would turn off public lighting between 11pm and 5am, so as not to frighten the animals.

Above: Structure before the works

Above: Structure after the works

ASSESSMENT

Monitoring shows a really positive effect of the works on the functionality of the structure. The structure allows animals to cross the road quite safely both night and day. Indeed numerous crossings are done during the day whilst cars are actually on the road above. This does not seem to disturb the fauna, which seem to be used to it.

Above: Pine Marten in the structure

Above: Wild Rabbit

SUMMARY: AN EFFECTIVE, BUT ISOLATED OPERATION

This operation has given good results, indicating the benefits of minor interventions on B-roads. This type of intervention could be generalized. The works could have been improved, in particular by positioning flaps at the bottom of the wooden barriers. We also have to be careful that public lighting on this part of the road remains non-invasive.

	Before works	After works
Passage / 24 hours	0.286	0.685*
Species	1 (Fox)	4 (Fox, Rabbit, Pine Marten, Red Squirrel)

*statistically significant difference

Gangway over PF01 – RD 1090

CONTEXT AND OBJECTIVES

This structure is on the D1090 B-road, under a stone vaulted bridge which allows the Furret stream to cross the roadway. Located in a natural (wooded) environment and on a major corridor the watercourse at this point creates a waterfall of several metres. It is difficult for terrestrial fauna to cross the waterfall and therefore to go under the bridge in order to cross the road. The objective of the works was to recreate continuity with the banks of the stream by creating a suspended bridge on the right bank downstream from the structure.

WORKS PERFORMED

The works were performed during the winter of 2011. They involved creating a concrete gangway.

ASSESSMENT

Monitoring shows a net positive effect of the works. The passage created improved the functionality of the structure. To prove this a wild boar was not photographed crossing the structure during our monitoring sessions, but one did come up to it and we are quite sure that it would use the crossing very soon, which was impossible beforehand.

Above: Structure before the works

Above: View of the built gangway

	Before works	After works
Passage / 24 hours	0.0	0.415*
Species	0	4 (Fox, Red Squirrel, Pine Marten)

*Statistically significant difference

SUMMARY: A REAL BENEFIT

This passage was made functional for the movement of fauna and at very low cost. It will enable fauna to cross the B-road and thereby help reduce collisions with vehicles.
It is one of many examples showing that small passages under A-roads are also used by fauna. There are several hundreds of these in Isère and it would be interesting to perform an inventory and imagine possible improvements in terms of ecological transparency. Works of the same type are possible at different points in the Grésivaudan.

Above: Fox

Above: Red Squirrel

Fauna and structures: summary analysis

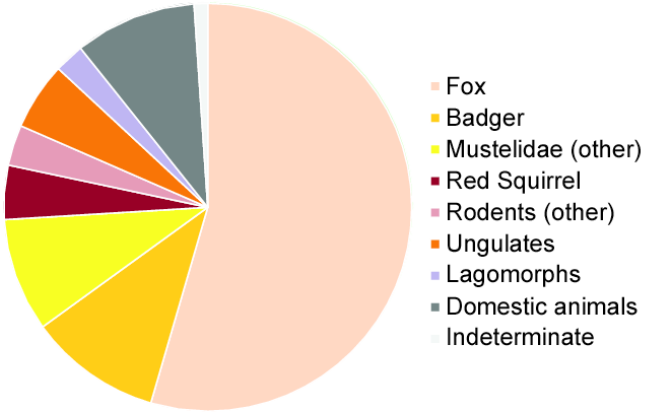
WHICH ANIMALS USE THESE STRUCTURES?

Monitoring allowed us to note the presence of 13 animal species in road and motorway structures (cf table below), excluding birds. The Fox is by far the animal we photographed the most.
The list and distributions of species observed solicit a number of comments. We would note first that this monitoring presents a technical limitation in the ability of the apparatus used to detect movement. The figures presented greatly underestimate the presence of micromammals in the structures and the presence of reptiles, amphibians and insects. The absence of Hedgehog may well be linked to this bias, but also perhaps to the rarity of that species in the Grésivaudan.
The frequency of species photographed is only partly representative of the fauna in the sector, in particular because the animals which are habitual makers of burrows are more likely to use underground structures than animals which live in the open (Hare, Roe Deer).

WHAT CONCLUSIONS CAN WE DRAW IN TERMS OF THE FUNCTIONING OF THESE ECOLOGICAL NETWORKS?

First of all we should note that not all animals cross roads and motorways only via structures; numerous individuals use the road surface itself with all the risk that that entails of being knocked over. A strong proportion of animals we photographed use structures in their day-to-day travel; only a limited portion corresponds to any real dispersion (the search for new territories). Whatever the case, this travel contributes to genetic exchanges between the two sides of the infrastructure.
The species we photographed live on the lowlands or at all altitudes; no mountain species were detected. This observation does not mean that these structures do not participate in intermountain range exchanges; these exchanges are rare and none were detected in what was, it has to be said, a limited number of days of monitoring.

DISTRIBUTION OF PHOTOGRAPHED SPECIES



Species	Number of passages
Fox	254
Badger	49
Beech Marten	6
Pine Marten	2
Pine/Beech Marten	33
Stoat	1
Red Squirrel	20
Coypu	5
Beaver	3
Brown rat	5
Micromammal	2
Wild Boar	23
Roe Deer	2
Hare	3
Wild rabbit	8
Domestic cat	42
Dog	3
Unidentified	5

HOW EFFECTIVE WERE THESE WORKS?

Monitoring before the works were carried out was too limited to obtain a very clear picture of the situation, but it does show an improvement of frequentation: from 0.094 passages per day before the works to 0.231 after (over all the projects).
Different passages saw a substantial increase in frequentation (cf figure below, first line). Two structures seem to show a reduction in passages after the works, but this is just a bias in the methodology (the hydraulic structure was dry during the pre-works period).

A NUMBER OF FACTORS EXPLAIN FREQUENTING OF STRUCTURES BY FAUNA

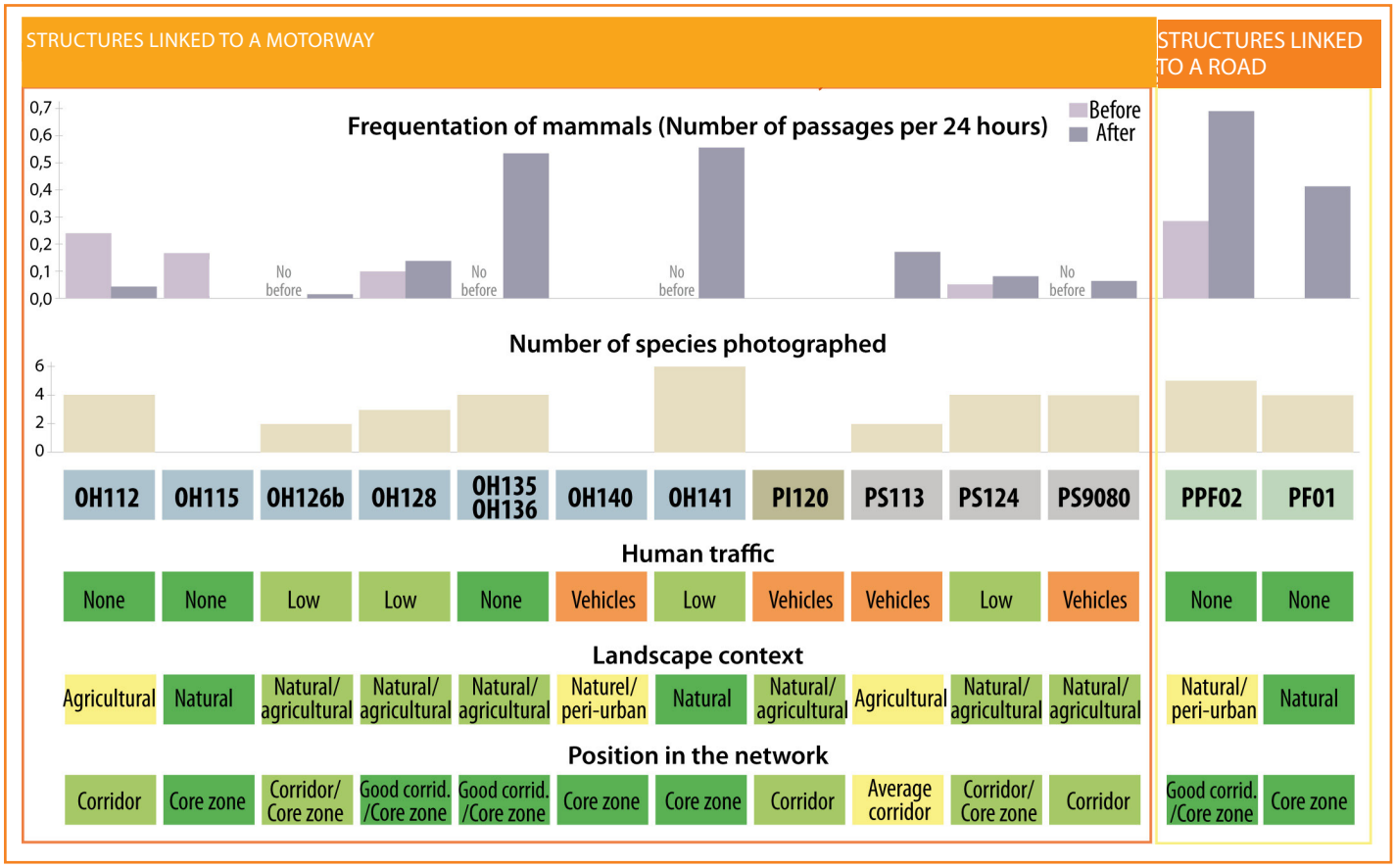
The frequenting of structures by wild animals is linked to a number of main factors (cf figure below):

• Type of structure
Road passages are much easier for fauna to cross than motorway passages because they are shorter. The dimension of the structure is undoubtedly a positive factor, but not a determining one; smaller passages (OH 135-136) appeared amongst the structures most frequented by fauna.

• Human traffic
Structures that are heavily used by pedestrians or motor vehicles are much less frequented than those which are not subject to human presence. The presence of pets (dogs and cats) is probably also an unfavourable factor.

• Immediate environment
The immediate environment around the structures has a major influence on their use by fauna. The presence of hedges or bushes at the entrance to the structure attracts animals and allows them to watch the area in safety before beginning their passage.

• Localization at the heart of the ecological network
Most of the structures which we monitored are located in ecological corridors or near core zones. We note that the structures most frequented by fauna are in particular those that are very well placed at the heart of an ecological network.



A BRIEF NATIONAL COMPARISON

It is possible to compare the results obtained in the Grésivaudan with those from other similar studies performed recently by Ecosphère in different regions of France.

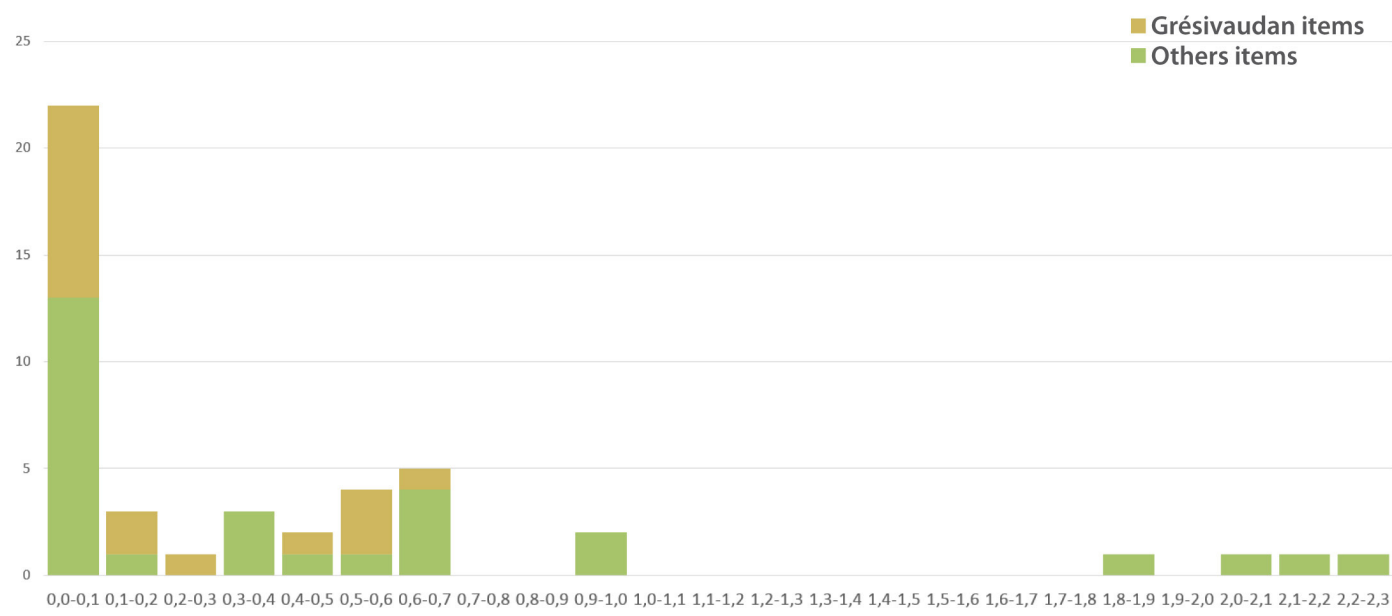
This analysis shows first of all the vast variety of levels of frequentation of structures. A large number of them are really very little used by animals because of their technical characteristics, but also because of where they are located (artificial environment).

The most interesting structures at national level are those that are located in relatively well protected natural areas.

The site at Devecey (Doubs) département is much more frequented than all the other sites that we have monitored (all of the points located to the right of the figure below). This is explained by a coincidence of favourable factors: road passage, no human traffic, an old structure (to which the animals have become used), location in a major ecological corridor.

Within this sample the Grésivaudan figures amongst the sectors studied where fauna frequentation is low. This situation reflects less the quality of the structures than the relative lack of fauna in this artificialized plain. A number of structures do however record fairly good frequentation, thanks to a good localization and to the effects of works performed within the framework of the Paths of Life project.

DISTRIBUTION BY FREQUENTATION, NATIONAL OBSERVATIONS – ECOSPHÈRE STUDIES



Y-axis: number of structures monitored ; X-axis: average number of passages of animals per 24 hours

Creation of an eco-bridge in Cluse de Voreppe

CONTEXT AND OBJECTIVES

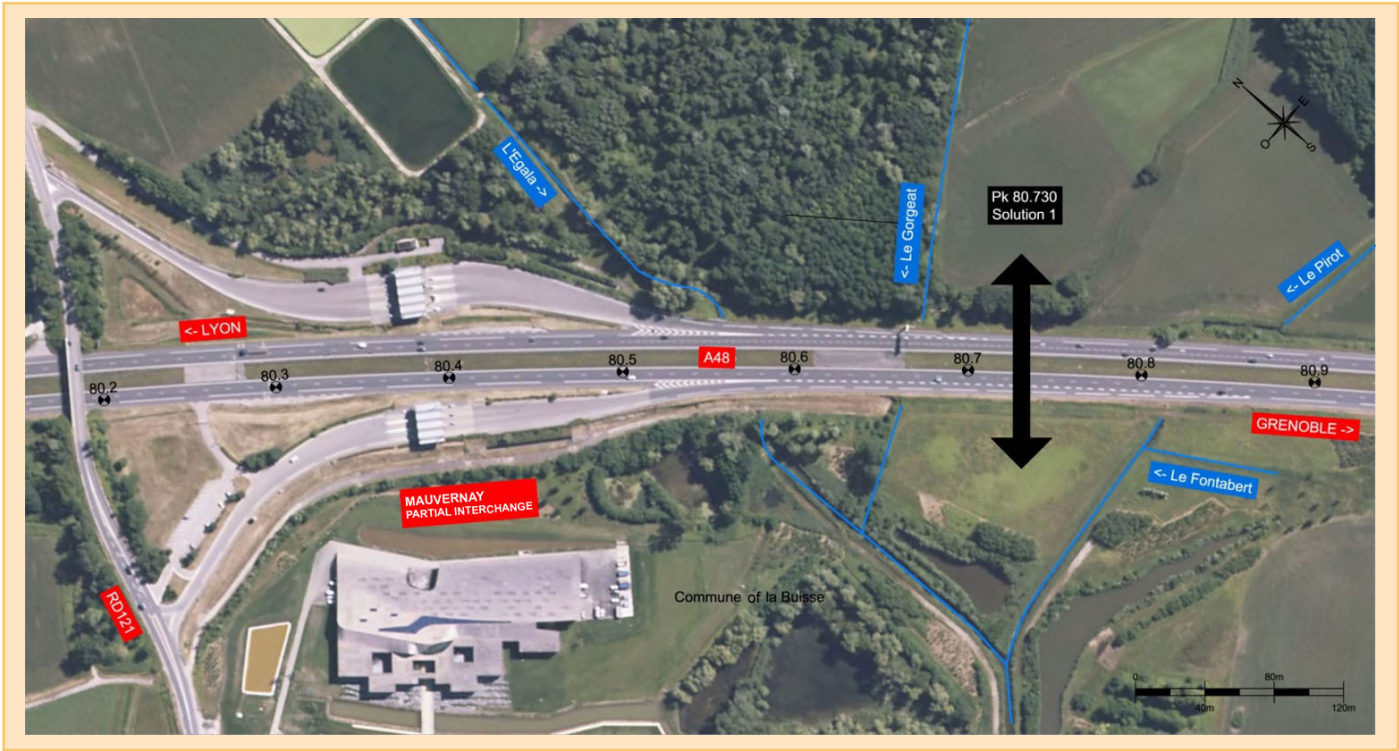
In Cluse de Voreppe, a major corridor between the Vercors, the Isère River and the Chartreuse is particularly vulnerable and requires deliberate action to protect and restore possible fauna traffic. The Paths of Life project allowed us to perform several actions on this route, which are described in this document. This project also planned the completion of an eco-bridge on the A48 motorway.

This action could not be performed within the operational planning of the project, but it will be completed. AREA, the concessionary company for the A48, which adheres to the principle of ecological networks, has committed to implementing the actions that will allow the passage for aerial, terrestrial and aquatic fauna.

As part of this it has committed to creating a specific structure to cross the A48 (the Grenoble-Lyon motorway), at the location of the biological corridor identified in Cluse de Voreppe.

A purpose-built 12 metre wide and 40 metre long entirely vegetalised eco-bridge is therefore due to be completed at the end of 2016, near ENS of Eterpa.

Assessment of the functioning of the structure is already planned.



Creation of two fauna passages under RD1085 and 121a (OA01 and OA02)

CONTEXT AND OBJECTIVES

The ecological corridor at Cluse de Voreppe has become progressively degraded by different works (roads, motorways, buildings). Its route passes via the D1085 and the D121a near Centr'Alp 1 where there is a single hydraulic structure (Egala stream) which is not usable by terrestrial animals.

The objective of the exercise is to restore this corridor by building two structures to allow free passage to all types of fauna, which may be present on this route in this sector of the Centr'Alp business park.

With this in mind, the creation of two lower structures were planned in the communes of Voreppe and Saint-Jean-de-Moirans. The first was to pass under the D121A, the second under the D1085. The areas around the passages were to be rehabilitated into refuge areas for fauna. Sound and visual screens were to be installed to partially protect fauna from disruptions linked to human activity.

WORKS PERFORMED

The works were performed successively on the two structures in 2014.
Structure 1 on the D1085 (route de Lyon): the choice was made to associate the passage of fauna to Egala by replacing the existing metal pipe with a single wider structure. A narrow structure was preferred so that natural light would illuminate the passage (which is reassuring for fauna).
Structure 2 under the D121a (rue Louis Barran): the choice was to create a passage on the left bank of the existing vaulted structure, in an extension to the amphitheatre created between the RD121A and the RD1085.

Above: Structure created under the RD1085 (route de Lyon)

Above: Structure renovated under the RD121a (rue Louis Barran)

ASSESSMENT

It hasn't been possible for us to install a follow-up over a sufficiently long period after the works because they are only just finished. However, according to monitoring performed by local hunting clubs it would seem that they have spotted tracks of Wild boar and Roe deer under the new structures. This suggests that the structures are functional.

SUMMARY: VERY INTERESTING WORK STRUCTURES, WHICH CAN BE AMELIORATED

This operation appears to be very positive. These two structures allow fauna to pass in a sector where previously it had been very difficult. It is important to support this work over the whole length of the corridor: maintaining natural zones near industrial and agricultural sectors, construction of the eco-bridge and so on.

Passage of small animals Cheylas (PPF01)

CONTEXT AND OBJECTIVES

For ten years or so in collaboration with LPO Isère the département authorities have identified a major passage area for batrachians near the RD 523 on the commune of Cheylas the lieu-dit La Rolande.

The crossing area covers around 260 metres between a wetland area and a wooded slope. In 2005, over 400 amphibians were found squashed in the space of a few days. It is therefore a major squash site and maintaining it in its present condition would lead to the total extinction of one or more species.

The idea was suggested to perform works to allow amphibians and small mammals (micro-mammals, snakes etc.) to cross in both directions, thereby reducing the incidence of animals being squashed.

WORKS PERFORMED

The works were performed during the autumn of 2012. The system comprises a collection network that runs along the route of the road and a network of 7 pairs of tubes that cross the road at a separation of less than 50 metres apart, so ensuring a maximum journey of 25 metres to a crossing.

Each passage is made of two one-way crossings made up of two tubes 40 centimetres in diameter. These one way crossings offer maximum efficiency for post-breeding or pre-breeding migration of amphibians. The crossing route is perpendicular to the road so as to reduce its length as far as possible. The passage is equipped with a U-shaped gutter on the east side of the road and an L-shaped collector on the west side. The gutter is equipped with escape ramps for micromammals. Trenches or buffer zones equipped with sills to encourage batrachians to cross.

The site is home to a rare species in the region, the European Tree Frog. To prevent this climber species accessing the road collector elements have been equipped with sills (with overhangs). This type of equipment has never been built before, to our knowledge.

At the intersection of the road and the path leading to some of the ponds a cattle grid was installed to oblige amphibians to follow the passages under the road. This same type of setup was installed at the end of the fauna passage (towards Pontcharra to the east and the west) to allow farmers to access their land.

A stream in the area flooded the passage during high waters; this had to be modified to preserve the structure (creation of a merlon to limit flood levels).

Above: Structure seen from the side

The concrete sides can prevent animals which are on the road from escaping; to eliminate the risk of collision a passage (wooden trellis) was installed opposite the exit to the path to the ponds (photo to the right).

ASSESSMENT

BEFORE THE WORKS, salvage operations were performed by LPO Isère from 2008 to 2012 with the installation of nets and buckets between mid-February and the beginning of April.

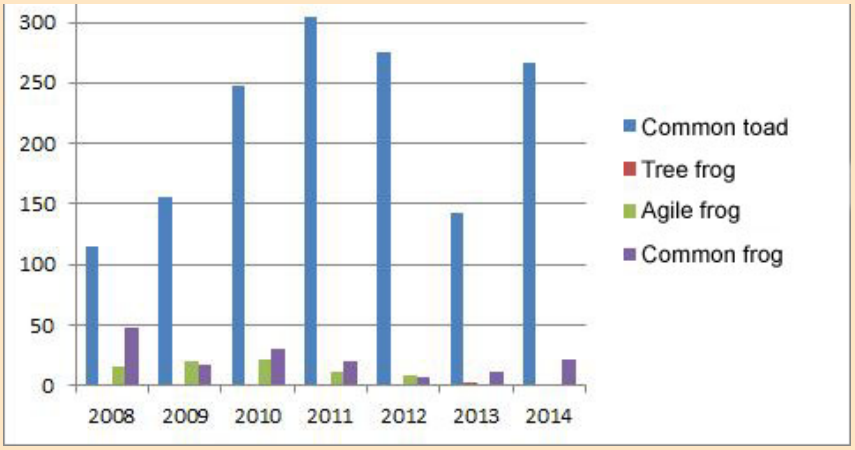
The setup involved installing a 30-centimetre high net buried 10 centimetres into the ground along the road, which was folded at the top so as to avoid amphibian crossings. Numbered buckets were buried along the netting at regular intervals of between 12 and 15 metres, allowing the animals which had been caught each day in the nets to be collected. The number of animals crushed was also recorded. The salvage operations performed since 2008 have shown the passage of 7 species, including the Tree Frog, and shown a net increase in the number of batrachians captured. The common toad represented more than 80% of captures.

Above: In the foreground: exit point of the climb tube. In the background: entry point to the down tube. Note the barb arm (overhang)

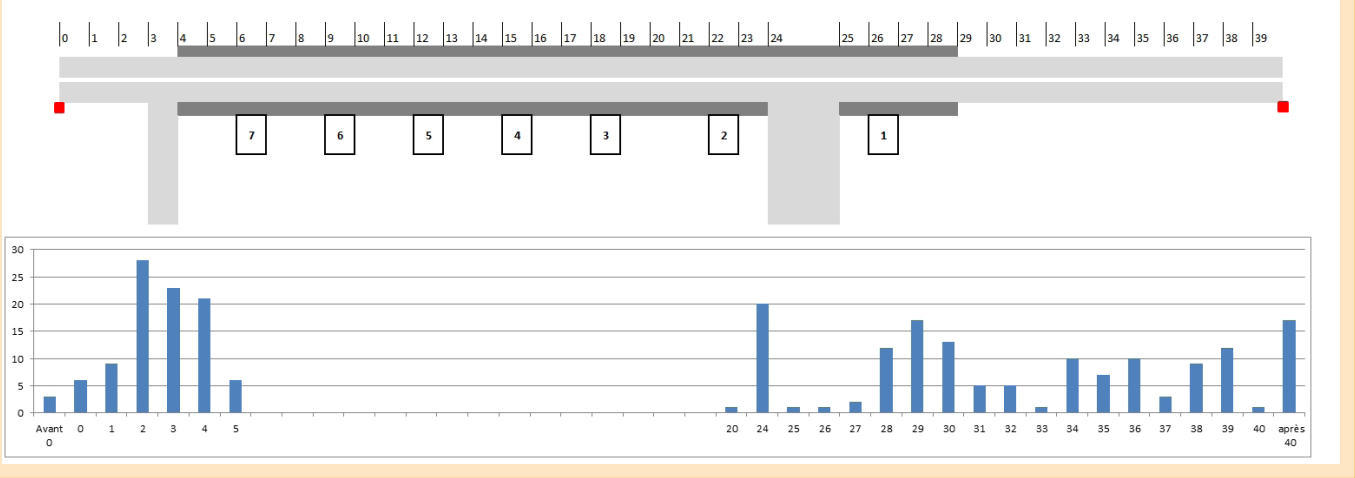
POST WORK FOLLOW-UP was performed in 2013 and 2014 in collaboration with LPO Isère, using trap boxes (cf photos); this involved daily collection at the exit to all the downstream tubes to monitor pre-breeding movement and of the 3 upstream tubes (out of 7) for the follow-up of post-breeding and emerging movement. All of this monitoring was performed between February 22nd and April 30th 2013 and between February 21st and April 16th 2014. It covered almost the whole period of the pre-breeding migration, but only part of the post-breeding migration, spread over a long period. In 2013, out of a total of 384 individuals which crossed, 92% were common toads and only 3 tree frogs were trapped. In 2014, 267 toads had crossed the road during the pre-breeding period, and no tree frogs were trapped.

The monitoring performed over the two years shows that the setup is working well in both directions. Its original design, which takes into account the specificities of the European Tree Frog, also seems to be efficient because this is the first time since 2008 that individuals from that species have been captured.

In 2014, in parallel to the monitoring of the crossing, precise monitoring of road deaths was performed across a stretch of road slightly longer than that of the structure itself. This allowed us to note that over the same period, whilst 310 batrachians used the structure to cross, 240 were crushed at the ends of the structure (and 90 in a single night). As of 2015 the structure was complemented by a temporary set up (buckets and nets).



Above: Trends in population numbers between 2008 and 2014



Above: Relevant stretch of road with the 7 dual tubes. The graph shows the location of toads crushed in the surrounding area.

Above: Monitoring by photo-trap was tested (automatic photos taken/ one per minute) with success. This simple method would allow us to perform minimal follow-up monitoring in the future without the need for capture.

SUMMARY: A STRUCTURE WHICH WORKS WELL, BUT WHICH CAN BE PERFECTED

This initiative was a great success; each year the structure saves thousands of amphibians' lives; it is also used by numerous insects, reptiles and small mammals. The innovative project designed for the Tree Frog seems to work.

Of course, the system can be improved. It would benefit from the extension of a guide mechanism that brings the animals towards the tubes. Some minor adjustments (closing of spaces between concrete elements, which allows little animals to get through) could also be made. Finally it would require minimal long-term maintenance, like any road structure.

Fauna detectors

CONTEXT AND OBJECTIVES

Each year in France it is estimated that 40,000 collisions occur between cars and large animals (primarily Roe and Red deers and Wild Boars); the Grésivaudan is of course part of this. The Paths of Life project sought to prevent collisions between cars and wild animals on certain road sections that were known trouble spots. The principle is to install detectors that trigger a lighted panel encouraging drivers to slow down.

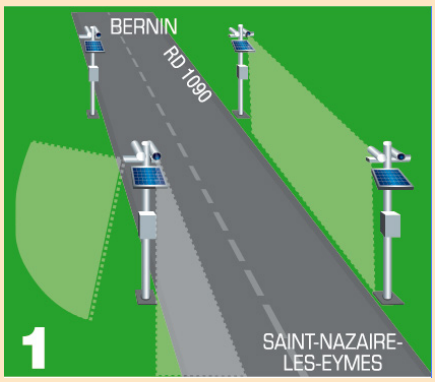
The project involved installing fauna detectors on road sections with high road kill (hoofed animals in particular); 7 sites in the Grésivaudan (Bernin, Le Touvet, Crolles, Chapareillan, Le Cheylas) and Cluse de Voreppe (La Buisse, St-Quentin-sur-Isère) were involved.

THE SYSTEM IN PLACE

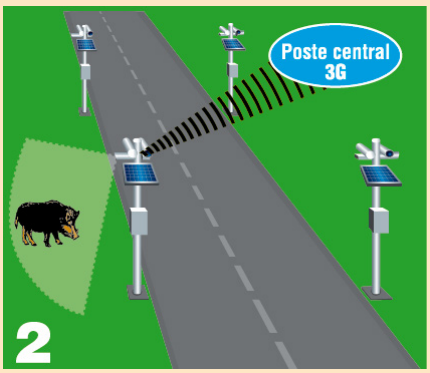
The system was designed by a France company called Néavia, along the lines of operations carried out in Switzerland and the US. The technology used to detect animals is based on passive inferred detectors and an analysis of digital signatures performed on the ground.

These detectors pick out differences in temperature in one area compared to a permanent 'background' (a sort of local temperature image). To do this, detection masts are installed on both sides of the road. These masts cover distances of around 300 metres (150 both sides) using two side detectors. They are equipped with an axial detector which analyses a zone of around 30 by 90 metres.

The whole solution is administered and supervised by a website that is accessible to registered users.



Four detectors are installed on each side of the road.



These devices detect animals from the size of a hare upwards over a large surface area. 3G central station.

When an animal is detected a signal is sent to two lighted panels: a beware of wildlife panel and a speed limit sign.

Once warned the driver can slow down, adapt his driving and avoid a collision.

Above: Mast with its infrared detector head and animal-detection camera

A field survey was performed before the installation of these fauna detection systems during the winter of 2011–2012 by the Fédération Départementale des Chasseurs de Isère (the Isère hunting federation). This survey refined the positioning of the detectors and substantial calibration work was performed. For certain sites (Saint-Quentin, Chapareillan, Le Cheylas), changes in location were suggested compared to the initial project. The operation was completed over two phases:

- Test phase: introduction of the system on the Bernin site in the spring of 2012. This phase led to a report being published to assess the efficiency of the mechanism.
- Implementation phase: triggered after the test phase, this involved installing 6 other detectors, which have been in use since February 25th 2012.

As of 2012, three cameras were installed in the Bernin site to allow the detection performance of the mechanism to be analysed. These cameras were then moved to the la Buisse site.

In October 2013 the signs were reconfigured to adjust their lighting up to sunrise and sunset (one hour after sunrise, one hour before sunset). This adaptation was decided upon to reduce the frequency of trigger events not linked to wild animals.

In September 2012 an act of vandalism was perpetrated on the Bernin site (a single solar panel was stolen out of a total of 48 masts).

Four training sessions were held in September 2012 and in February 2013.

These allowed département employees to better understand any maintenance and calibration interventions that were required on the equipment.

All the equipment was monitored in real time thanks to a web-based application, which, combined with email alerts, allowed for precise technical follow-up of all 48 masts in service.

ASSESSMENT

The system was assessed over several stages:

• DETECTION CAPACITY

Several experiments were performed: tests using dogs (by the Isère hunting federation), coupled with automatic cameras, use of videos taken by cameras on certain masts and so on. The detection system proved very effective in open spaces, but not very effective in forest areas (the detectors did not detect thermal variations very well).

• EFFECT ON COLLISIONS

The assessment of the system came up against a number of difficulties (phasing, technical, human aspects etc.). Monitoring of collisions near the systems was initiated, but did not produce sufficient results on which to base conclusions.

Monitoring of car speed before and after the installation of the systems was performed, but there was excessive methodological bias involved. This monitoring did, however, show that a very high proportion of motorists exceed the speed limits, while it is known that speed is highly correlated with the risk of collisions.

In general terms, the literature shows us that such systems are highly effective. A study was performed in Switzerland (Moser-Berger, 2003) on 7 different sites over comparable periods (on average 7 years before the introduction of the system and around 6 and a half years after). The results are very significant, with an average of 2 collisions (Red and Roe deers) per year and per site before installation, compared to 0.4 per year afterwards. Even the least effective site saw a 50% drop in collisions (1.2 compared to 2.3 before), whilst the site with the most spectacular results saw accidents fall from over 3 per year to 0.

SUMMARY: A FIRST IN FRANCE

The département's challenge was an ambitious one. It involved introducing for the first time in France an innovative mechanism simultaneously on no fewer than 7 sites. This experiment has allowed us to develop this technology and to improve it as the tests move forward.

The results suggest that this mechanism is effective in reducing road death amongst fauna and improving public safety. It also has a very interesting teaching role in raising awareness amongst drivers as to the risk of collisions.

This initiative is worth improving in the future, in particular through moving the two systems that are currently the least effective systems due to their environment (wooded areas and low walls).

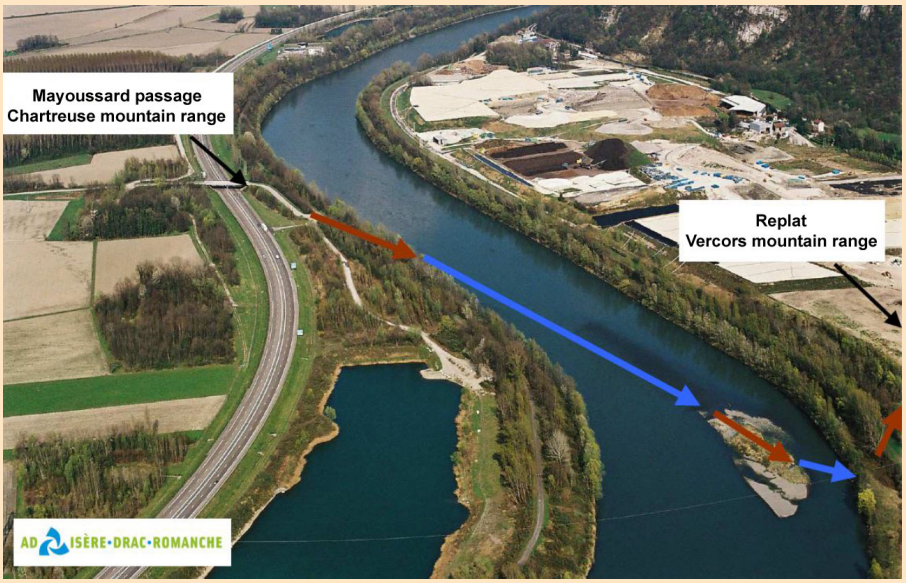
Ramps on the River Isère

OBJECTIVES

The Isère in Cluse de Voreppe is located on a major corridor, but it is difficult for fauna to access because of its steep and dammed banks. The ADIDR suggested building access ramps on two banks of the Isère.

WORKS PERFORMED

The works performed in 2013 involved reducing the access slopes to the Isère River at two points of the river at the level of PS 9080, which have in the past been reworked for fauna (through the installation of occulting mechanisms).



ASSESSMENT

Monitoring was performed using photo-traps over three consecutive weeks. These showed that species such as the Wild Boar were present on the site and they frequently travelled along the Isère River. Unfortunately we weren't able to observe any crossings of the Isère by animals at this precise point. However, the presence of wild boar is frequently mentioned on the islands in the middle of the Isère River. It is therefore highly probable that these ramps are used to cross the river.

SUMMARY :

The creation of ramps at this point in the Isère seems pertinent to the extent that an overpass has been built for fauna. It will probably take a few years before the animals incorporate this new structure into their inter-mountain range travel plans. It will be a good idea to manage vegetation so that the environments do not close up too quickly.

Above: Ramp which goes towards the Isère

Above: Wild Boar near the ramp at night

Restoring of the banks of the Coisetan

OBJECTIVES SOUGHT

The Coisetan stream is a tributary on the left bank of the Isère River, upstream from Grésivaudan and near the border with Savoie; it was perfect for developing an ecological corridor because it crosses an intensive farming area, but it has been substantially degraded (irrigation, cutting back of the riparian vegetation). There was too little vegetation on the corridor and the maintenance of its banks was overly rigorous.

The objective of this initiative was not only to work on the banks to make them more appealing and more practical for fauna, but also to modify management practices.

OPERATIONS PERFORMED

The following actions were performed by the département association Isère-Drac-Romanche, which manages this watercourse:

- Rebulking of the banks (2010–2011) and planting of marsh plants and pollarded trees. Repairs were required in 2011 because the first vegetation planted in 2010 died because of excessive water levels.

- Management practices modified to be more in keeping with the corridor issues, avoiding, for example, cutting during the nesting period.

Above: Coisetan before works

Above: The Coisetan bank in 2013

ASSESSMENT

It wasn't possible to perform an initial inventory before the works. Furthermore, the bushes that were planted are still too young and will only really come into effective service in the years ahead. Certain data, however, were collected:

- Terrestrial mammals: photo-trapping and searching for tracks allowed us to observe that foxes and badgers followed the natural corridor; this is undoubtedly also the case for other terrestrial animals;

- Bats: an automatic ultrasound recording device, SM2-Bat, was installed on the edge of an alluvial wood for 7 nights (around 56 hours of recording during twilight and overnight). It showed that at least 16 species and groups of species of bats were present in the study area. This diversity is important for what is a relatively small area, but reflects the typical population of Grésivaudan landscapes. The common pipistrelle dominates this population by some margin (over 60% of contacts recorded); this species is relatively typical of approaches to wooded areas.

- Dragonflies: 19 species were observed within the restored Coisetan area. The specific diversity is important in relation to the relatively small area of the study area and reflects the mosaic of natural habitats of the Coisetan, which is favourable to structured odonatological populations.

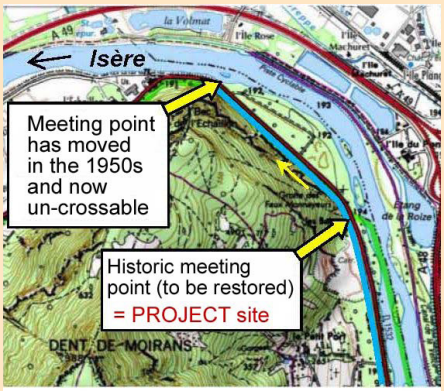
SUMMARY:

The rehabilitation of the banks of the Coisetan was a positive initiative. It reinforced the role of this key corridor, which plays a particular role for forest and aquatic animals, bats and insects. It will be increasingly useful over time if the vegetation planted continues to develop correctly, i.e. if the water levels do not rise too high.

Réhabilitation de la confluence du Ruisset

OBJECTIVES SOUGHT

The meeting point of the Ruisset and the Isère (which was moved around a kilometre downstream in the 1950s) has become un-crossable for fish. The progressive settling of the Isère bed has generated a difference in levels of several metres at the meeting point of the Ruisset and the Isère, preventing any fish communication between the two watercourses. This disconnection of the Ruisset has resulted in particular in a degradation of its trout populations (low density and unbalanced populations).



Above: Situation before the works

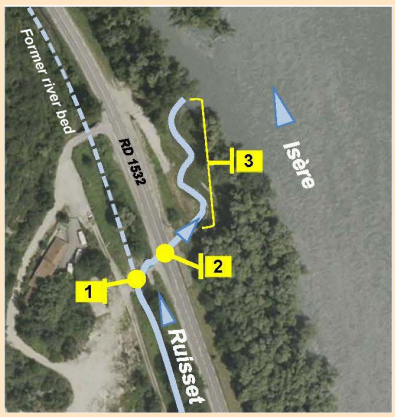
WORKS PERFORMED

The technical solution chosen was to restore the historic meeting point of the Ruisset by:

1 installing a deflector sill in rocks on the bed of the Ruisset,

2 sinking a tube under the RD 1532 (diameter 1600; length 28.5 metres),

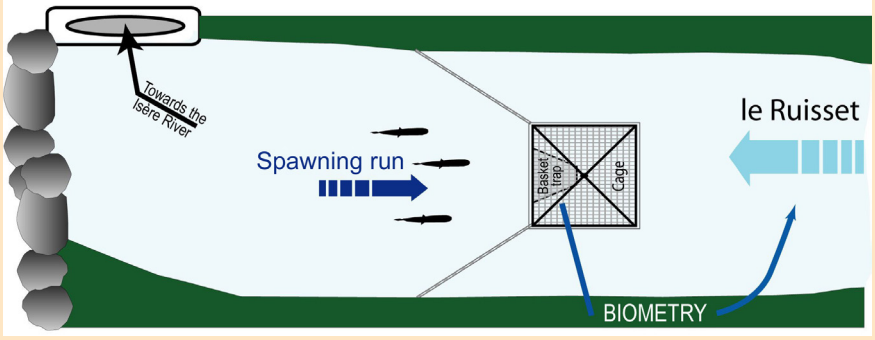
3 creating a new bed between the road and the Isère (80 metres re-diverted).



ASSESSMENT

A passive trap device was installed on the bed of the Ruisset upstream from the tube to capture fish swimming up from the Isère (cf diagram below).

This device, designed especially for this monitoring process, comprises a wire cage (around 1 cubic metres) equipped with a trap facing downstream. Two side panels guide the fish towards the trap. All of the cages are covered by a 1 centimetre mesh grid (adapted to small species).



Above: Diagram of the trapping system

Above: Fish photo trap

Trapping is scheduled over two periods of the year:

- April/May 2015: Upstream migration to fast running (and sheltered) waters by the Cyprinidae,

- October/December 2015: Climb of the Salmonidae (trout).

This operation will be performed primarily by the FDPPMA, which is located near the site.

The spring campaign currently under way was disrupted by high-water conditions on the Ruisset River (high rainfall). The last capture sequences (cage installation and removal) are planned between now and the end of May. Electric fishing will also be performed in the re-meandered section so as to assess the crossability of the ramps (before crossing the pipe).

Above: The course of the Ruisset river realigned

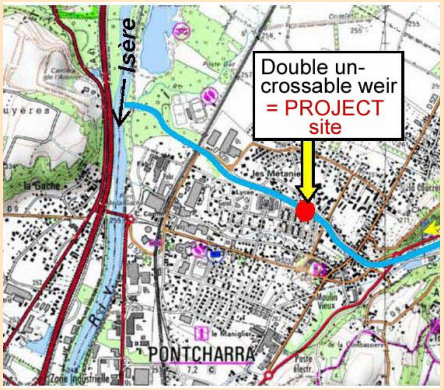
SUMMARY: RESTORATION OF A MORE NATURAL CONFLUENCE

La This operation involved overcoming some technical difficulties linked in particular to digging under a main road without major disruption to traffic.
The project improved the situation, thanks to the restoration work on the downstream section of the Ruisset: reducing slope facing fish, recreating a meandering river bed to support fish stocks.
Follow-up on the project gave rise to the design of an original technique (trap-cage), little used in the past; this equipment could be used in the assessment of other similar projects.

Creation of a fish pass on the Bréda

OBJECTIVES SOUGTH

The double weir in the Méttanies districts (cf map below) is located around 1.4 kilometres from the meeting point of the Bréda and the Isère. This structure could not be crossed by fish fauna (cf photo below) and in this respect represented the first obstacle to trout swimming up the Isère River in the Bréda.



Above: Situation before the works

WORKS PERFORMED

The hydraulic and usage constraints associated with the double sill have oriented the crossing mechanism towards the idea of a rock ramp on the right bank of the Bréda (cf photo below). In practice, rows of large blocks which are sealed perpendicular to the flow create a succession of small crossable weirs that make up the height difference created by the double weir.

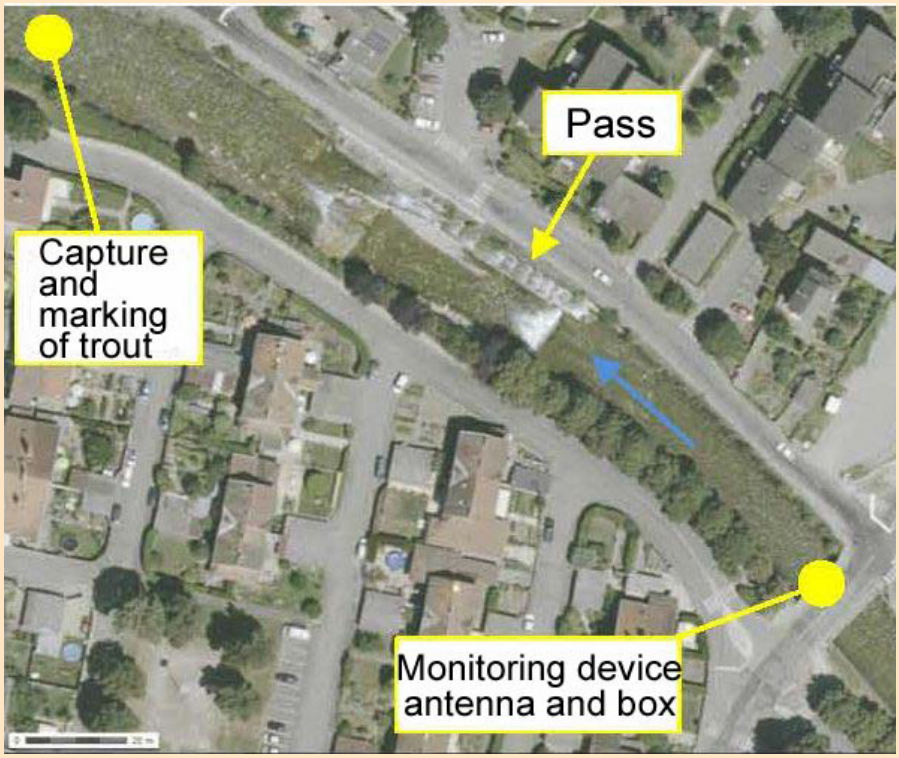
ASSESSMENT

• La solution de suivi retenue pour ce site repose sur le principe du « Radiotracking ».

This device adapts the principle of telecontrol to fish (RFID technique):
Several dozen trout are captured downstream of the pass and equipped with an individual 'badge' (number, size, weight etc.).
An antenna is installed upstream of the pass (= a cable along the bed of the Bréda). A recording box combined with the antenna captures real time passage of 'badged' trouts over the pass.
The mechanism was tested several times beforehand (spring 2012 and 2015) in collaboration with CIPAM. This technology remains fairly experimental in natural conditions (problem with interferences etc.).
The antenna will be installed at the bridge near the rue du Grésivaudan (cf map below). The latest test validated the location of the antenna.
The trout will be marked in September 2015 before their winter climb towards the cooler zones. To do this they will be captured by electric fishing, put to sleep (in order to install the transponder in the abdominal cavity) bio-marked (size, weight) and put back in the water.
Monitoring of recordings will be performed by the ONEMA teams during the winter of 2015/2016.

Above: Transponder

Above: Reception box



SUMMARY: AN AMBITIOUS, POSITIVE OPERATION

The Bréda's double weir was an insurmountable obstacle for Trout; and this situation has now been substantially improved. The operation re-establishes the connection between the Isère and Bréda rivers, as a complement to the work to restore the confluence supported by SYMBHI.
The creation and validation of these monitoring processes (protocols, equipment, period etc.) was the result of numerous exchanges between the département, ONEMA and the Isère fishing federation. This close collaboration, which was crucial to the implementation of these pilot monitoring phases, was a very positive first step in the assessment process within the Paths of Life project. The follow-up planned for next autumn will show us just how effective the project has been.
Similarly to the Ruisset, this operation allowed Isère personnel to develop innovative techniques which could be used subsequently on other waterways.

Trees and hedges in farming areas

OBJECTIVES SOUGTH

In terms of the management of farming areas the increased presence of trees is a strong ecological challenge. In high crop growing areas such as the Grésivaudan, trees are indeed few and far between because of their impact on production (shade and consumption of water), even though they do play a very important role as natural habitats and corridors for fauna. Conscious of this challenge the Isère département accompanied several projects in favour of the planting of trees in farming areas.

• PLANTING OF HEDGES

The Paths of Life project included an objective to plant 'guide vegetable structures' designed to welcome fauna and encourage movement. And so, AURG did the mapping that was then presented to local actors during site meetings. At the same time, the ADATG (Association for the Development of Agriculture in The Grenoble Y) and the Isère agricultural chamber initiated a number of actions to raise awareness amongst farmers on this point and to propose agro-environmental measures. Two operations succeeded thanks to the involvement of the FRAPNA Isère and the communes; they were initiated in the communes of Tencin at the Touvet, over a length of around 200 metres. In the Touvet we should note the involvement of the municipal council of children.

These actions are positive although modest and somewhat disconnected from other ecological corridors. The vegetation planted is still too young for an ecological evaluation to be performed. Occasional monitoring of the Touvet site showed a use of the sight by 9 species of bats.

• AGROFORESTRY

Agroforestry is the combination of trees and crops or animals on the same farming plot, around its borders or in the fields. This technique allows cropping to take place whilst planting trees of an ecological and economic interest (such as walnut trees, rowan and ash); trees bring the benefit of using the deep layers of the soil, thus enriching that soil. An initial agroforestry test site was set up in Saint-Nazaire-les-Eymes, in partnership with the Chamber of Agriculture. The plot was acquired by the département and entrusted to a farmer. It is planted with maize and sunflowers, and walnut and cherry trees were planted. The département signed a partnership contract with the Chamber of Agriculture to raise awareness about this practice.

• FENCES

Certain plantations of walnut trees and local truffle oaks are fenced in by their operators to avoid theft. The département consulted the actors concerned so as to ensure the possibility of local animal traffic (identification of fences, choice of fence type).

• POLLARDED TREES

Since 2009 the botanic association Gentiana has been performing an inventory of pollarded trees in the Isère and conducting awareness raising actions around these remarkable trees with the support of the département.

CONCLUSION: A PRIORITY, BUT COMPLEX ACTION

Agriculture is undoubtedly the area where the Paths of Life project met the most difficulties and where the least was translated into action. The sociological assessment of the project (OSL 2013) indeed shows that farmers were the most sceptical people involved in the whole project. This is undoubtedly related to the situation faced by agriculture in the region, which is subject to substantial pressures (from urbanization, infrastructure etc.) and dominated by an intensive farming model (culture of corn).
All the work performed over the years with the world of agriculture has certainly not been in vain and should bear fruit at some point in the future.

Above: Pollarded tree

In addition to the works performed, awareness raising actions

At the same time as these works were being carried out, awareness and consultation initiatives were led and targeted at populations that were important in different ways and interested in the issue of ecological networks.

• GUIDE FOR TAKING CORRIDORS INTO ACCOUNT IN URBAN PLANNING DOCUMENTS

One of the major means of protecting ecological corridors is to take them into account in urban planning documents and first of all in local urban planning plans. The planning agency of the Grenoble region has written a methodological guide on this subject to help local authorities to contribute to this policy.

AWARENESS-RAISING ON REASONED SPATIAL MANAGEMENT

Each commune is involved at its own level in ecological networks because parks and gardens and roadsides are all possible ecological corridors, or even reservoirs for small animals. The Gentiana association has designed and distributed a guide to sensible management that seeks to strengthen the presence of biodiversity as a concern in the management of these areas. It has also held training days with commune personnel and given presentations to nursery owners. An exercise was led in collaboration with the département Association of Isère-Drac-Romanche, who are responsible for maintaining ditches on the plain, resulting in an interesting adaptation of management practices (choice of dates, the battle against invasive species). A telephone poll held in 2014 across 22 communes concerned by the project, showed that 73% of them practised reasonable roadside hedge cutting without having an actual cutting plan. 95% were committed to a policy to abandon phytosanitary products, but only half of them had signed proceedings to abandon phytosanitary products requested by the département as part of its eco-conditionality process. More than half had received training in sensible management of communal areas.

RAISING AWARENESS FOR INFRASTRUCTURE MANAGERS

Some large infrastructures (electricity lines, railways, motorways etc.) occupy a substantial portion of the ecological network because they are both obstacles and corridors for fauna. The ecological management of vegetation surrounding these infrastructures is therefore particularly desirable. Information initiatives targeting infrastructure managers (SNCF, AREA, RTE etc.) have been organized to promote this approach.

We should also note that the Isère département is itself a leading spatial manager through its network of A and B-roads. The Paths of Life project has substantially brought on board the département's roads department, contributing to an increased awareness of biodiversity issues in its management practices.

SCHOOL ACTIVITIES AND PUBLIC OUTINGS

Between January 2010 and July 2014 FRAPNA Isère ran no fewer than 156 half days for schools or the public related to the Paths of Life project, raising awareness among a total of 1,576 people. In spite of a difficult start due to lack of knowledge of the topic, the information sessions were a real success. This subject is now being addressed during ENS sessions funded by the département. A film has been made to present the work done during those sessions.

DISCOVERY PATH

A discovery path was created between Terrasse, la Frette and le Touvet, using communal paths. 11 educational information panels help the public to discover the local fauna and ecological corridors. Located on the hillsides, it also provides a view over the valley and the corridors. A flyer has been printed for the communes.

LIGHT POLLUTION

Lighting leads to light pollution, which disrupts the movement of certain nocturnal species known as 'lucifugous'. Isère département has led actions in this area with la FRAPNA: participation in the national event 'Le jour de la Nuit', distribution of a technical guide, a labelling system and so on. Certain communes such as Bernin and Le Versoud have changed their public lighting practices to help fauna and to give the general public a better view of the stars.
This action was not formally included in the Paths of Life project; we mention it here for the sake of consistency because it is another aspect of ecological corridors.

CONCLUSION:

Other actions have been led in the area of information: exhibitions, distribution of brochures and other documents, and so on. All of these efforts are useful in helping all members of the public understand the issues around ecological networks.
This is a long-term exercise because the actions undertaken are not sufficient to immediately transfer these principles into all of our behaviour.

4 OVERALL ASSESSMENT OF THE PROJECT

4.1 Principles

Having analysed each initiative it is possible to make an overall assessment of the Paths of Life project, using as a reference the following assessment criteria: completion, suitability, effectiveness and coherence. An assessment of efficiency was not in our remit.

First of all it is important to make some comments on the conditions under which this assessment took place, which other project leaders can use when monitoring their own projects. First of all we should note that the assessment of ecological corridors is a very complex domain, which is not covered by any reference approach; it was even less so in 2009. The whole project and its assessment element therefore constitutes an experimental and pragmatic dimension.
The leaders of the Paths of Life project equipped the project with a solid assessment mechanism both through the resources used and the duration of that assessment; this point is extremely positive. The slightly tardy launch of the assessment limited the period of study before the works, compromising the before/after comparison. It seems important to initiate such monitoring as quickly as possible.

Finally, we note that the project objectives as initially formulated were relatively generous ('allow the passage of any type of fauna' etc.). More precise objectives (species targeted, quantity of objectives etc.) would have made the evaluation work easier.

4.2 Completion

The actions planned at the beginning of the Paths of Life project were fully implemented, although with some nuances to this:

- Very many actions were completely implemented; this is particularly the case with work done on motorway and road infrastructure and fauna detectors.
- One action was postponed, to the extent that it was actually taken out of the project. This is the eco-bridge in Cluse de Voreppe. This postponement has few consequences to the extent that the structure is actually planned.
- Some actions were only partially implemented. This is the case for measures affecting the quality of space (planting of hedges, work in farming areas, work on natural spaces around fauna detectors), where implementation was very difficult in the land tenure and socioeconomic context of the Grésivaudan.
- A number of actions were actually abandoned, because they turned out not to be implementable. This was particularly the case for the installation of traffic slowing devices on certain road accident spots; this measure proved impossible for reasons of safety.

This outcome is quite satisfactory and shows that the project was well prepared beforehand. The low implementation rate of the 'spatial planning aspect' is the less positive point. We regret this even though it is easy to understand why it happened.

We would also note that some actions that were not planned originally were implemented during the project. Personnel responsible for project monitoring and the many exchanges between actors allowed us to seize opportunities and to implement a number of interesting projects:

- Action in favour of dark corridors;
- Experimentation in agroforestry;
- Work on compensatory measures. In la Buisse, a wasteland plot of 6,000 square metres belonging to the département and located in an ecological corridor will become the site of a compensatory wetland area within the framework of a project led by a neighbouring mining company.

4.3 Suitability

Suitability refers to the match between a project and the challenge presented.

It is possible to assess the suitability of a project on several levels.

Generally the suitability of the project is not in doubt. The fragmentation of spaces is one of the major causes of the decay of biodiversity throughout the world. Isère département was a pioneer in translating this relatively new principle into operation. The Paths of Life project presented a high level of overall suitability because it concerned all the factors in the degradation of ecological connectivity: not only occasional obstacles, but also the overall quality of the landscape and spatial planning.

The actions contained within the project addressed real issues. The mapping of the ecological network confirmed their suitability to the extent that the works performed were almost always part of proven ecological corridors or even biodiversity reservoirs.

As always in an assessment it is important to stand back and take stock. The fauna detectors primarily recorded common species whose state of conservation is not under real threat (Roe Deer, Wild Boar, Fox, etc.). However, their suitability is bolstered when we consider that these mechanisms can also protect more rare species. Suitability is strengthened even more if we consider the educational dimension.

The detailed localization of the two detectors seems relatively unsuitable because the layout of the location (presence of low walls etc.) renders them inoperative. It would be preferable to move these systems a few hundred metres further on, to more sensitive sections of the road.

4.4 Effectiveness

Effectiveness refers to the attainment of objectives.

Most of the project actions can be considered effective. Fauna passages allow numerous animals to cross roads without danger. Detectors were shown to be technically effective (they do detect animals); the literature and a number of elements in our possession would suggest that there has been a reduction in collisions as a result.

A number of structural changes do not seem to have been effective since no increase in fauna traffic had been observed. This situation may be temporary since we know that animals take some time to incorporate a new structure

into their movement habits. Nevertheless, certain works (OH115, PI120, OH140) would appear to be of limited interest because of their physical characteristics, excessive human traffic or an unfavourable environment (lack of vegetation guiding animals towards the structure).

The overall effectiveness of the Paths of Life project is relative because these modest actions are not sufficient to preserve and restore ecological connectivity over several tens of thousands of hectares. The project is of greater indirect effectiveness because it had a major dynamic effect on other policies and other public and private actors (cf below).

4.5 Coherence

INTERNAL COHERENCE (WITHIN THE PROJECT)

The Paths of Life project is very coherent because it is made up of complimentary actions. This coherence was made fragile, however, by the low level of achievement of actions concerning land use.

EXTERNAL COHERENCE (BETWEEN THE PROJECT AND OTHER PUBLIC AND PRIVATE POLICIES)

One of the strengths of the Paths of Life project is that it has initiated complementarity, or even synergy with other projects, including the following:

- The Isère Amon project lead by Symbhi: the restoration of fish corridors, planting of substantial sections of hedges (cf box below).
- Local authorities. Grenoble Alpes Métropole, the community of communes to the south of Grenoble and other authorities have initiated approaches in favour of ecological connectivity. The involvement of local authorities is especially important when the preservation of connectivity over the whole of the territory must take planning documents into account.
- Infrastructure managers have become involved beyond the Paths of Life project. The eco-bridge project at Cluse de Voreppe is currently under study under the guardianship of AREA. SNCF has financed the creation of small fauna passages in the Cheylas area and is envisaging a more ambitious requalification programme for its rail network in Grésivaudan in terms of ecological connectivity. EDF is studying the possibility of making it easier for fauna to cross the Saint-Egrève dam. A partnership between EDF and FRAPNA has identified and treated the most dangerous sections of overhead cables for birds.
- In Combe de Savoie to the north of Grésivaudan, another corridor contract has been implemented in recent years to improve ecological connectivity between the Chartreuse and Bauges ranges.

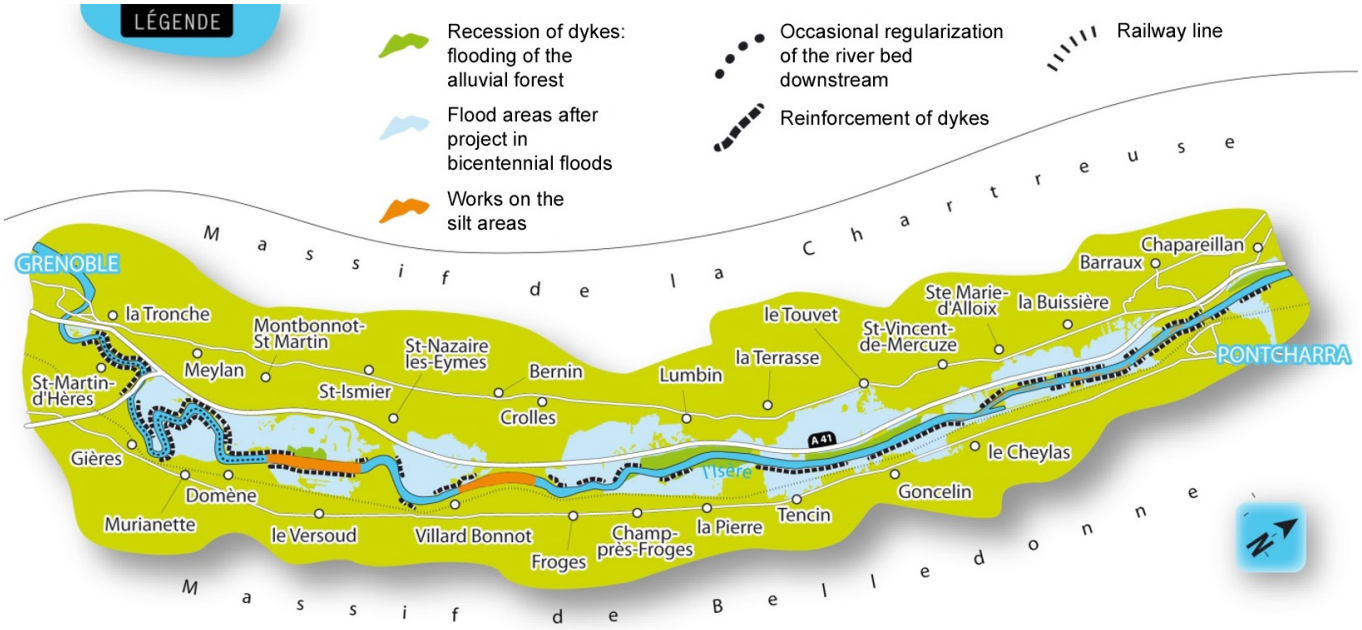
Pipes under a railway line in Cheylas

During modernisation worked on the line, SNCF Réseau installed four 60-cm pipes, with a flap system for animals. Monitoring (Ecosphère, 2014-2015, 800 days of photo-trapping) led to the detection of almost 260 animals of 13 different species. This set-up is efficient for medium-sized species (Fox, Badger), and even more so for small animals (micromammals, Common Toad, Newt, Lizard, etc.).

Above: Western green lizard

Substantial complementarity: The Isère Amont project

The Isère Amont project, led by SYMBHI (Syndicat Mixte des Bassins Hydrauliques de l'Isère) focuses on the overall restoration of the Isère River from Pontcharra to Grenoble, stretching over 29 communes. It has three objectives: protecting urbanized areas from flooding, rehabilitation of natural areas and the use of the river banks by locals (development of leisure activities).



This project contributes to the restoration of ecological corridors on the banks of the Isère River:

- Works on 8 confluences and a weir which pose an obstacle to fish because of the settling of the Isère River;
- Reinforcement of the ecological corridor by planting hedges in dyke recession zones and on other plots purchased by SYMBHI on the banks of the Isère River and occasionally on the plain;
- Filling and reinforcement of almost 300 hectares of alluvial forest.

These works began in 2012 and complement the Paths of Life project by reinforcing the very important role of the banks of the Isère River as a place of refuge and corridor for fauna and flora.

Above: Bréda-Isère confluence after rehabilitation of fish cross-ability. Photo Symbhi – Photec.

PROSPECTS

In spite of its scale the Paths of Life project is a relatively modest one. It has produced some interesting results that need to be substantiated and completed. We present a number of avenues that could involve the Isère département, but also other actors (local authorities, developers, owners and users of those spaces).

5.1 A priority: spatial planning

The preservation and sustainable restoration of ecological networks means taking all aspects of spatial planning into account. A number of themes appear particularly crucial.

PLANNING DOCUMENTS: CONTINUE AND STRENGTHEN THE APPLICATION OF THE GRENELLE PROCESS

Since the Grenelle Environnement, local planning plans have to take into account the green and blue habitat networks. This approach is crucial to creating non-urbanized zones between the villages and the towns of the Grésivaudan. It should be made easier by the work on raising awareness done by actors within the framework of the Paths of Life project. The maps developed within this assessment may contribute to discussions and debates around how to define communal grids without fixing boundaries.

PATHS OF LIFE STRUCTURES: FUNCTIONALITY WHICH NEEDS TO BE REINFORCED

The benefit gained from the structures created or improved within the project is linked to the quality of their environment and in particular the existence of landscape structures (hedges, woods, meadows etc.) that lead animals towards these preferential passing places. The Paths of Life project sought to tackle this question in spite of major difficulties, linked in particular to land tenure and the agricultural context. In spite of its complexity this issue should be tackled again with determination.

FARM AREAS: A PRIORITY SUBJECT

It is very important to preserve and strengthen ecological connectivity within farming areas, by planting hedges and grassy strips, taking the movement of fauna into account when erecting fences, enacting ecological management of roadsides and ditches. This work means continuing to consult with the farming world, which will allow us to envisage some ecologically interesting solutions that would also be economically viable.

INFRASTRUCTURES AND OTHER REWORKED SPACES: POSSIBLE IMPROVEMENTS

In an area that is as artificialized as the Grésivaudan, many reworked spaces can contribute to ecological connectivity: roadsides, motorway buildings, dykes, ditches, power cables, urban or industrial zones in greenbelt areas, capture fields, air strips and so on. The Paths of Life project allowed us to raise awareness with actors of the ecological management of some of these areas. These actions should be continued and substantially developed.

REINFORCING THE NATURAL SENSITIVE AREA OF ALLUVIAL FORESTS

Isère département launched an ambitious project with the creation of l'Espace Naturel Sensible for alluvial forests in the Grésivaudan. This project is very interesting in terms of ecological networks because it seeks to preserve and sustainably restore a vast natural wooded area at the end of a valley. Alluvial forests like this act as a biodiversity reservoir, corridor and relay point for animals in transit. It is therefore desirable that the project should be backed up by land purchase and actions to restore and maintain the ecological balance of this area. This action is complementary to the Isère Amont project, which must over the long term take on board the question of ecological connectivity.

TAKING LOCAL ECOLOGICAL CORRIDORS INTO ACCOUNT

The Paths of Life project sought to raise awareness among members of the public of ecological corridors. This action should be continued and amplified so as to ensure that all members of the public become actors in the protection of biodiversity. Great potential exists in outer-urban areas which have many greenbelt spaces. Interesting actions can be led at a very local level on private or public land: choice of fences that can be crossed by fauna, creation of small crossing structures (rope bridges, etc.), resorption of fauna tracks (rain water drains etc.), managing green areas more sensitively.

5.2 Works to be completed

The works carried out for the crossing of fauna have been beneficial, but they need to be adapted and if possible supplemented:

THE SMALL FAUNA PASSAGE IN CHEYLAS

This structure should be supplemented to capture animals that attempt to cross the road from one side or the other. After one or two years monitoring it will be possible to choose the best technical solution (extending the pathway, installation of a new pipe etc.).

MOTORWAY PASSAGES

Certain motorway structures could be improved with some additional works:

- Occulting overpasses
- Creating dry passages
- Improving funnels: laying soil, stone etc…

The priority is to improve the areas immediately around these structures, through planting vegetation which will attract fauna, and including indigenous bushes.

FAUNA DETECTORS

Two fauna detector systems need to be moved towards sections of road where they will be more effective, in particular through better fauna detection capacities, i.e. plan their installation in crop growing areas.

ONE DAY WILL THERE BE AN ECO-BRIDGE IN HAUT-GRÉSIVAUDAN?

As planned in the project the actors investigated the possibility of creating an eco-bridge over the A41, at the upstream end of the sector. This section, which is on the Savoie border, represents a major corridor thanks to the maintenance of relatively natural areas on both sides of the motorway. This project was not considered feasible in the current economic and technical context; it may possibly see the light of day over the medium or long term.

GENERAL CONCLUSION

Paths of Life is one of the first French projects to target the overall restoration of an ecological network within a territory of several tens of thousands of hectares. When the operation was first put together the actors sought to identify all complementary actions that could be implemented within the context of the site and the project (deadlines, budgets, human resources, regulatory and institutional resources).
This approach led to the introduction of a diverse range of actions, concerning not only the resorption of occasional obstacles to the movement of fauna, but also spatial planning and the raising of awareness amongst all actors concerned.

This project had an experimental character that translated into the development of innovative technical solutions like, for example, the fauna detectors that were developed for the first time by a French company. This innovative aspect and the pressure on space were of course sources of difficulty: the need to rework certain projects, the impossibility of introducing actions affecting land use in any substantial way, and so on.

In spite of these limitations the scientific and technical assessment shows that the project can be considered a success. The vast majority of the planned actions were implemented. The project has allowed us to improve the crossing conditions for fauna of numerous structures and to eliminate certain sectors of animal mortality. It has also enabled us to improve spatial occupation locally (planting of hedges, restoration of the banks of the Coisetan). The main success of the project may be to have mobilized a large network of actors that allowed us to initiate or reinforce numerous complimentary projects: restoring ecological corridors on the banks of the Isère (SYMBHI), taking the green and blue habitat networks into account in planning documents, environmental projects of local authorities, developers and associations, and so on. This dynamic leaves us optimistic as to the long term effectiveness of the project.

Ecological networks can only be preserved if there is a combination of multiple actions implemented at varied levels and continued over the long term.

The Paths of Life project must be considered a first step in this direction; it should be continued and strengthened over time through an increasingly global approach to space, and in terms of the diversity of partners involved.
This prospect requires an overall approach to the conservation of ecological networks. Of course, first and foremost it is a project that seeks to offer long-term protection for fauna and flora in the Grésivaudan and the surrounding mountain ranges. Yet it is also an approach that answers other needs of our society: maintaining a balanced countryside, avoiding urban sprawl down the valley, preservation of local nature that contributes to the quality of life of inhabitants, maintaining viable farming in peri-urban areas, protection of important natural areas in terms of eco-systemic services (regulation of water cycles, microclimate etc.).
All these objectives underpin the interest of the Paths of Life project and the need to continue it in the same spirit.

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GLOSSARY

BIODIVERSITY

Contraction of 'biological diversity', it designates the diversity of all forms of life. It includes genetic and species diversity and ecosystems and therefore all natural processes which ensure the perpetuation of life in all its forms.

CONSANGUINITY

Linked to the increase of the probability of mating between related individuals, a reduction in consanguinity does lead to the disappearance of deleterious mutations by the increased mortality of individuals who have two copies, but it weakens the demographic of those populations.

CORE ZONE

A sector in which principal species or ecosystems are present and where vital living conditions are met.

ECOLOGICAL CONTINUUM

A continuum is associated with a sub-habitat and represents an accessible area from reservoirs of biodiversity to groups of species associated with that sub-habitat. A continuum includes biodiversity reservoirs and a variable sized envelope around those reservoirs. The size of the envelope corresponds to the maximum distance which can be covered by the group of species calculated according to the ease of movement offered by the different types of areas crossed. As a result depending on the distance between two biodiversity reservoirs and according to the type of environments between them two biodiversity reservoirs can belong to the same continuum or not. In practical terms the continuum is often made up of several sub-assemblies which require ecological corridors to link them up.

ECOLOGICAL OR BIOLOGICAL CORRIDOR

A route taken by fauna or flora that links biodiversity reservoirs. This functional link between ecosystems or natural habitats of a species allows it to disperse and migrate.

ECOLOGICAL NETWORK

Ensemble des milieux de vie des espèces et des continuit és écologiques permettant le déplacement de ces espèces.pourraient en l'absence de facteur de fragmentation.

ECOSYSTEM

An ensemble formed by an association or community of living beings and their geological, pedagogical and atmospheric environment.

FRAGMENTATION

An artificial phenomenon of fragmentation of space, which can or may prevent one or more living species from moving around as they could and should in the absence of fragmentation factors.

NATURAL HABITAT

Corresponds to the place where a given species lives. In the strictest sense it contains all the elements of the land used by the species.

POPULATION

A set of individuals of the same species living in a given territory.

SUB-HABITAT

Sur un territoire donné, c'est l'ensemble des espaces constitués par un même type de milieu (forêt, zone humide ou pelouse calcicole...) et le réseau que constituent ces espaces plus ou moins connectés. Ils sont composés de réservoirs de biodiversité, de corridors et d'autres espaces qui contribuent à former la sous-trame pour le type de milieu correspondant. Synonyme : sous-réseau, continuum.

TROUBLE SPOT

An intersection between a biodiversity reservoir, a corridor or a continuum and a natural or artificial barrier. The barrier is a place where the mortality rate of individuals is very high or where fauna cannot cross.

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