

Ecological corridors in spatial planning: lessons from over ten years of contract-based experiences in the French Alps

Ten years after the introduction of laws resulting from a national consultative process (Grenelle de l'Environnement) in which ecological connectivity was strongly promoted, what can we say about the creation of “corridors” as a new element in spatial planning? In a context of strong land pressure such as the French Alps valleys, where the financial stakes for landowners can be exacerbated, strong involvement and coordination of elected officials and stakeholders is essential. We analyze here a few experiences in Isère and Savoie to discover how this political will could be concretized and the lessons to be drawn in terms of approaches and tools.



Initiatives to set up ecological networks have multiplied throughout Europe since the 2000s as a way to address biodiversity loss, particularly in the Alps. Examples include the Swiss national ecological network (REN), the German initiative "BayernNetzNatur" and in

France the ecological network of the Isère department (REDI), set up in 2001. The REDI illustrates a specificity of the Alpine context where most of the (mostly natural) mountain massifs are separated by densely populated valleys where infrastructure, urbanisation and intensive agriculture are concentrated. This is particularly the case along the valleys that connect the cities of Geneva - Chambéry - Grenoble and Valence.

These Alpine valleys are significant obstacles to the movement of large fauna and the re-establishment of viable populations of threatened species such as the Eurasian lynx. Aware of this issue, the local government of Chambéry (*Métropole Savoie*) uses the lynx in its communication on biological corridors: "No Alpine massif can accommodate a hundred lynxes or a hundred eagles, so they must be connected in order to ensure the exchange of individuals. This is not a problem for the

golden eagle that can fly across the valleys, but it's much more of a problem for a young lynx looking to establish a new territory. Roads, motorways, railways and housing estates are in the way."

The Alpine valleys have played a pioneering role trying to protect wildlife corridors: in the wake of the REDI in 2001, the Savoie branch of "France Nature Environnement" (a conservation NGO) carried out an analysis of the corridors of Savoie in 2004-2005, and the Rhône Alpes Region integrated corridors into its own biodiversity policy in 2006, followed by the "cartographie des réseaux écologiques", a mapping of ecological networks in 2007-2008. These efforts have contributed to the important place taken by ecological corridors (known as the "trames vertes et bleues", TVB) in the "Grenelle de l'Environnement" (a national consultative process on environmental policy reform initiated in 2007) and in the laws that resulted from it: obligation for the regions to set up regional TVB committees and to define what was to become the regional scheme for development, sustainability and territorial equality (SRADDET). These high-level plans must be taken into account in local spatial plans (such as SCoT) and the local urban development plans (PLU).

Over the same period, environmental regulations that apply to developers of infrastructure projects have been strengthened in terms of avoidance, reduction and compensation ("in kind" offsetting) for their impacts on protected species and natural habitats. Ensuring linear infrastructure does not hinder wildlife movement has become a central issue in their design and management, as has the progressive definition of territorial strategies for the avoidance, reduction and compensation of impacts implemented by certain local authorities. Among these, Chambéry was a forerunner with its action plan for wetlands (PAFZH), voted in 2012, which identified the network of wetlands to be restored with the resources generated by the ecological compensation obligation imposed on developers impacting other (lower priority) wetlands.

Among other pilot experiences in France, those of the Alpine valleys have inspired and permeated the national regulatory framework, and ecological corridors are still a structuring concept for public action in the field of biodiversity in the French Alps, particularly for the regional government (Auvergne - Rhône - Alpes). In this article, we examine and draw lessons from this experience, particularly with regard to the design of multi-sectoral and multi-partner landscape-level initiatives and the tools that can be used by public and private stakeholders.

On a large scale, the corridors are intended to link biodiversity "reservoirs" such as the mountain massifs (see Figure 1). Within these corridors, the aim is to link fairly well-preserved habitat patches (e.g. woodlands or wetlands) (1) by removing obstacles to the movement of certain species (for example through wildlife crossings over or under roads, or by reducing road mortality) and (2) through the ecological restoration of degraded natural habitats that surround them. Several tools can be used to achieve and maintain the functionality of corridors on the targeted pieces of land:

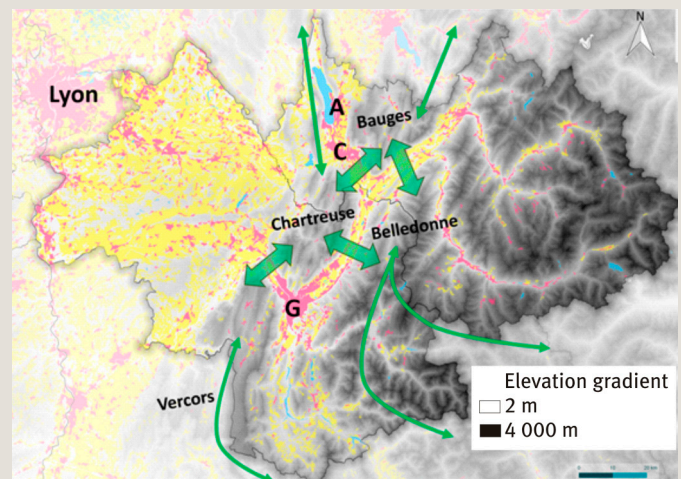
- Regulatory protection through a local-level designation enacted by the State ("*Arrêté Préfectoral de Protection de Biotope*");
- Land purchase by an entity whose purpose is to ensure long term protection: e.g. a local government, a land trust ("*Conservatoires d'Espaces Naturels*" or CEN), an association or a foundation; local governments at the *Département* level, in particular, have a pre-emptive right to purchase land for conservation (articles L113-8 and L215-1 of the Urban Planning Code), as do the public land agencies (EPFs) according to articles L.321-1 and others of the same code) and the parastatal entities mandated to regulate rural land trades to favour farming (SAFERs) under articles 143-1 and 2 of the "*Code rural*" (Rural Code);
- Zoning, whereby construction can be forbidden on a targeted plot of land, to conserve its biodiversity value (e.g. as a "*Zone prioritaire pour la biodiversité*" under articles L411-2 of the Environment Code), to protect woodlands ("*Espace boisé classé*" under article L113-1 of the Urban Planning Code), or to ensure it remains available for farming as a "*Zone agricole protégée*" (under article L112-2 of the Rural Code), which entails a cumbersome procedure for its change of use;
- Zoning whereby the plot of land is explicitly designated as an "*Espace de Continuité Ecologiques*" (ecological connectivity area: a corridor!) under article L113-29 and

others of the Urban Planning Code, which triggers restrictions that are enforceable under urban development plans such as a "*Plan local d'urbanisme*", which can also enact guidelines (e.g. protecting specific rows of trees, woodland patches or ditches). These zoning designations are not very protective and can be revised by local governments;

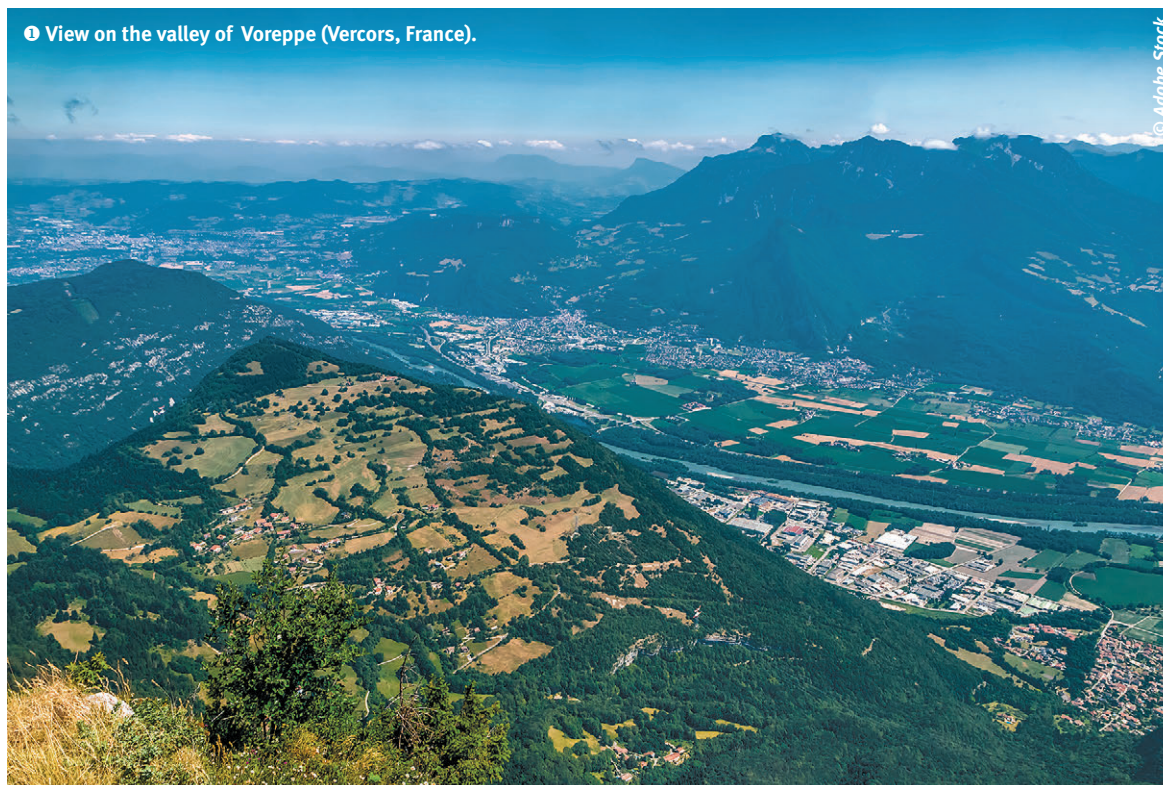
- Contracts with land-owners (e.g. through a covenant: "*Obligation réelle environnementale*"), generally associated with a financial compensation, which can also include agri-environmental measures financed by the European Common Agricultural Policy, funding from water agencies or funding from infrastructure and other project developers with ecological compensation obligations.

The political support needed to deploy these tools cannot be limited to establishing a shared culture around corridors by raising awareness among land-owners, farmers and users through clever communication. The intended outcome, rather, is to ensure that the conditions that enable wildlife movement are maintained or enhanced by integrating this goal into all projects that affect the local landscape such as agricultural practices and equipment (fences), road networks, and river bank management. This is particularly complex when a large number and diversity of land-owners and users are involved, and all the more so when the targeted corridors go beyond local administrative boundaries and multiple local government levels need to be involved. Where demand for land is high such as in the Alpine valleys, the financial stakes for landowners can be exacerbated, which requires a strong commitment by elected officials, and effective coordination with stakeholders. Here we analyse several concrete cases to discover how political support for corridors has been put into practice and the lessons to be learned in terms of approaches and tools.

1 Location in Isère and Savoie of the corridors analysed, between the Bauges, Chartreuse, Belledonne and Vercors massifs (double wide arrows), separated from densely populated and cultivated valleys. Urbanised areas are shown in pink and agricultural areas in yellow. Other Alpine corridors are illustrated by thin double arrows. Cities are indicated by a letter: G = Grenoble, C = Chambéry, and A = Aix-les-Bains.



1 View on the valley of Voreppe (Vercors, France).



Precursors: the “Corridors of Life” of Isère

With the establishment in 2001 of the ecological network of the Isère department (REDI), the local government of Isère was a forerunner in identifying and integrating ecological corridors into its policies, particularly in the Grésivaudan valley, between the Chartreuse and Belledonne massifs, and downstream from Grenoble where the “*Cluse de Voreppe*” separates the Chartreuse and Vercors massifs (see Photo 1).

The intention to restore links between the massifs took the form of a project named “*Couloirs de vie*” or “corridors of life” (2008-2014) led by the local government of Isère with various financial and technical partners like the former Rhône-Alpes Region, the Rhone Mediterranean Corsica water agency, other local (municipal) governments, the motorway concession holder AREA, the publicly-owned Urban Planning Agency (AURG), conservation NGOs, the managers of the Isère, Drac and Romanche rivers, and hunting and fishing federations.

With a budget of nine million euro, this program has made it possible to coordinate actions carried out by various public and private entities, particularly in connection with the ‘transparency’ of road and motorway infrastructure, and the management of the Isère river banks (the river corridors have also benefited from flood prevention works between Pontcharra and Grenoble carried out under the “*Isère amont*” project).

One of the most significant actions was the construction of a 12 m wide, 40 m long and entirely vegetated wildlife overpass on the A48 motorway in the “*Cluse de Voreppe*” valley, at a cost of more than 5 million euro, 85% of which was financed by the motorway concession

holder. This structure is a complement to 3 other wildlife crossings: two created under the smaller roads (number 1085 and 121a) and an improved underpass under the A49 motorway. It was not completed until 2018, however, 10 years after the start of the programme. Despite this considerable delay, the programme has improved ecological connectivities at other scales: mountain slope-to-valley movements, longitudinal connections along watercourses, local connections within the agricultural and peri-urban matrix.

The effectiveness of wildlife passages is tied to the corridors with which they are associated and lead animals to these preferential passages. In spite of particularly extensive actions in terms of consultation and awareness-raising among stakeholders, the programme has encountered major difficulties in guaranteeing the functionality of such corridors beyond the land effectively controlled by the project owners.

An evaluation of the project carried out by the Lyon Social Observatory found reluctance among certain actors, particularly in the agricultural sector which is currently caught between an intensive (conventional) farming model, considerable urban pressure and growing calls for change by environmental movements. The evaluation explicitly recommends developing ecologically relevant and economically viable solutions for preserving and strengthening ecological connectivities within agricultural areas, including the planting of hedges, sowing of grass strips, taking into account wildlife movements when setting up fences and ecological management of roadsides and ditch banks. This is typically the purpose of the contractual approaches mentioned in the introduction.

The Savoie "corridor contracts": the limits of the contractual approach

In 2009, the Rhône-Alpes Region published a map of ecological corridors (RERA) and wished to implement their protection and enhancement through pilots: the Bauges-Chartreuse (€3,665,032) and Chartreuse-Belledonne (€1,610,942) contracts were structured around 5-year action programmes, like the watershed contracts of water agencies and the Isère's Corridors of Life.

Initiated by the FRAPNA and the local land trust (CEN) of Savoie, these contracts brought together all the local governments of the corridor's territory as well as key stakeholders (e.g. farmers, fishers, hunters and developers of linear infrastructures) within an ad hoc political and technical governance structure led by *Métropole Savoie*.

While the evaluation of these contracts confirmed the relevance of the contractual approach as a tool for the coordinated mobilisation of multiple actors around a common object, on a scale that transcends traditional administrative and institutional boundaries, it also revealed certain stumbling blocks and inefficiencies:

- Although the construction of an underpass on the road between the Bauges and the Chartreuse (at the level of Chignin and Saint-Jeoire-Prieuré) was a clear success, at a cost of €1.5 million, the railway or motorway infrastructure managers did not engage with the approach.
- Efforts have focused on ecological restoration or conservation management activities within the identified corridors. Tangible results, however, have mainly been on land already secured or legally protected (particularly wetlands and aquatic environments) or where local stakeholders have a well-identified interest (e.g. for hunted or fished species). The mobilisation of agricultural stakeholders, in particular, has been blocked by the ineligibility under existing financing tools (agricultural subsidies) of the actions targeted by the corridor contracts.
- The failure to integrate protective measures for connectivity into urban development plans due to a lack of synchronisation with the timeframe for revising the zoning plans (PLU), which is itself governed by decisions outside the scope of influence of the actors involved in the contracts.

Even though it facilitates the emergence of local consensus, the contractual approach remains vulnerable to the volatile nature of political commitments which are needed to put this consensus into the decision-making agenda. Without this, the tools deployed have no prescriptive force and are structurally inadequate in the face of institutionalised decision-making processes such as environmental permitting of linear infrastructures, agricultural policies or the revision of urban development plans.

The place of ecological compensation examined in the Chambéry and Bourget wetland action plans

It is with prescriptive tools that wetland action plans (PAFZHs) were set up in the territories of the metropolis of Chambéry (in 2012) and of Bourget-du-Lac (in 2013),

in order to limit the degradation of wetlands and restore, maintain and protect them. In Chambéry, 113 wetlands (totalling 560 ha) were identified, including 19 wetlands (405 ha) of remarkable interest to be protected and 35 wetlands requiring work to restore their functionality (350 ha).

A significant proportion of these wetlands are located on private property and a local policy of "*opposition à déclaration*" signed in 2014 has made it possible to block by regulation any project that would lead to the draining, impounding, sealing or filling of wetlands or marshes as defined in article R.214-1 of the Environment Code. These provisions complement the inclusion of wetlands in urban development plans (under a "Nzh" zoning). In order to encourage owners to sell their plots, a financial incentive was set up which allows the real value of the plot to be doubled, with a minimum of €500 per acquisition. In order to legitimise and secure the investment of public funds into private land, a formal Declaration of general interest was obtained in 2016 (for Chambéry). Land management is a long-term process, but the PAFZH seems to have achieved more tangible results than the corridor contracts, with 57 ha in Chambéry either acquired or secured through long-term management contracts with landowners.

The PAFZHs have also made it possible to set up an operational framework for finding land to implement compensatory measures for development project impacts on wetlands: project owners implement their compensatory measures by contributing financially to the PAFZH on the basis of an area-ratio of 2:1 (set by the SDAGE, a regulatory scheme for watershed and water resource management) and a flat-rate cost of 2 euro/m² (which does not cover the cost of managing the wetlands once they have been restored). The developer remains legally and financially responsible for the implementation of its compensatory measures, but the implementation of the restoration and maintenance phases is delegated to the local government through the PAFZH. These provisions are illustrated by the compensatory measures for the construction of a business park at Landiers Ouest (Epinettes), in La Motte-Servolex, which was permitted in 2017.

The PAFZHs were financed and implemented within the framework of the lake Bourget watershed contract (2011-2017), whose mid-term evaluation highlighted the confusion on roles and responsibilities (who does what?) due to the large number of actors involved: the joint association for the sanitation of lake Bourget (CISALB), the CEN Savoie, decentralised State services like the DREAL (in charge of the Environment, Planning and Housing) and their equivalent at the *Département* level (DDT) as well as the Rhone Mediterranean Corsica water agency (the main funder). The diversity of financing mechanisms (watershed contract, "corridor" contracts, ecological compensation, agri-environmental measures) was also noted. Land acquisition has also been laborious, with around 12 ha acquired and restored within the framework of the PAFZH of Chambéry. However, a new contract for the period 2019-2023 foresees more wetland restoration (2 million euro) and the management of invasive plants and reed beds (1 million euro).



Conclusion and recommendations

The experiences presented above show how corridors have become a boundary object through contractual approaches organized around a coalition of actors and flexible governance which allows each actor to contribute to a coherent programme of activities. Since the early 2000s, this has generated a common language around a concept that was not at all consensual at the outset and led to it being anchored in numerous legal and financial tools.

The new Auvergne - Rhône - Alpes region has adopted this approach with its "*contrats vert et bleu*" ("green and blue contracts"), such as the one signed in 2017 with the Grenoble - Alpes metropolis for nearly €11.5 million (more than 70% of which is allocated to works rather than to coordination or studies).

Despite these advantages, the contractual approach remains fragile: the implementation of commitments on the ground ultimately depends on institutionalised decision-making processes, anchored in sectoral regulations. Its effectiveness is conditional on its political, technical and financial incorporation into these processes.

The French legal framework has evolved in favour of the institutionalisation of corridors under the concept of green and blue infrastructures, which makes it possible to define coherent corridors between spatial scales, with the assignment of the corridor function to cadastral plots (e.g. "Aco" for an ecological corridor in an agricultural zone and "Nco" for a corridor in a natural area). This function is thereby made explicit in zoning plans and urban development plans, and can be enforced against development decisions (if the local authority is willing to play along).

The goal of preserving ecological corridors has been linked to the goal of preserving agricultural (or potentially agricultural) land in the Alpine valleys, which helped to overcome the barriers that certain actors, including farming interests, raised against the concept at the outset. This was consolidated through the establishment of legal obligations (through zoning) which complemented the important work of raising awareness on the function and importance of corridors, generally entrusted to conservation NGOs.

Today, it appears that it is local governments at the municipal and inter-municipal levels that are best placed to articulate the strategic orientations and the decision-making processes needed to make corridors a concrete reality in the various sectors concerned (like infrastructure, education and ecology). It may be useful to provide a shared multi-sectoral technical assistance unit to support local governments and their partners and stakeholders (landowners, infrastructure developers etc.). This is the role that the CEN Savoie has played in the Savoie experiments (corridors, PAFZH), but without the necessary mandate or capacity to establish new business models for the corridors and their owners or users, e.g. through tourism or novel agricultural models. A duo between a local government and an urban planning agency with skills in wildlife and ecosystem management can also be a good model, as was done by the Grenoble metropolitan area for the preparation of its zoning and urban development plan (SCoT).

It is not enough to bring stakeholders together in order to obtain consistent intersectoral planning. There must also be temporal consistency and the contracts must involve the right actors at the right decision-making level and steps. Some sectors and actors risk remaining on the fringes of processes exclusively carried out by local governments. For example, the duration of the contracts (5 years) and their spatial scale are not consistent with that of decisions on the construction or redevelopment of large transport infrastructure. It was not until 10 years later that the A49 motorway's eco-bridge was finalized. Integrating decision-makers concerned with national infrastructure planning and investment rather than their regional counterparts may be a solution. At the other end of the scale, the financing mechanisms set up by the Regions in the field of biodiversity do not always make it possible to target actions on a particular plot of land when providing support to a whole farm.

The experiences of the Isère and Savoie regions also highlights the strategic nature of the land policy of local governments and their ability to develop and implement a coherent strategy for the conservation, restoration and economic and social development of corridors and associated natural and agricultural areas. This puts actors such as EPFs, SAFERs and the *Département* level governments at the centre of the game. Specific financial arrangements may be required to make it all work at the right level. The PAFZHs were precursors in this field, and in 2020 the preparation of a strategy for mitigation and ecological compensation in the Drôme Department was initiated which will be able to organise the joint treatment of the conservation and restoration of ecological corridors with the avoidance and compensation of development impacts on biodiversity, including financial tools. Despite clear requirements to avoid, minimize and compensate such impacts (articles L371-1 to -6 of the Environmental Code), and the opportunity to use this to conserve and restore ecological corridors, this approach is still new and not yet effectively applied. ■

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Table for the acronyms

Acronym	Full form	Translation
AURG	Agence d'urbanisme de la région grenobloise	Urban planning agency of the Grenoble region
CEN	Conservatoires d'espaces naturels	Regional conservatory societies
CISALB	Comité intersyndical pour l'assainissement du lac du Bourget	Joint association for the sanitation of lake Bourget
DDT	Direction départementale des territoires	Departmental land use directorate
DREAL	Direction régionale de l'environnement, de l'aménagement et du logement	French Regional Department of the Environment, Planning and Housing
EPF	Établissement public foncier	Public land agency
FRAPA	Fédération Rhône Alpes Protection Nature	Rhône Alpes federation for nature protection, it became part of "France Nature Environnement", the French federation of associations for the protection of nature and the environment.
PAFZH	Plan d'action en faveur des zones Humides	Action plan for wetlands
PLU	Plan local d'urbanisme	Local urban development or zoning plan
REDI	Réseau écologique du département de l'Isère	Ecological network of the Isère department
REN	Réseau écologique national	National ecological network (Switzerland)
SAFER	Société d'aménagement foncier et d'établissement rural	Parastatal entity mandated to regulate rural land trades to favour farming
ScoT	Schéma de cohérence territoriale	Territorial Coherence Schemes, a zoning and urban development plan
SDAGE	Schéma directeur d'aménagement et de gestion des eaux	A regulatory scheme for watershed and water resource management
SRADDET	Schéma régional d'aménagement, de développement durable et d'égalité des territoires	Regional scheme for development, sustainability and territorial equality
TVB	Trames vertes et bleues	Green and blue infrastructures