Towards a panel of indicators for monitoring the alluvial wetlands of the Garonne river

Pauline Quintin[1], Nolwenn Le Métayer[1], Alexianne Damien[1], Ludovic Olicard[2], Fabien Boutault[3]

A conservation strategy at the scale of the Garonne river corridor

Located in the southwest of France, the Garonne River is the fourth longest river in the country, with a watershed covering approximately 56,000 km². The Garonne is a highly anthropized river due to past and present human activities (sediment mining in active channel, embankment, hydropower plant), yet its valley harbors a remarkably rich natural heritage.

In 1987, following the end of sediment mining in active channel of the Garonne River, the NGO Nature En Occitanie (NEO) began managing the Ramier de Bigorre site in Merville (Haute-Garonne). Since then, NEO has become a key stakeholder along the river corridor, and manage several alluvial wetland sites, selected for their ecological and functional value. To ensure territorial coherence and operational efficiency, these sites have been integrated into a multi-site conservation management plan. This tool provides a broader perspective on habitat dynamics and conservation priorities across the corridor.
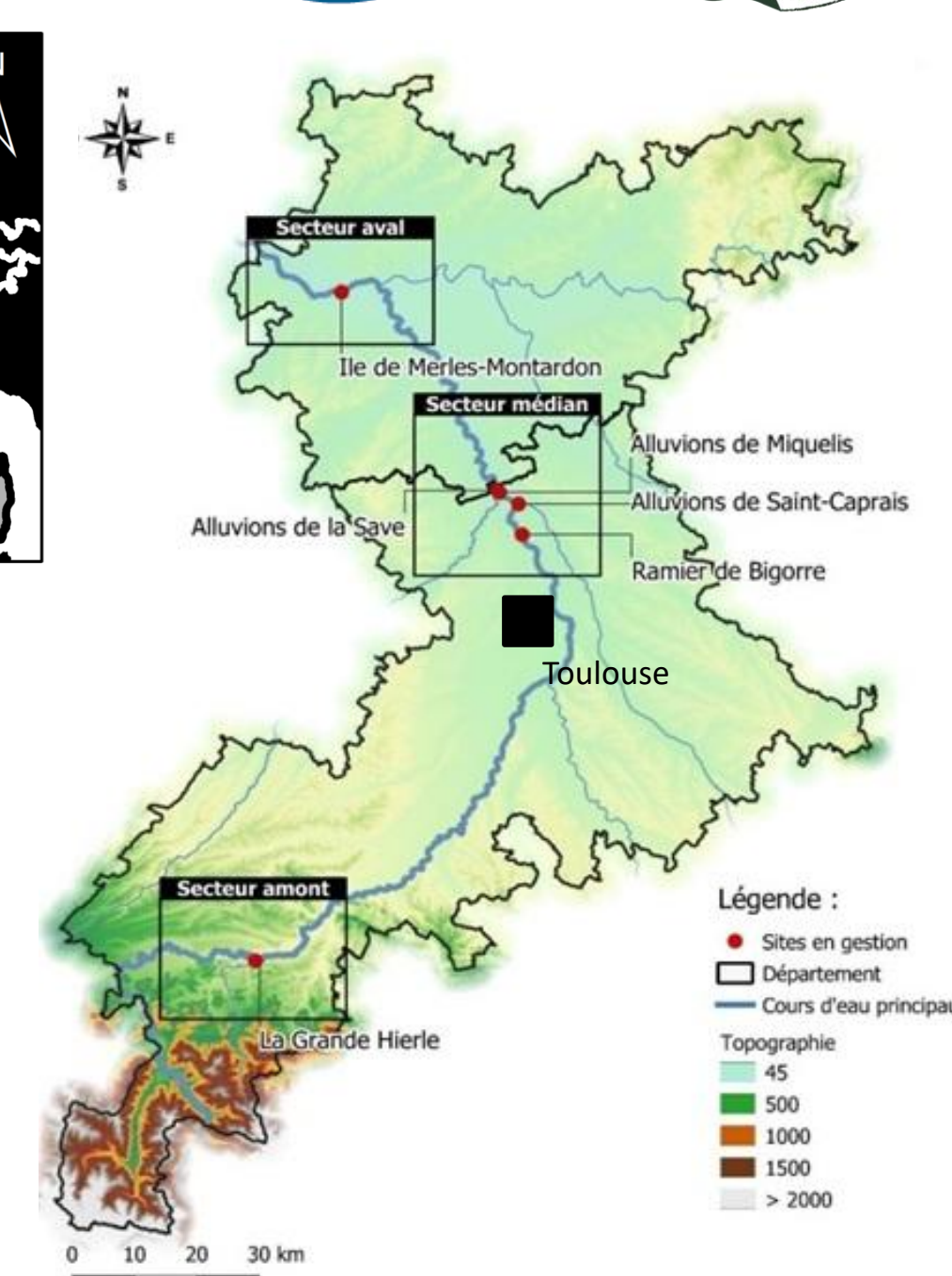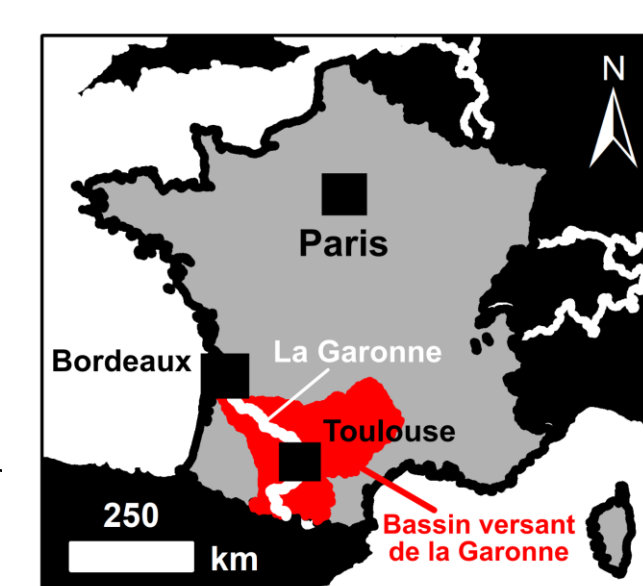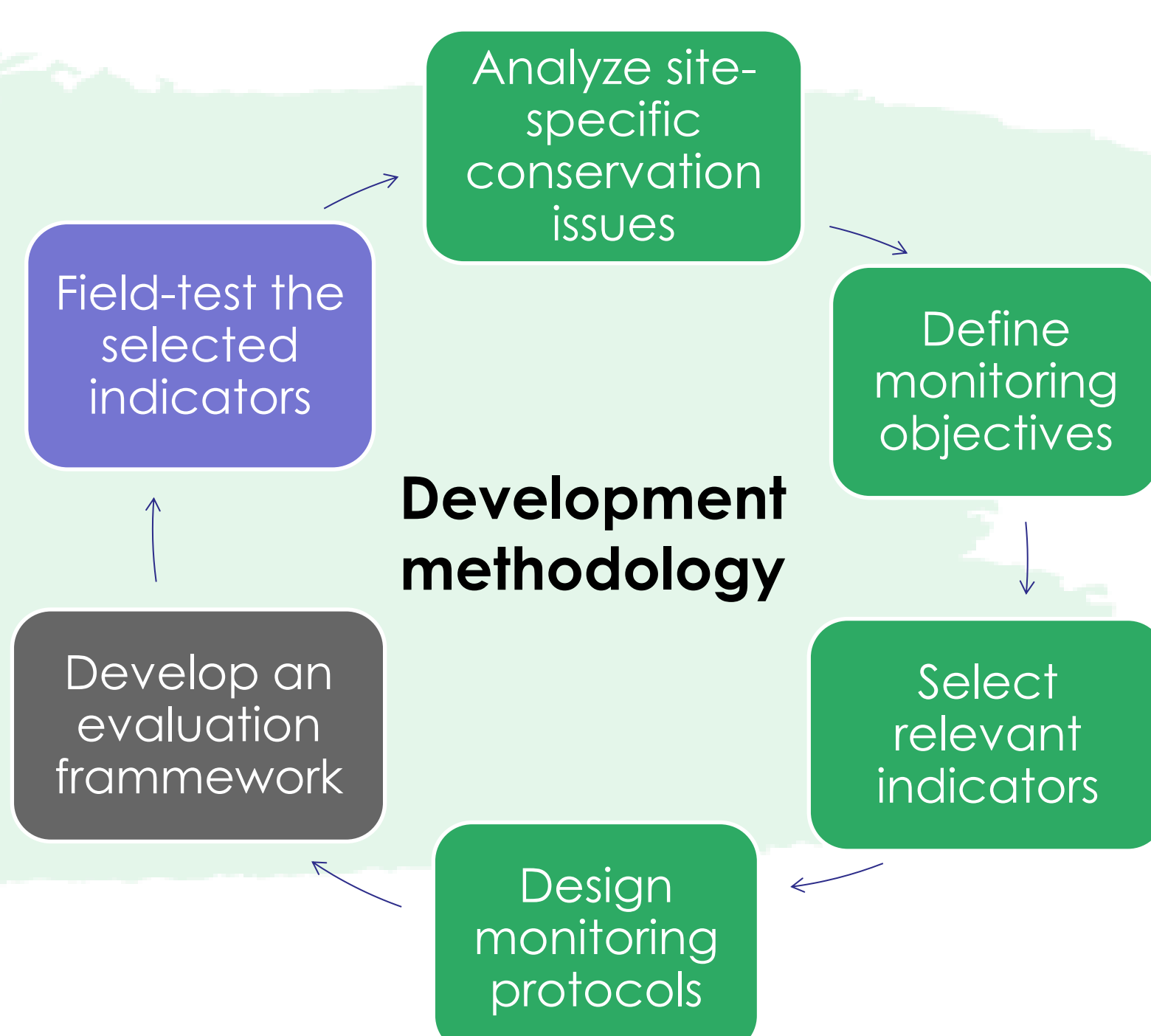
Context, objectives and method

Shared conclusion of a lack of coherence in scientific monitorings carried out:
- Multiple stakeholders involved along the Garonne river;
- Absence and heterogeneity of protocols;
- Limited spatial and temporal replicability = making comparisons and trend analysis impossible.

Objectives of this action:
- Standardize biodiversity monitoring along a homogeneous river section;
- Dual operational goal: assess the conservation status of alluvial habitats and evaluate the effectiveness of management measures;
- Provide reliable, shared tools to help site managers implement and adapt their actions.

Development methodology
- Analyze site-specific conservation issues
- Define monitoring objectives
- Select relevant indicators
- Design monitoring protocols
- Develop an evaluation frammework
- Field-test the selected indicators

Protocols adapted and adaptive to habitat types and functioning

3 priority habitat types → 3 main monitoring objectives → 13 selected indicators

Alluvial forests

Alluvial meadows

Fluvial side channels

Evaluate the conservation status of alluvial forests
- Index of Biodiversity Potential (IBP) and Index of Biodiversity and Connectivity of riparian forests (IBC riplsylves)
- Surface and structural typicality
- Floristic composition
- Eutrophication and ruderalization indices, and impact of Invasive Alien Plant Species (IAS)
- Bat assemblages
- Saproxylic insect assemblages

Evaluate the conservation status of alluvial meadows
- Dung beetle activity in grazed alluvial meadows
- Surface of meadows and colonization by shrubs and woody species
- Agroecological indices of permanent meadows
- Impact of IAS

Evaluate the functioning and sustainability of fluvial side channels
- Floristic composition
- Ecological integrity of odonate assemblage
- Hydrological connectivity, topographic field measurements and sedimentary

Application example: assessing the conservation status of alluvial forests

3 complementary indicators:
- Structural and spatial typicality;
- Floristic composition;
- Eutrophication and ruderalization indices, and impact of Invasive Alien Plant Species (IAS)

3 field date sheets adapted to the forest type encountered: Willow-poplar woodland (*Salix–Populus*), Alder-ash woodland (*Alnus–Fraxinus*), Oak-elm woodland (*Quercus–Ulmus*)

Forêts alluviales à bois tendres (*Populo albae - Salicetalia albae*)
Saulaies arborescentes à Saule blanc 91EO-1

Typicité surfacique et structurelle

	< 5 m	5-20 m	> 20 m
Largeur du boisement	< 5 m	5-20 m	> 20 m
Nombre de types de boisement perpendiculaires au cours d'eau	-	1	≥2
Connectivité à d'autre boisements amont - aval	-	1	2
Bon			Ensemble des trois facteurs réunis
Moyen	-	Autres situations	-
Défavorable	Uniquement si < 5m		

Typicité floristique – Strate arborée

Strate arborée	Nombre de présence	Recouvrement au sein de la végétation (%)
Salix alba (inclus S. X rubens)	X	40 %
Populus nigra		
TOTAL		
Bon	≥ 2	≥ 50%
Moyen	= 1	[25-50%]
Défavorable	= 0	< 25 %

Typicité floristique – strate herbacée

Strate herbacée	Diversité spécifique	Recouvrement de la végétation (%)
Phalaris arundinacea	X	5
Lysimachia vulgaris		
Lycopus europaeus	X	<1
Scutellaria galericulata	X	<1
Rorippa amphibia	X	<1
Iris pseudacorus	X	<1
Persicaria hydropiper	X	<1
Bidens spp.	X	<1
Solanum dulcamara		
Galium palustre		
TOTAL		
Bon	> 4	< 50%
Moyen	[2-4]	[50-75%]
Défavorable	≤ 1	> 75%

Espèces exotiques envahissantes

Impact PEE sur l'évolution floristique des boisements			
Acer negundo	R >25%	présent	Absent
Robinia pseudoacacia	R >25%	présent	Absent
Reynoutria sp.	R >25%	présent	Absent
Impatiens sp.	R >25%	présent	Absent
Parthenocissus sp.	R >25%	présent	Absent
Helianthus tuberosus	R >25%	présent	Absent
	Au moins 1 cas	≤ 3	= 0

Synthèse du critère de structure et fonction de l'habitat 91EO (*Populo albae - Salicetalia albae*)

	Etat de conservation		
	Bon	Moyen	Mauvais
Typicité surfacique et structurelle		X	
Typicité floristique – Strate arborée		X	
Typicité floristique – Strate herbacée	X		
Espèces exotiques envahissantes			X

Interpretation must be adapted to each indicator: evaluation methods are inspired by literature but may be unsuitable or inapplicable in some cases.

Limits of the approach and recommandations

- Habitats subject to flooding dynamics vs. a traditional "conservation-oriented" vision of natural area management
- Need to focus on evolutionary trajectories rather than static conservation status, moving beyond fixed thresholds
- Necessity to adapt and overlap protocols during the transition of environments (side channel to alluvial forest or vice versa); quantify changes of connectivity and their causes