



INITIATIVES POUR L'AVENIR  
DES GRANDS FLEUVES  
INITIATIVES FOR THE FUTURE  
OF GREAT RIVERS

**Switzerland**



**River, lake and city:  
the conditions for a  
successful alliance**

**10<sup>th</sup>  
SESSION**

PLEAS AND RECOMMENDATIONS

From 27 September  
to 1 October 2021

Initiatives for the Future of Great Rivers (IFGR) carries the voice of the rivers to safeguard them and value them in the transition to a more sustainable world. By engaging in an original dialogue - international and multidisciplinary - between rivers from all over the world, the association responds to the complex challenges linking water, climate, biodiversity, health and food. Platform for exchanging knowledge and practices, IFGR's other missions are to raise awareness among the greatest number of people to preserve the common good that is fresh water and to alert decision-makers so that rivers are an integral part of international negotiations and solutions.

IFGR is chaired by Erik Orsenna, economist and member of the French Academy, and is supported by CNR, its founding sponsor.



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## Introduction

Populations have settled next to rivers since the beginning of time. The basins of the Euphrates, Tigris and Nile witnessed the first urban civilisations. **The form of the town was modelled** from the use made of these natural habitats: the development of industry, the construction of ports, infrastructures for drinking water and the discharge of wastewater, irrigation canals and spaces for leisure. Nonetheless, the relation between the city, its inhabitants and the river has not always coincided with harmony and integration.

History teaches us that after centuries of cities developing close to their rivers, the latter have often been sacrificed: branches of rivers have been covered over to build roads; high levees have been raised to protect against floods; domestic and industrial pollution has contaminated their waters, etc. Recent decades have seen cities **progressively reappropriate their rivers**, with nature being allowed more space and changes in lifestyles in society.

“ We co-exist with a channelled river. We’re working to build a living river, and it’s a real challenge to seek balance between the space left to the river, safety in a densely built plain and uses. ”

FRANZ RUPPEN,

STATE COUNCILLOR, CANTON OF VALAIS, DURING THE OFFICIAL OPENING OF THE SESSION

What does this increased interest imply? Is it a simple aesthetic or symbolic enhancement to strengthen territorial identity? What is the economic and ecological impact of these new development projects and how do they favour resilience to climate change?

IFGR wanted to make its contribution to rethinking the urban model in the Anthropocene era, where the number and size of urban spaces is increasing constantly, further weakening the preservation of natural resources, the first of which is fresh water.



*The IFGR delegation in front of Chillon castle and Lake Geneva, Veytaux (Switzerland).*

What sustainable relation can be created between the city and its river, that goes beyond the current dichotomy between risk – flooding, pollution – and opportunity – development and improving the living environment? How can the balance between the preservation and exploitation of water resources be guaranteed, when the planet Earth will accommodate 10 billion people in 2050, 70% of whom in urban areas?

“ *The future of cities cannot be conceived without reflecting on water and the urban environment (...) and it's time to learn to live with water in the city.* ”

BÉATRICE MÉTRAUX,  
STATE COUNCILLOR, CANTON OF VAUD

To organise its thinking, the Rivers Committee of IFGR focused its attention on the Swiss Rhone, extended to Lake Geneva, and was welcomed on the occasion of this 10th international session by the Cantonal Water Office of the State of Geneva. Considered the water tower of Europe, Switzerland is a country of rivers and lakes, where more than 6% of the continent's freshwater reserves are concentrated whereas the country itself covers only 0.6% of its surface area. Travelling in the company of the Cantons of Valais and Vaud, and the CIPEL\*, from the entry of the Rhone in the lake up to Geneva, IFGR's international experts combined their knowledge and experiences with local stakeholders.

They shared a strong conviction: new strategies of adaptation to climate change will be efficient only if development and nature are treated with equal importance and if we act in partnership with our rivers.



*The IFGR delegation received at the Palais des Nations in Geneva on the occasion of the Conference of the Parties of the Convention on Water.*

\*CIPEL: International Commission for the Protection of Lake Geneva's Waters





# The Rhone, between resource and risk

# 1

Living with the Rhone appears to be a recent paradigm, since this river has long been feared for its overflows, with strict separation of land and water for agricultural needs. Converted from its wild state to a mostly anthropized one, both the Rhone and Lake Geneva have been tamed. The challenge is now to give back to the Rhone, heritage shaped by humankind, its rightful place and change the relations its users have with it.

# 1.1

## Controlling the river to exploit it

**6%**  
of Europe's  
freshwater  
reserves  
are in  
Switzerland

**2**  
corrections  
of the Rhone  
each lasting over  
**30 years**

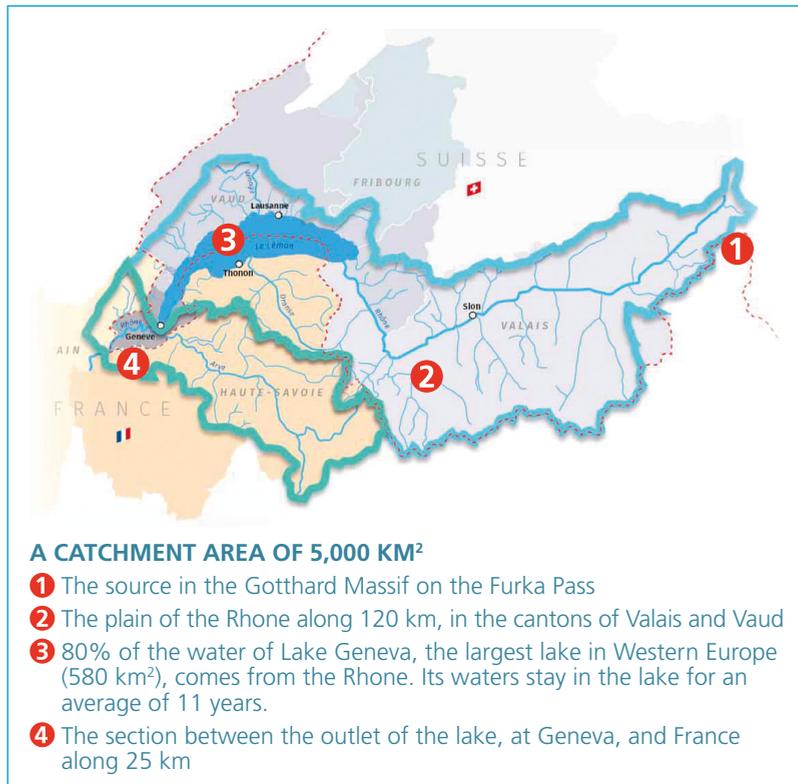
Lake Geneva  
supplies

**900,000**  
people with  
drinking water

Since the middle of the 19<sup>th</sup> century, anthropic pressure on the landscape and geomorphology of the Rhone Valley has increased constantly. Although the land around its source, at the col de la Furka, remains wild, its course stretches 120 km before it flows into Lake Geneva and crosses a plain densely occupied by:

- **industry** and the **development** of large transport infrastructures (rail and road);
- the **expansion** of intensive farming, with drainage developed to fertilise the soil and make it productive in the period between the two world wars;
- **urban sprawl** since the 1960s in certain floodable areas.

**These transformations have been made possible by successive works to "correct" the Rhone**, in order to protect the neighbouring population from flooding and develop the exploitation of the surrounding land. In September 1860 in Valais, an exceptionally catastrophic flood destroyed harvests and caused considerable material damage. This event triggered the 1<sup>st</sup> correction of the Rhone, intended to channel the river and dry the marshes to transform them into arable land. In the 1930s, a new phase of major works (2<sup>nd</sup> correction) raised the dikes and narrowed the riverbed.



Source: CIPEL



The wild Lake Geneva



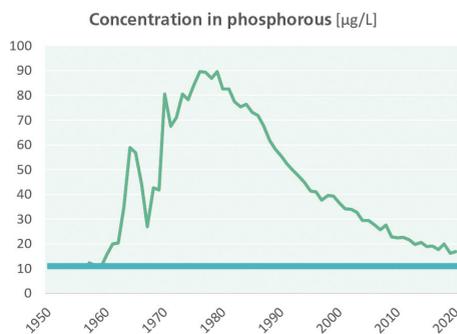
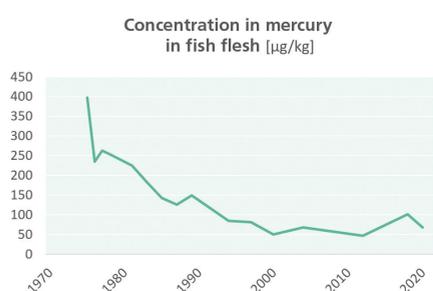
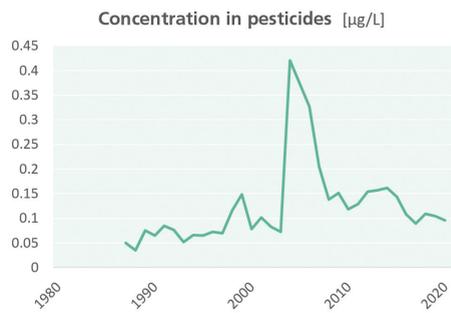
The tamed Lake Geneva

Thus tamed, the Rhone could provide many lasting services to society. An economic resource, the river serves cities, crops, industries and run-of-the-river hydropower plants. Its sediments and sands are also exploited.

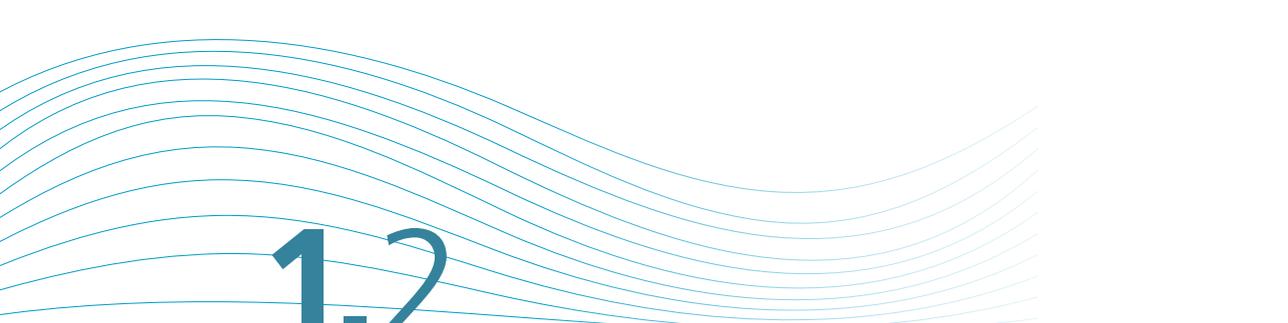
Lake Geneva has also been tamed, as presented by Lionel Gauthier, Curator of the Museum of Lake Geneva. Until the end of the 19<sup>th</sup> century, the surrounding population had adapted to the wild lake, by keeping sufficiently far away to avoid being submerged by rises in its water level, fluctuating with snow melts and the discharges of the river. A convention between the three Swiss cantons that share Lake Geneva changed the situation in 1884, by installing an artificial means of controlling variations of the water level. At the same time, its shores were reshaped, with concrete wharfs, and the construction of ports and properties. Today, nearly 60% of its shoreline is urbanised and its banks have to a great extent been privatised. A hundred beaches have been created and there are many leisure activities: bathing, angling, sailing, etc.

**Taming these natural habitats has occurred at the expense of their biodiversity**, destroyed or polluted by industrial and agricultural activities and urban pressure. *“The lake, a reservoir with a certain inertia, bears the heritage of these former pollutions”*, explained Audrey Klein, General Secretary of the CIPEL, organization in charge of the monitoring and improvement of the quality of the lake’s waters since 1963.

Phosphorous, mercury and pesticides left the lake in agony during the 1970s. With a population of 2 million, the wastewater treated by 207 wastewater treatment plants and discharged into the lake has increased and, with it, other types of micropollutants such as drug residues and plastics, whereas in exchange it supplies 900,000 people with drinking water.



Concentration in pesticides, phosphorous and mercury - source: CIPEL



# 1.2.

## Learning to care and respect the river

The time has come to restore a more peaceful relation with the river and the lake, by giving space back to the Rhone, rewilding the tributaries in the plain, and developing a new “ecological infrastructure”<sup>1</sup> linked to wetlands. Although human hands and engineering continue to dominate, the projects carried out nonetheless give a new impetus that combines biodiversity through biological corridors with enriched landscapes and better flood protection, such as on the large artificial canal between Saint-Triphon and Lake Geneva or with the 3<sup>rd</sup> correction of the Rhone, a new ambitious plan to develop the river and public spaces intended to combine safety, ecological and societal objectives. For the lake, where only 1% of its banks have been rewilded in 10 years, the effort has above all been focused on the preservation of rare areas rich in biodiversity such as the outlets of rivers, and reed beds.

However, taking a technical approach is not enough, especially when the natural risk is ever present. The weight of perceptions and uses, frozen in time, is so heavy that a new identity must be built around this aquatic heritage, endorsed by the public authorities and appropriated by the inhabitants.

### CHANGING THE NARRATIVE

*“We have built a historic story around the human victory over the river. Switzerland appears to be struck by amnesia, without respect or memory of floods whereas a flood by the river can cause between 15 and 20 billion Swiss francs of damage”* according to Tony Arborino, head of the Rhone flood protection service of the Canton of Valais. As for Lionel Gauthier, he is convinced that “the domestication of nature has a perverse effect: we are no longer beware of it, which makes us more vulnerable,” at a time when scientific proof of the existence of 5 tsunamis in Lake Geneva has been found and the task is now to predict the next one, though the date remains unknown.

This narrative is based on negative images of the river: the Rhone is there to jump into when one wants to end one’s life. As stated by Emmanuel Reynard, Professor of physical geography at the University of Lausanne and President of the association Memories of the Rhone, *“the terms used to express the relation that the people of Vaud have with the Rhone, a river that must be controlled”*. The semantics are warlike: the term “correction” used for the different development schemes for the Rhone is linked to the idea of punishment.

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<sup>1</sup> Network of natural habitats, defined by the Swiss Biodiversity Strategy, composed of central protected areas linked together by connecting areas (passages for fauna, flood expansion areas, etc.).

It also instils in the collective consciousness that nature does things “badly” and that human beings must correct its errors. Likewise, the term “drainage” means drying marshes, which are nonetheless vital for the river ecosystem. The media contribute to perpetuating this perception, by striking an emotional and dramatic register of a destructive river during flood episodes. A change of semantics is therefore unavoidable in order to redefine our relationship with the river, go beyond the objective of co-existence with domestication and change the perspective: human beings must once again adapt to their natural environment, and that has an impact in particular on urban development plans.



*The cosmography of Sebastian Münster, 1544.  
Source: Archives of the State of Valais, photo: E. Reynard.*

“ Is it possible to correct a great river? Or can one learn to simply live alongside it? Together and with respect, we can become better and live in harmony. ”

VÉRONIQUE DIAB-VUADENS,

PRESIDENT OF THE MUNICIPALITY OF VOUVRY, ON OPENING THE SESSION

## MAKING THE RIVER MORE VISIBLE

Making the river more accessible and visible represents a double opportunity:

- **Prevent disasters**, by giving more space to the river so it can spread when it floods, and make the neighbouring population aware of the danger, due to this newfound proximity. *“Rivers and streams have a memory, longer than that of the inhabitants, stated Bernd Gundermann, architect-urban planner, and member of IFGR. One day, the river will take its revenge, showing that all the efforts to control it and keep it in its bed were in vain, with huge tracts flooded by its waters.”*
- **Transforming the river into a structure of resilience**, in a strategy of adaptation and climate change.

We have witnessed several examples: at Christchurch in New Zealand, the river Avon was at the heart of the city’s reconstruction after having suffered considerable destruction during the earthquake of 2011. A new urban space was created to facilitate access to the water (promenades by the river, green spaces and cycle tracks; pedestrian areas; speed limits of 10 km/ph for vehicles).

The river has become a destination in itself and a symbol of the city's renaissance. Rainwater is held in rain gardens with a wealth of indigenous plants that separate the pedestrian path from the road. These measures may be improved still further by opening up a large number of buried tributaries to use their potential to lower the temperature of the city.

In Lyon, the enhancement of the banks of the Rhone in the 2000s was designed to attract the Lyonnais back to the river by creating an urban park along 5 km, while facilitating the passage of foreseeable floods. Lastly, in Switzerland, the 3<sup>rd</sup> Rhone correction are aimed at widening the riverbed along 164 km to better conform to its alluvial morphology and prevent catastrophic floods.

*Sector of the delta of the Rhone, before the 3<sup>rd</sup> Rhone correction, cantons of Vaud and Valais*



*Sector of the delta of the Rhone, after the 3<sup>rd</sup> Rhône correction*

Another major objective of the project, ensured by the landscaping and town planning agency, BASE, is to redevelop the banks of the Rhone and its connections with the foothills<sup>2</sup> and side valleys, and create a network between the land and the river. The main aim is to "*install a resilient territory capable of anticipating the changes of the future*" according to Bertrand Vignal, co-manager of the agency. The members of the IFGR were also able to visit the outlet of the Rhone in Lake Geneva in the company of Marianne Gfeller, Head of the section Rhone 3 in the Canton of Vaud. The challenge is to revive a delta in this huge area that includes a nature reserve and a forest, where the Rhone can spread on the right bank, while maintaining dikes along the densely urbanised left bank.

<sup>2</sup> A strip of varying width of plains and hills located at the foot of a mountainous massif.

# 1.3.

## Towards a new type of flood risk management

At present, about 100,000 people live and work in an area exposed to danger in the plain of the Rhone, an urban and social reality made possible by choices taken to develop the territory through history, and by the river correction works that strengthen a false sense of safety. This situation has been explained by Margaret Cook in her book, in which she describes how the priority given to facilitating access to goods along the river and the use of the fertile land in the floodplains for farming led to the development of Brisbane in Australia in vulnerable areas<sup>3</sup>.

Seeing the risk as a natural phenomenon and a social construction permits adopting more sustainable solutions; also, climate change will increase the number of extreme meteorological phenomena such as excess rainfall and drought, and make them more variable.

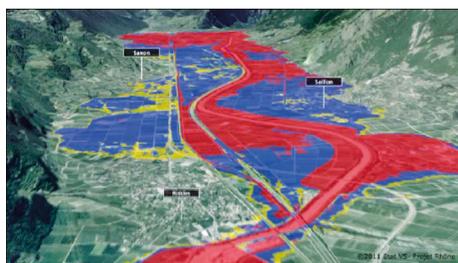
### INTEGRATED RISK MANAGEMENT

Firstly, it is necessary to no longer consider flood risk as an isolated threat. Indeed, it is strongly linked to urban development, changes in land-use and the impacts of climate change. This leads to the need for integrated risk management.

In the cantons of Valais and Vaud, this new management has three dimensions:

- **Emergency action.**

In Valais, a map of hazardous areas has been drawn up, with three levels of risk that influence the alert and emergency procedures. Using flood forecasting models, the authorities can regulate the volumes of water stored in the dams to slow down the flood wave and prepare possible evacuations if a dike were to be breached. However, this emergency procedure, although vital, would solve only 10% of the safety problem caused by flooding.



*Hazardous areas in the canton of Valais*

<sup>3</sup> *A River with a City Problem: A History of Brisbane Floods*, Margaret Cook (September 2019, University of Queensland Press).



*The Seujet dam, in Geneva*

- **It is vital to modify existing urban development** in addition, since the source of factors that exacerbate flooding lie in urban structures: the sealing of soils; the under-dimensioning of rainwater drainage networks, the training and channelling of streams and rivers, etc. Frédéric Bachmann, head of the Territory and Strategy Unit at the Cantonal Water Office of the State of Geneva, stated that Geneva, like many other cities, had become watertight and disconnected from the water cycle, because the channels in which water circulates had been buried: *“There is a real separation between the world above and the world below”*. Rain infiltrates less and the drainage network is saturated. Here the challenge is not to aggravate the hazard itself (as done by the *Waterproof Amsterdam* project, one of the pilot sites of the Delta programme<sup>4</sup>), or reducing its impacts, in particular by incorporating the possibility of flooding in the design of buildings, as imagined in the city of Hamburg in Germany for the district of *HafenCity* (by raising the buildings above sea level or building public wharves that can be temporarily flooded).

In the case of the 3<sup>rd</sup> correction works on the Rhone, the strategy is to widen and deepen the river to allow more water to flow, and to build a dike in retreat to ward off residual risks of overflows.

- **Public policies in a larger framework of adaptation and mitigation of the effects of climate change.** The choice of Switzerland is to work with climatic uncertainty, to ensure more flexible adaptation. This results in providing flood zones with lower, thicker, and stronger submersible dikes that allow a large quantity of water to pass into the plain without leading to major disasters. Thus, the situation should always remain under control, since the level of protection is separated between what is done in the river, and what is done in the plain. Between them, dams are used to optimise the stock so that the spill-over into the plain occurs as slowly as possible.

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<sup>4</sup>This project is based on a new approach known as “multilayer” flood risk management, that includes a prevention section (dikes and dams), organised urban development to reduce the exposure of the main infrastructures, while leaving part of the territory as a natural wetland capable of absorbing floods and the implementation of crisis management (evacuation plans, awareness of the population).

## LEARNING TO LIVE WITH RISK

Understanding, foreseeing and reacting to floods is the same challenge: learning to live with a risk that cannot be eliminated. In the same way as Japan regularly teaches children to react when earthquakes strike, it would be pertinent to set up obligatory training for schoolchildren concerned by flood risks.

The neighbouring population must also be made aware of the risk, an essential prerequisite to ensuring the safety of the largest number of people during flooding but also to inform democratic participation during consultations on major projects. In Switzerland, a country with a long tradition of seeking consensus and global coordinated solutions, consultation between the stakeholders is systematic and continuous.



*View on Lake Geneva and Saint-Gingolph*

In the framework of the 3<sup>rd</sup> river correction works on the Rhone, the authorities have drafted an all-households document sent once a year over the last twenty years to all the inhabitants of Valais, completed with participatory groups, regular press conferences and exhibitions. The hazardous areas are subjected to public inquiries.

“ Changing from a rationale of governing by fear to that of governing by the heart. ”

TONY ARBORINO,

HEAD OF THE RHONE FLOOD PROTECTION SERVICE OF THE CANTON OF VALAIS

This pedagogical effort has two virtues: it **trains citizens** rather than only informing them; it **examines social demand** to favour the acceptability of projects that structure the territory, and it strengthens the credibility of scientific communication.



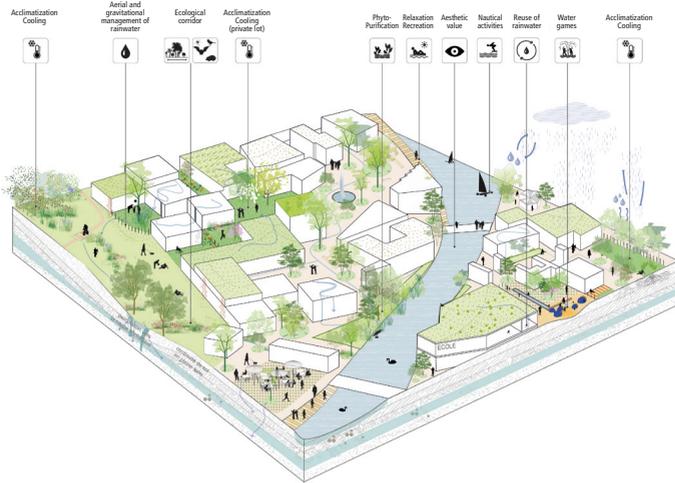
# Nature in the city, the city in nature

# 2

The relationship between a city and its river or lake cannot be limited to a single use or its geographical influence, still less its administrative borders. To achieve a successful alliance, it appears crucial to resituate this relationship in new multifunctional territorial projects, by rethinking the city as being an integral part of nature.

# 2.1.

## Using natural resources for a resilient city



Increasingly, we hear of “ecosystem services” to highlight the importance of the role of ecosystem functioning for human societies, regarding both their development and living conditions. **Water is essentially a local resource, whose potential is exploited for social and economic uses as well as its natural ones. Thus, it is no longer a threat.**

*Water in the city,  
Cantonal Water  
Office of the State  
of Geneva*

SIG (Services Industriels de Genève) is currently developing two types of renewable energy using hydric resources in the Geneva region: **hydrothermal and geothermal energy**. These energies are a considerable asset in efforts to reduce greenhouse gas emissions and reforge links between the city and its local resources. The hydrothermal energy programme *GeniLac* aims to draw water with a temperature of about 7°C from 45 metres depth in Lake Geneva to supply a cold water network that runs through the most urbanised areas of the city, in order to replace electric air-conditioning systems that consume large quantities of fossil fuels, and to serve as a cooling source to supply heat pumps in winter. The water is then returned to its natural environment in the Rhone.

The *Géothermies* programme consists in exploring the subsoil to exploit aquifers whose temperature is constant to cool or heat buildings, and to find new sources of drinking and irrigation water.

The vegetation, or rather the **greening of the city**, must be massive and not artificial, and it can also play a role in urban resilience: planted roofs can, for example, hold back rainwater for 2 to 5 hours, thereby reducing pressure on the drainage network. Trees whose roots develop in the soil can also absorb water and prevent it from flowing to already saturated networks.



*Planted rooftops in Marseille (France)*



*Quai Victor Augagneur in Lyon (France)*

In China, the national “sponge city” programme, developed since 2015, pushes this approach still further. The aim is to loosen the soils hardened by transport infrastructures to re-install permeable coatings that absorb water and permit it to infiltrate and disperse in the city, and then to re-use the runoff water.

**These ideas are not new, and it’s important to take into account the solutions found by the first urban civilisations when rethinking the city of tomorrow:** the first Mesopotamian cities were equipped with drained roadways, with shards and earth used as coating material to absorb overflows of water from torrential rains in these arid regions. The runoff was channelled outside the cities by canals and recovered in cisterns.

**Above all, these services rendered by nature will not be efficient unless we consider nature as alive, meaning as complex and dynamic.** The aim is not to fabricate nature in the city but rather to dynamically orient its presence, by accepting moving landscapes, in which water and earth can blend. This vision is still new for Switzerland where urban development projects are only just beginning to exploit nature-based solutions.

The city must show itself capable of being crossed by nature and of integrating rivers. With coherent spatial layout design, green and blue grids, rich in biodiversity and creating an improved living environment, can then take shape. They can form new arteries in which nature and the city coexist. The development of a park along the banks of the Rhone in Lyon, France, is a good example of this type of circulation, likewise with the series of parks and promenades along the Yarra River in Melbourne or the Swan River in Perth (Australia).

# 2.2.

## Seeing big!

Only solutions conceived in harmony with the scale of the watershed will be capable of responding to the challenges of the future. The challenge for tomorrow's urban planning is to organise the different habitats and cities in a single large territory intelligently, with social equity and ecological responsibility in mind.

To protect cities from floods, it is first necessary to act within and outside them to reconstitute exposed surfaces: this means better absorption of water in farming areas, where the use of fertilisers and chemical products has hardened the soil, and in forested areas; the restoration of hedges and replanting of forests, as learned from the lessons of the Yellow River<sup>5</sup>.

More globally, it is necessary to think on the right scale, that of the watershed. Two examples were presented during the session.

### THE NEW CENTURY VISION FOR THE GREAT LAKES, IN NORTH AMERICA

The Great Lakes represent  
**20%**  
of the world's  
freshwater  
reserves

**72%**  
of inhabitable  
land affected to  
human activity

The watershed of the Great Lakes and the Saint Lawrence River stretches across the United States and Canada for 3,200 km in length and covers a surface area of 246,463 km<sup>2</sup>. The largest freshwater reservoir in the world, it is home to more than 30 million people, mostly in big cities, and it includes a quarter of Canada's agricultural production and 7% of that of the United States.

After a century and a half of booming industrial development, this region is faced with the impacts and degradation of its ecosystems exploited and must take up the new challenge of climate change. Another difficulty is the fragmentation of governance down to the geographical representation of this whole, as the maps stop at the borders of each country.

*The New Century Vision for the Great Lakes* proposed by Phil Enquist and the architecture agency Skidmore, Owings & Merrill (SOM) is to **consider the watershed as a huge park that includes cities, and in which uses and people coexist**. This notion of park as common property is capable of inciting respect for nature by the people of both countries and solidarity between the cities that border the Great Lakes. Furthermore, at the initiative of the Mayor of Chicago at the beginning of the 2000s, the 130 main cities set up a forum with scientists to consider programmes to restore the environment for the next three decades. The other actors, industrial companies, farmers, community associations and federal agencies, are also invited to

<sup>5</sup> International Session of IFGR: *River and Biodiversity: lessons learned from the Yellow River and experiences shared with other rivers*, October 2019, China.

participate to co-fund projects or implement local actions. This vision is based on a strong premise: “*place nature and urban development on an equal footing*”.

## THE BIG SÉQUANIEN GARDEN IN THE SEINE WATERSHED

18.3 million people live in the Seine watershed, i.e. a quarter of the French population on 15% of the country's territory. This watershed is a single entity, a succession of natural and populated habitats, contrary to the vision of a sprawling and cramped “metapolis” of greater Paris. Taking a leaf from the Great Lakes, the French urban planner Bertrand Warnier, in collaboration with another urban planner, Phil Enquist, and the landscapist Drew Wensley, both American, pleads for the creation of a large garden on the scale of the Seine and its tributaries<sup>6</sup>.

Their objective is to **better reconnect the cities and outer-urban belts using the river as the federating principle for major development and planning projects that respect water, land and air** in the new timeframe imposed by climate change.



Agence BASE

The development project for the 3<sup>rd</sup> training works of the Rhone stems from the same ambition to **create a major landscape infrastructure to drive a common narrative**, by integrating the river, of course, as well as the fields around it and the network of streams that cross the surrounding countryside to the banks, in the form of *alleys of the Rhone* to make the river more accessible. By creating *landscape routes*, a concept that already exists in northern European countries, the dimensions of the sublime and contemplation will serve to harmonise the spaces along the river. The entire project bears the name “*Rhônatureparc 2050*”, a natural and landscaped park around this living corridor that provides the continuum: the river.

<sup>6</sup> Plea for a big Séquanien garden – International workshops of urban planning and design, URBA 2000, Institut Paris Région, 2021.

# 2.3.

## Complexity is better managed together

Urban projects are currently dominated by public-private partnerships. However, corporate power tends to dominate, pushing aside the ordinary citizen from a decision-making process that above all concerns them. Joint management including listening and the involvement of community associations is therefore desirable and made more obvious by the reappropriation of the river by all.

For example, in Brussels, the *Brusseau* project aims to develop *hydrological communities* that gather community associations, scientists and public institutions to propose diagnostics and solutions in which the neighbouring population is involved as a partner<sup>7</sup>. By permitting the proposal of diverse approaches and ideas, these communities are best placed to respond to complex and multiform issues linked to the effects of climate change on rivers.

This type of assembly permits questioning social demand, by going beyond the simple framework of consultation on a specific project. It augurs **a new form of governance capable of thinking in the long-term and adapting to face ominous natural and climatic hazards and avoiding the risk of poor adaptation**. The actions taken could be more flexible and maintain advantages, whatever the real impacts undergone. For example, creating cooler urban areas to prepare for rising temperatures presents several advantages: the development of public spaces, improving the quality of life, energy saving, etc.



Lake Geneva, the Pâquis baths

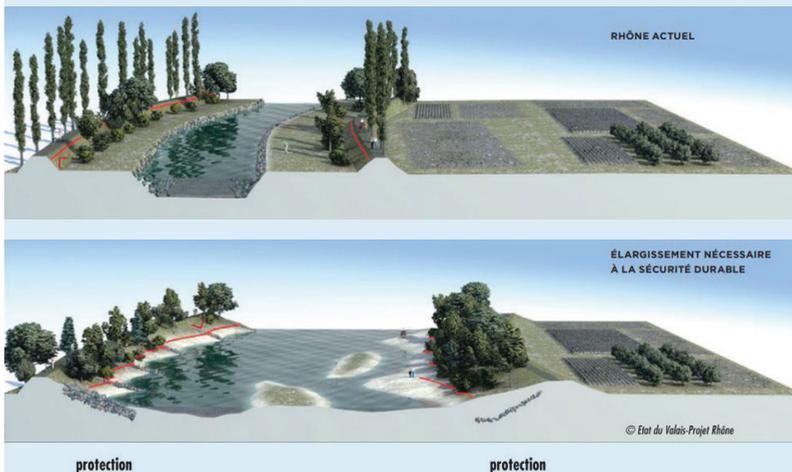
Lastly, **it is necessary to break down barriers that separate both spaces and policies**. A space should no longer be dedicated to one or several uses according to the rationale of zoning. Since space is becoming rare, synergies must be placed to the fore while ensuring good compatibility between uses. Likewise, the emergence of complex and transversal projects like that of correcting the Rhone, must go beyond the simple addition of sectoral requirements, as pleaded by Tony Arborino: “*We ask for the coordination of sectoral policies. Transversal projects have*

*difficulties in satisfying everyone. We therefore ask, at the level of Switzerland, to build bridges*”: bridges between development policies such as the habitat, the economy and transport, and policies of risk management and adaptation for more ambitious and sustainable

<sup>7</sup> Towards the end of waterborne sewage systems for rainwater in Brussels, L’Echo (lecho.be).

projects. It was one of the objectives when Greater Geneva was constituted in 2007 as a functional space of reference for the cross-border management of water between Switzerland and France, intertwined in policies to develop biological corridors and territorial contracts for Sensitive Natural Areas<sup>8</sup>.

## THE 3<sup>RD</sup> RIVER CORRECTION WORKS ON THE RHONE: THE WORK OF ONE GENERATION FOR FUTURE GENERATIONS



- **A new phase of large-scale works** on the Rhone decided following the historic flood of 15 October 2000 and the flooding of 1,000 hectares on the plain.
- It began concretely in **2009**.
- **Objectives:** Secure the plain and its inhabitants against floods by widening the Rhone wherever possible, strengthening the existing dikes and deepening the bed elsewhere. A genuine sustainable territorial development project for the whole plain, it also includes another ambition: to make the river accessible to the population.
- **Challenge:** develop 160 km of river, by including the 9,300 km of tributaries crossing the territory.
- More than **€ 3 billion in investments** and **at least 20 years** of works scheduled.
- **€200 M in compensation** for the agricultural sector, to make up for losses of farmland.

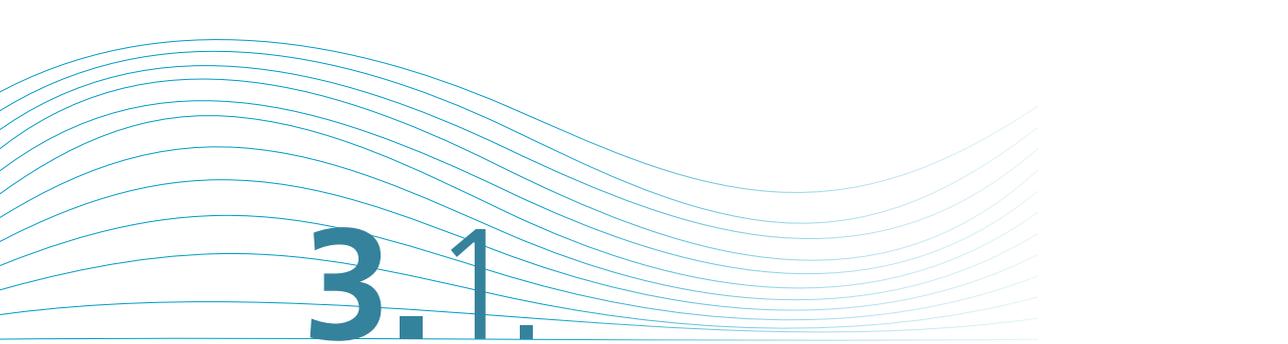
<sup>8</sup> "Cross-border management tools of water resources and use - Greater Geneva area" - Geneva Water Hub, University of Geneva / Cantonal Water Office of the State of Geneva, 2021



# Co-producing knowledge for a common vision

# 3

Data allow tracking, detecting and foreseeing risks. When processed they help understanding and guide action for public policies applied to urban development and natural risk management. But knowledge is only useful when it is understood and appropriated by everyone. How can narratives conveying different perceptions of water intersect? How can the data be shared to build a common vision? Between conflict and cooperation, water integrates flux at the very heart of the democratic debate.



# 3.1.

## From the collection of diverse data...

A large number of sources of data on water and rivers coexist: satellite data; in situ data, data resulting from monitoring networks composed of hydrological stations, data from sampling and observation campaigns during participatory science projects with members of the public; even socio-political data, although they are often the forgotten element of environmental science programmes. The social sciences teach us to consider other types of knowledge that complement statistics, and which are still neglected such as the knowledge and closeness of indigenous communities with the natural cycle of rivers, including the occurrence of floods.

**All these data must be crossed with each other to ensure adapted and dynamic governance.**

At the beginning of September 2021, Lake Geneva took on a brown color due to the proliferation of a fortunately inoffensive algae. The CIPEL detected the problem thanks to field observations and the alert sounded by the population. At that point no analysis had been made, proving to Audrey Klein, the general secretary of the CIPEL *“that one cannot count on the environmental monitoring programme alone to sound the alarm”*, and that civil society must be more closely involved to watch over and take care of rivers and lakes, goods common to all. Participatory science initiatives point in this direction, by educating and permitting each and every one to be an actor. For example, the *“Association de Sauvegarde du Léman”* offers the application *Net’Léman* to the neighbouring population. It permits identifying different plastic wastes and fuelling a database used by scientists to dialogue with the authorities and companies about plastic pollution in Lake Geneva. 50,000 kg of plastic waste is found every year in the lake!

The CIPEL plans to develop an observatory for Lake Geneva like that for the River Durance<sup>9</sup> in France, to federate the bodies that produce environmental data and aid strategic and policy decisions. This observatory could also respond to the need for better integration of data produced by the hard sciences with spatial and socio-political data to encourage the emergence of more inclusive models.

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<sup>9</sup>The Durance Observatory emerged from the shared desire of the partners of the first River Durance Contract (2008-2016) to improve sharing knowledge of the river. The Observatory is not a legal entity apart, it is a tool for sharing and managing data.



*The Rhone river, in Vertrieu, Isère (France)*

**Cross-checking different types of data is essential; their veracity too.** Indeed, data can be exclusive to a government or an entity. The way in which data are produced generates biases, making them partial. They can also be poorly understood or inaudible. What credibility can be given to them in this case? **The challenge is that of having confidence in the data used.**

For Dominique Bérod, Head of the Earth System Monitoring Division at the World Meteorological Organisation (WMO), says that a preliminary period of building mutual confidence in projects requiring the sharing of data from countries sharing the same watershed or between social groups is vital to ensure they last.

To build this confidence and give a political meaning to the data, Anne-Claire Vial, President of the Institut du Végétal – ARVALIS raised the subject of the new ethical labels attached to databases. They allow guaranteeing essential principles such as respect for private life, data quality and the inclusion of citizens.



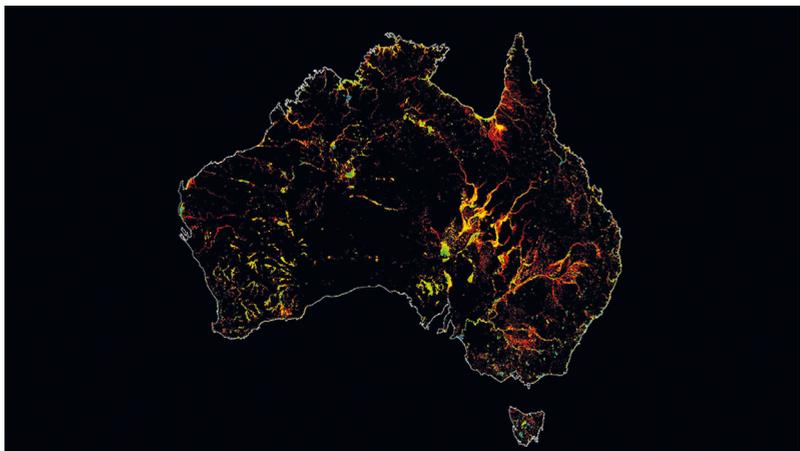
# 3.2.

## ...to dynamic analysis

It's not enough for data to exist: they must be analysed and above all transformed into useful and relevant information to be used! Indicators must be built from data obtained from monitoring essential climate and water variables, and from knowledge of watersheds and activities from the past to the present, in order to make decisions for the future of integrated water management. *"From the political viewpoint, the challenge consists in giving a meaning to this large volume of data so they can be used"* said Grégory Giuliani, a researcher at Geneva University.

Even today, **the volume of data, their heterogeneity, the difficulty of integrating them in models and the scientific knowledge necessary to make use of them represent a considerable barrier regarding their analysis.** The *Swiss Data Cube*<sup>10</sup> to which Grégory Giuliani contributes, is a tool of choice for scientists to bypass the problem of time spent researching and preparing data. It allows them to devote themselves solely to analysis. This data cube stores and uses the data obtained by the Earth observation satellites of the NASA and ESA over the past 35 years. The data, organised and analysed in space and time, literally form a cube.

The *data cube* was first developed in Australia, where it made it possible to use 27 years of satellite data and analyse the presence of water for each 30 square metre plots of Australian land. This information formed the basis for producing a map showing permanent surface water (lakes and rivers) and areas temporarily covered by water (flood zones).



Result of the use of the datacube tool in Australia, Digital Earth Australia

<sup>10</sup> Joint initiative of GRID Geneva, Geneva University, Zurich University, the WSL with the support of the Federal Office of the Environment – [swissdatacube.org](http://swissdatacube.org)

Developed for Switzerland, the tool permits estimating the changes that have occurred over the last twenty years on the Rhone glacier: it lost 4% of its permanent snow during winter. The Swiss government aims to use it to guide its orientations, thanks to open access to certain data and products. Based on the open science principle, the next step will be to offer this data cube technology on demand to any territory that asks for it, and thus improve the process of common learning between scientists, managers and decision-makers.



Data cube on demand

**The problem is that scanty use is made of data in the decision-making processes of governments and international commissions relating to the environment.**

“ My dream is that we'll all be able to obtain information on the resources we use since we could understand the impact they have on our lives. ”

ANTHONY LEHMANN, ASSOCIATE PROFESSOR AT GENEVA UNIVERSITY AND VICE-DIRECTOR OF THE INSTITUTE FOR ENVIRONMENTAL SCIENCES

Anthony Lehmann fights to define and make available at the global scale essential environmental variables, very different from economic data such as GDP. They are multifaceted and concern the climate, water, biodiversity and the socioeconomic uses made of nature, since all these problems are connected. He says that reasoning in terms of nexus is the best approach to confront human beings with their relations with nature and the global limits reached in the Anthropocene era: “*food, water and energy form the basis of our survival. The environment provides us with natural resources that are used in the framework of our activities, creating a demand and questions regarding the sustainability of available resources. The nexus food – water – energy confronts humans with the limits of the territory in which they live.*”

Pascal Bourdeaux, Associate Professor at the *Ecole Pratique des Hautes Etudes*, goes further, suggesting that these research and learning infrastructures should also be thought of as pedagogical tools, by interpreting complex phenomena for young people and providing quantified understanding of the impacts that human beings have on nature. **Making science fascinating and less complex is the basis for encouraging greater commitment from the community in the major environmental transformations in progress.**

# 3.3.

## How to share and with whom?

**260**  
transboundary  
river basins  
in the world

Pooling knowledge is the challenge that must be achieved in order not to separate scientific tools from administrative decision-making. Nonetheless, is it pertinent to completely open access to databases, without knowing how the data will be used by society?

**40**  
cross-border water  
management  
tools in Greater  
Geneva

In a domain as strategic as that of water, the source of life and development for territories and their populations, data form an important component of governance. Sharing them is a prerequisite for ecological democracy.

### CONJUGATING SCIENCE AND DIPLOMACY AT THE CROSS-BORDER LEVEL

Water management is often extremely fragmented within the same country and between countries. However, worldwide, 260 river basins are shared by at least two countries, representing 60% of surface freshwater and 40% of water resources for the global population.

Regarding the Rhone and Lake Geneva, the image given during the session was that water management resembles a “millefeuille” for both France and Switzerland, although vertically for the former and horizontally for the latter. In terms of international cooperation, Gilles Mulhauser, General Director of the Cantonal Water Office of the State of Geneva, recalled that nearly 40 water management tools are used by Geneva, the cantons between them and Switzerland’s French neighbours! **Solutions must be found to correct this fragmentation of governance and the difficulties of access to and sharing data that result. This is especially the case in the context of scarcer water resources that inevitably stoke tensions between users and countries.** Switzerland is not spared by the situation, as mentioned by the Geneva Water Hub and the Cantonal Water Office of the State of Geneva in their publication<sup>11</sup>, despite circumstances that seem comfortable at present for Greater Geneva. *“Some local authorities foresee tension over water resources that could increase over the next thirty years”*. The systematised pooling of data is therefore essential as from now.

Anoulak Kittikhoun, Manager of Strategy and Partnerships at the Secretariat of the Mekong River Commission (MRC), presented several examples of data sharing for the Mekong, a basin that symbolises the conflicts that can exist between upstream and downstream. With a length of 4,350 km and a population exceeding 70 million people, the Mekong basin is one of the most densely populated in the world. It is also rich in biodiversity and constitutes the largest inland fishery in the whole of Asia.

<sup>11</sup> “Cross-border management tools of water resources and use - Greater Geneva area”  
Geneva Water Hub, University of Geneva / Cantonal Water Office  
of the State of Geneva, 2021

However, it is very vulnerable due to the combined effects of climate change and its rapid development. MRC's mission is to collect data (rainfall, sediment load, water quality, fish resources, etc.), in cooperation with the member States (Laos, Thailand, Cambodia, and Vietnam; China and Burma cooperate without being members) and share it to ensure a common development strategy for the basin and protect the populations. It is a complicated task for the MRC which acts as a water diplomacy platform for countries that, historically, once waged war with each other.

“ It's in times of peace that one must prepare for difficult times, especially for an international river. ”

HAMED DIANE SEMEGA,  
HIGH COMMISSIONER OF THE SENEGAL RIVER DEVELOPMENT ORGANISATION (OMVS)

## GOING BEYOND FRONTIERS BETWEEN THE SCIENTIFIC COMMUNITY, POLITICAL DECISION-MAKERS AND CITIZENS

**The paradox is striking: knowledge is crucial but it is not omnipotent; it is a lever for decision for politicians, but its efficiency is not measured only by the fact that decision-makers make use of it.** Géraldine Pflieger, Professor at Geneva University and Director of the Institute of Environmental Sciences, calls into question the preconception by which *“scientists are seen as being apolitical, whereas the decision-maker is generally considered as ignorant, without basic awareness of the problems”*. The production of knowledge and the political process are increasingly intertwined, and she considers that *“the role of scientists is not only to produce knowledge but to gather the contributors of knowledge around the same table”*.

Once again, it's an appeal for diversity and breaking down the barriers between disciplines. Knowledge should not be the prerogative of the scientific community, it must also come from actors in civil society, international organisations, participatory experiments and the community. According to this rationale, each actor – political, citizen, non-governmental organisation, elected representative – can produce *“their own narrative of the environmental issue”* and several types of knowledge are interweaved. Even though the data are always imperfect or incomplete, there is a need to act immediately, and if participatory democracy reaches its limits, it is necessary to encourage the silent to speak.



“ In a democracy, one must listen to the silence, so that it doesn't begin to wail and, if there is no response, start to reject everything in an accumulation of madness whose source is legitimate. ”

ERIK ORSENNA,  
CHAIRMAN OF IFGR

Dominique Bourg, philosopher and Professor at Lausanne University, goes further regarding the remodelling of our participatory systems. According to him, it is time to go beyond environmental democracy which consists in democratising the public decision-making process regarding the environment. It is necessary to promote ecological democracy which, in recent decades, has led to the inclusion of ecological problems in democratic institutions thanks to new scientific information and has allowed for a double result: that of being aware of long-term change and that of being able to make decisions in the short-term to deal with it.

According to him, it is henceforth necessary to bring scientific knowledge into the public decision-making process without ignoring the principles of representative democracy. To achieve this, he proposes a new constitutional framework with *“a third chamber that would not be composed of elected representatives since they are, by definition, limited to short-term decision-making, but to parity between experts and citizens.(...) This mini IPCC on the national scale could serve to make the population and elected representatives aware of all the long-term challenges, through several modes of action: following up work by commissions, the capacity for whistle-blowing, the suspension of a law before its promulgation in order to start a new debate in parliament, recourse to a constitutional court for countries possessing one”* .

## In conclusion

At the end of four days of intense dialogue on the banks of the Rhone and Lake Geneva, the Rivers Committee first hailed the Swiss model, with its solid financial, technological, and political foundations, and the large place it gives to public expression. It has proven its capacity to forge a successful alliance between cities, their river, and their lake. **Exigence stems from excellence, especially when it is necessary to confront new climatic, hydrological and urban challenges. There is also a certain responsibility, in particular regarding the least advanced regions of the world.**



*Restitution of the 10<sup>th</sup> session in the presence of Antonio Hodgers, State Councillor of the Canton of Geneva*

Several conditions of the alliance between the river, lake and city came to light:

### 1. MAKING THE NECESSARY RECONCILIATION

- **Between water and land:** rivers and streams are too often limited to their beds whereas the hydrographic networks they form irrigate territories. The role played by banks, soils, flood plains and alluvial forests in the river ecosystem should be resituated at the heart of reflection. Having forgotten these roles, modern societies perceive rivers as canals and not as winding and dynamic watercourses. Likewise, this omission leads to the separation and even opposition between land and water in development projects, whereas it is necessary to create moving landscapes, amphibious territories where water and land can merge.

- **Between uses:** holistic reflection at a nexus (like that of water, energy and food) confronts human beings with the limits of the territory they inhabit and is more apt for exploring a sustainable future.
- **Between above and below.** In the city, the world above (that of the architect, landscapist and urban planner) is separated from that of below, often the realm of the engineer. The lack of dialogue between these different professions leads to a perception of water as a constraint and fails to grant it a central place in urban development. Why not create new hybrid professions (“urbanscapists” or “engintects”) to share visions and skills and break down the partitions between fields of action, as suggested by Frédéric Bachmann of the Cantonal Water Office of the State of Geneva? Up to the 18<sup>th</sup> century, before the State Engineering School (Ecole des Ponts et Chaussées) was founded in France, architect and engineer was the same trade!  
But then this world of below must exist, since many cities, especially Asian ones, have not been developed with these underground networks to cope with rainwater and wastewater. Although the concept of sponge works well on the scale of a district, it is not necessarily sufficient on the scale of the city, according to Hong Zhu, Chinese architect and landscapist. It is therefore necessary to maintain and combine every type of engineering.

““ *It's said that a river that washes all away is violent, but one never hears about the violence of the banks that enclose it.* ””

BERTOLD BRECHT

- **Between the city and its surrounding territory:** territorial development policies must be coordinated around and in cities. In addition to changing the city, the territory surrounding it must undergo change as well.
- **Between the city and the water cycle:** architects, urban planners and engineers should rely on nature-based solutions in the city to invent a more resilient urban environment that uses the functions of infiltration, evapotranspiration, storage, retention and runoff. We have to accept water and use it, as it is a resource and neither a hazard nor a waste. Living with water rather than seeking to control it: this should be the motto of urban policy regarding nature. Furthermore, the history of interactions between human beings and their environment is very long, and there are more records about adaptation to difficult habitats than control and harnessing the elements. According to Frédéric Bachmann, *“it is essential to give water to the soil, trees and vegetation in a trio composed of water-soil-tree in which advantage is gained from these elements to obtain a pertinent solution. The tree cannot grow without water or without healthy soil linked to infiltrations. Many cities forget this when planting trees. The water cycle is a question of basics.”*

## 2. FORMULATING A PROSPECTIVE FOR 2050

Sustainability raises questions; it is essential to identify the signs that show that a situation will not necessarily last. What will have happened to the Rhone and Lake Geneva by 2050? The reports of the IPCC provide scenarios that depend on several levels of temperature increase. But do we want to believe in them? As emphasised by Erik Orsenna, *“everyone hates imagining the worst, considers that what exists will always exist, and does not want to believe in change or their own mortality”*. Above all, **this prospective 30-year timeframe has to be projected globally**, by considering the impacts of climate change on the uses of water, to clearly analyse and change apparently solid models like that seen in Switzerland. Lower discharges will have impacts on energy and drinking water. How, asks Anne-Claire Vial, will food production respond to this challenge tomorrow? This also shows the full importance of innovation. We must not only change agricultural practices but also find new solutions.

## 3. BUILDING A TERRITORIAL NARRATIVE FOR THE MEMORY OF THE PAST AND THE FUTURE

Such a narrative avoids the dangerous amnesia of natural hazards. Dams have made floods less frequent and reduced their extent, but by doing so they have distanced floods from human awareness and created an erroneous feeling of safety. **It is necessary to cultivate a fluvial memory, so that rivers do not emerge from oblivion only when they flow out of their beds.**

This narrative first relies on a change of semantics and on joint construction by the different actors so it can be fully integrated in the daily lives of those living close to the river, which is also an actor. For example, the Base Agency drew up authoritative manuals that identified the major components of new public developments of river banks (plantations, soft mobility, furniture, etc.) and opened test sections so that everyone could share this new narrative right from the design stage. It's a question of environmental justice since disadvantaged populations are most often less acquainted with environmental subjects whereas they are the first to suffer from environmental damage.

“ *If we want to give a meaning to our scientific, geographical, historical and political observations, we have to know how to tell stories about rivers to our media and economic partners.* ”

GILLES MULHAUSER,  
DIRECTOR OF THE CANTONAL WATER OFFICE OF THE STATE OF GENEVA

Next, this narrative must not ignore the past. It should be recalled that the 2<sup>nd</sup> Rhone correction works on the Rhone were aimed at fertilising the plain between the two world wars, an era when the population was starving to death. The Museum of Lake Geneva at Nyon favours this closer contact between the population and the lake, through better knowledge of the past in order to better apprehend the future. Museums dedicated to lakes and rivers are rare and should be developed.

Finally, this narrative is vital to achieve the change from knowledge to belief so as to forge a link based on affection and emotion so that people can identify with their river or lake.



#### 4. COOPERATING ON THE CROSS-BORDER SCALE OF A RIVER AND AT THE INTERNATIONAL SCALE

For Antonio Hodgers, State Councillor of the Canton of Geneva, *"The environmental future of our planet will without doubt put our democratic systems to the test"*. Water is by essence a resource shared between people, between local authorities and between countries. **The need for common spaces and strong rules will be felt everywhere in the world around rivers and lakes.** This vital dialogue is not only political. It is also cultural, since rivers are the common property of all, from their sources to their outlets.

“ It is ethically impossible to refuse the right of scrutiny to a neighbour regarding a water resource located upstream. ”

ANTONIO HODGERS,  
STATE COUNCILLOR OF THE CANTON OF GENEVA

Moreover, each basin can learn from another located in a different geographical, economic, historical and social context. **Setting up twinning between basins favours a dynamic of reciprocal learning**, more profitable than a lesson given by one country to another. In particular, the idea of developing a twinning agreement between Lake Chad and Lake Geneva after this session: Lake Chad has lost nearly two thirds of its surface area and is now in danger of vanishing completely. The irreversible environmental disaster taking place in Lake Chad could have considerable impacts on the rest of the world. Solutions like transfers of water between the Congo and Lake Chad are illusory according to Hamed Semega (OMVS), far removed from reality. *“More than ever, we need a global vision that makes countries aware of the need to develop solutions.”*

This international solidarity would work both ways: the Swiss can provide their technical skills whereas the countries of the Chad basin are able to share their knowledge of crisis management, more precisely about drinking water. The urgent need for dialogue is also apparent between emerging cities – where the temptation to build is great since development is a symbol of modernity and necessary to satisfy demographic growth – and the cities of wealthy countries that are beginning to leave behind this idea of the city for reasons of climatic necessity.

Once again, this twinning scheme must not remain purely technical: the members of IFGR raised the idea of creating a network of the major music festivals in Switzerland and elsewhere, to bring life to the issue of rivers and lakes.

**Why not make Geneva, an international city of water, the world capital of rivers and lakes**, as suggested by Erik Orsenna?



Pictures of the Rhone river and of Lake Geneva in this booklet are from Camille Moirenc, a selection from his exhibition «Faces of the Rhône – the king river» [www.visagesdurhone.com](http://www.visagesdurhone.com)

# The rivers committee

## **Ricardo Javier Álvarez**

Vice-President of the Argentine subsidiary of the Iberian-American Institute of Maritime law (IIDM) and legal coordinator of Hidrovias of Latin America.

**Dominique Béro**  
Head of Division, terrestrial monitoring system of the World Meteorological Organisation (WMO).

**Pascal Bourdeaux**  
Historian, Associate Professor of the École Pratique des Hautes Études (Religions of Southeast Asia).

**Corinne Castel**  
Archaeologist, Director of Research of the CNRS, Director of the French-Syrian Archaeological Mission of Al-Rawda, linked to the "Archéorient Environnement et sociétés de l'Orient ancien" laboratory of the Maison de l'Orient et de la Méditerranée (MOM).

**Daniel Dagenais**  
Vice-President of Operations of the Montreal Port Administration.

## **Katherine Daniell**

PhD and researcher at the Australian National University; member of the Australian National Committee of Water Engineering; specialist in water governance and participatory processes.

**Thierry Guimbaud**  
Managing Director of Voies Navigables de France (VNF).

*VNF was represented at this session by Cécile Avezard, Territorial Manager Rhone-Saone.*

## **Bernd Gundermann**

Architect, founder of Urbia-Group – Think Beyond.

## **Mirdad Kazanji**

Director of the Pasteur Centre of Cameroun.

## **Anoulak Kittikhoun**

CEO, Secretariat of the Mekong River Commission.

## **Kabiné Komara**

International consultant, member of the International Action Council, former Prime Minister of Guinea.

## **Ghislain de Marsily**

Emeritus professor at Sorbonne University (Paris VI-Pierre-et-Marie-Curie) and at the École des Mines de Paris, member of the Academy of Sciences.

## **Gilles Mulhauser**

Director of the Cantonal Water Office of the State of Geneva, Switzerland.

## **Tamsir Ndiaye**

Managing Director of the Société de Gestion de l'Énergie de Manantali - SOGEM (Mali).

## **Jacqueline Nyirakamana**

Specialist in cross-border cooperation on water, Ministry of the Environment of Rwanda, member of the advisory technical committee of the Nile Basin Initiative (NBI).

## **Erik Orsenna**

Economist, author, member of the French Academy, and specialist in sustainable development, the environment, agriculture and emerging economies.

## **Commodore Golam Sadeq**

President of the Bangladesh Inland Water Transport Authority (BIWTA).

## **Dr Papa Abdoulaye Seck**

Ambassador of Senegal to the FAO and Italy, former Minister of Agriculture and Rural Equipment, Republic of Senegal.

## **Hamed Diane Semega**

High Commissioner for the Development of the Senegal River – OMVS.

## **James Spalding Hellmers**

Councillor to the Director at Financiera El Comercio; former Managing Director of Itaipu Binacional (Paraguay).

## **Yangbo Sun**

Director of International Cooperation of the Yellow River Conservation Commission, Ministry of Water Resources, China.

## **Anne-Claire Vial**

President of the Institut du Végétal – ARVALIS.

# Resource-experts

## **Julien Clément**

PhD in anthropology, head of organisational development, Klarna (Sweden).

## **Sergio Makrakis**

Associate professor and director of research at the State University of Western Paraná - Unioeste (Brazil); specialist in assessing the impacts of fish passes on migrating fish populations.

## **Irina Ribarova**

Professor at UACEG (University of Architecture, Civil Engineering and Geodesics, Sofia, Bulgaria), expert in the integrated management of water resources and the circular economy in the area of water.

## **Alfredo Sese**

Technical secretary of Transports and Infrastructure at the Rosario Stock Exchange – BCR (Argentina).

## **Marie-Laure Vercambre**

Managing Director of Partenariat Français sur l'eau.

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