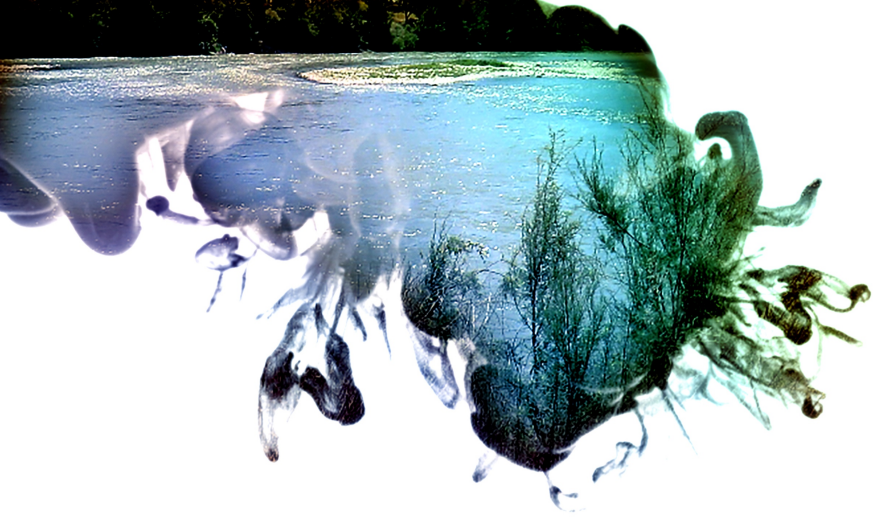

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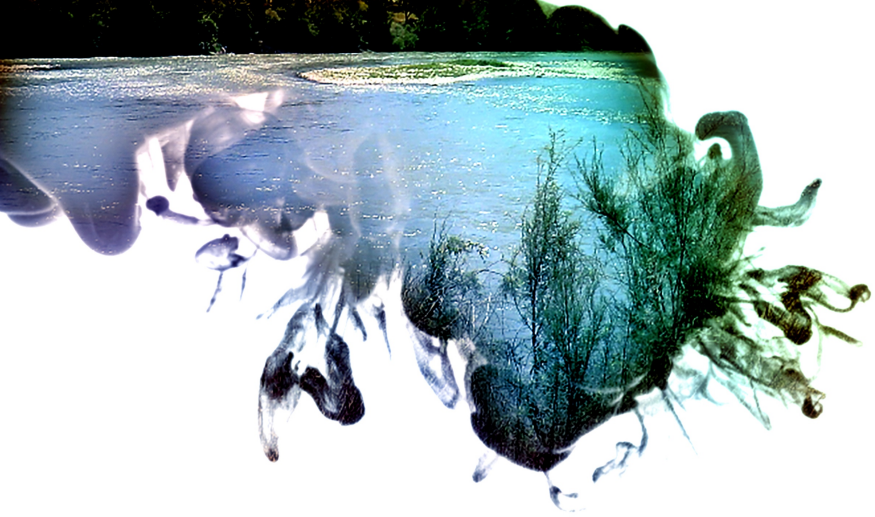
Urban River Restoration

Giancarlo Gusmaroli
Italian Centre for River Restoration – Technical Director

Abstract

The river has always represented for man a strategic element in the choice of settlements and in the development of civilizations. Impelling needs, alternating with far-sighted visions, have contributed over time to the continuous transformation of watercourses in areas of urban interest, paying attention now to functionality, now to aesthetics, more rarely to both contextually. The outcomes of these schemes have been different, even far from the expected results, but often the ecosystem value of the watercourse has been penalised. Nowadays the fluvial cities constitute drastic interruptions of the ecological *river continuum*, with environmental repercussions on usually more extensive areas of the same urban settlement. While on the one hand the settlements have influenced the watercourses in terms of the quality of the fluvial geography, on the other hand it must be underlined that they have been able to - and still can - receive enormous benefits from the watercourses themselves. This given, the attention of decision-makers and technicians towards the opportunities offered by urban river restoration is becoming more and more consistent. Intervening on urban rivers, however, requires clear visions on the multi-functional value of watercourses, holistic planning approaches and integrated decision-making processes. A possible answer today comes from a discipline – the so called “waterfront design” - that deals with rethinking the relationship between city and river. This approach aims to solve the urban and architectural dysfunctions of the areas at the interface between cities and rivers. However the recovery of the ecological health of the watercourse generally does not play a priority role among the considered objectives. In order to develop a river restoration strategy in urban areas - aimed at improving the ecological status of the watercourse -, it is necessary to take into consideration the territorial context hosting the city, including the socio-economic fabric, and the environmental peculiarities of the river itself. The challenge is therefore to identify a set of environmental restoration measures applicable in urban rivers, also when classified as heavily modified, capable of



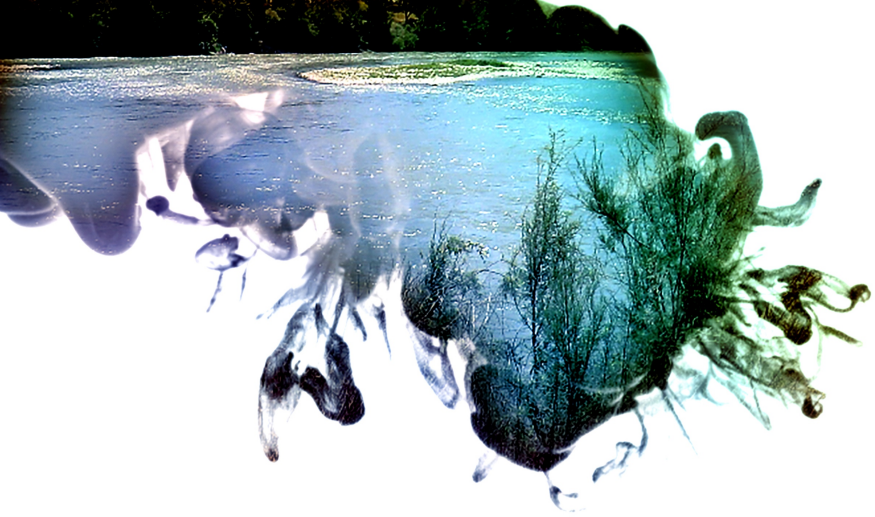
integrating or at least not penalizing (often acting in confined spaces) the city's multiple interests, from flood management to water uses, from real estate enhancement to degraded areas recovery. By adopting an ecosystem approach and going beyond the concept of waterfront design, this article explores the opportunity and feasibility of a regeneration of urban rivers from an environmental improvement point of view.

1 RIVERS AND CITIES: YESTERDAY AND TODAY

The relationship between rivers and cities in history has not had a univocal course, although some recurring issues are identifiable. The presence of water has had an important role for cities in defining their physical structure, economic development and cultural building, even if with obvious specificity deriving from different contexts. Conversely, urban communities have contributed over time to the continuous transformation of rivers, paying attention now to anthropic functionality (fluvial navigation, military defence, industrial development, wastewater management, flood security, drinking water supply, etc.), now to the aesthetic enhancement of the water spaces (scenic riverside, panoramic terraces, celebratory bridges, villas and river parks, etc.), more rarely to both contextually.

The severe degradation of the ecosystem value of urban waterways has substantially led the contemporary fluvial cities to constitute drastic interruptions of the ecological *river continuum*, with serious environmental and socio-economic repercussions even upstream (eg. reduction of the fish stock) and downstream (eg. water pollution). In many cases the river has become a residual space of urban planning (or, even worse, non-planning), becoming itself a transformation area with channeling, culverting and over-settlement actions. Those rivers sometimes remain only in the memory of some retired technicians or of a few senior citizens, occasionally just in some urban toponymes. But they become evident during flood emergencies, as cities are hydraulic bottlenecks where flood events usually generate considerable damages.

Since the seventies of the last century, many Western countries have begun to experience the first significant effects of the slowdown in socio-economic growth, with the consequent crisis of many urban areas developed along rivers. At the same time, the civil society start facing a growing environmental awareness, with a consequent significant expectation of environment protection and quality of life improvement (Kibel, 2007). Since then, both policy-makers and practitioners have experienced a new

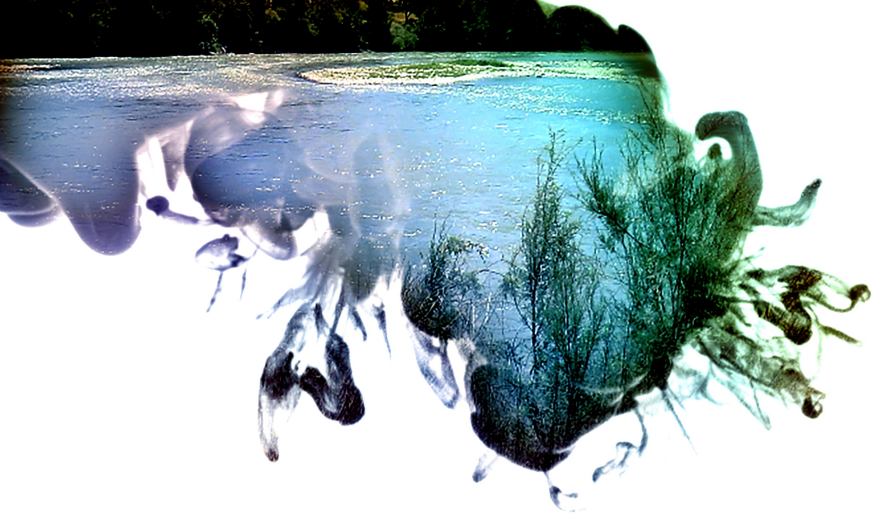


interest on urban rivers, in a first phase oriented essentially towards the reduction of pollution and the improvement of water quality, and subsequently also to the recovery of active channels and riparian areas. Interest that with time has gone even further, even arriving at proposals for the creation of new watercourses (CIRF, 2006).

The process of suburban production areas decommissioning (industries and ports) and the simultaneous social demand for new spaces for leisure (green areas and sport facilities) have fostered the generation of a real estate market that sees in urban river corridors a great palatability. This phenomenon has allowed - and still promotes - in many cities the start of urban regeneration initiatives, often through public-private partnerships (eg. project financing), transforming degraded areas into public spaces and encouraging their re-appropriation by citizens (Farinella 2008). Most of these experiences of urban-fluvial systems revitalisation matured to date are mainly characterized by a socio-economic valorisation strategy linked to the creation of spaces for recreational uses (eg. Paris and Turin) and/or the real estate recovery of abandoned production sites and/or port areas (eg. London, Amsterdam, Hamburg). But in some areas there are also experiences of environmental rehabilitation in urban areas (eg. Warsaw and Monaco). It is precisely from the consideration of the latter that some observations can be made about the opportunity and feasibility of an ecosystem approach to urban rivers management.

It is useful to remember that, since four out of five Europeans live in urban areas (EC, 2006) and their quality of life depends directly on the state of the urban environment (EEA, 2009), cities play a central role in the European Union agenda (EEC, 2006). The European Community itself affirms that in urban areas the environmental, economic and social aspects are more interconnected than elsewhere and, even if many environmental problems are concentrated in urban settlements, cities are nevertheless the engine of economy and the centre of business, thus allowing the easy activation of solutions to complex problems (EC, 2006). To be said too, this is a challenge whose resolution affects at least half of the global population (www.ined.fr).

The most relevant answer from the technical-scientific sector to these cultural and socio-economic background is the “waterfront design”. This is a discipline (or a multidisciplinary approach) that engages the creativity and expertise of technicians and artists at global level, in order to recover and/or re-think the relationship between city and river around the lines where they meet. This approach mainly aims at solving the urban dysfunctions along the city fronts that face rivers (and - more generally - natural



or artificial water bodies), with the frequent result that the watercourse remains a bystander of the regeneration process and is limited to mirroring some new architectures (Giacomozzi, 2007).

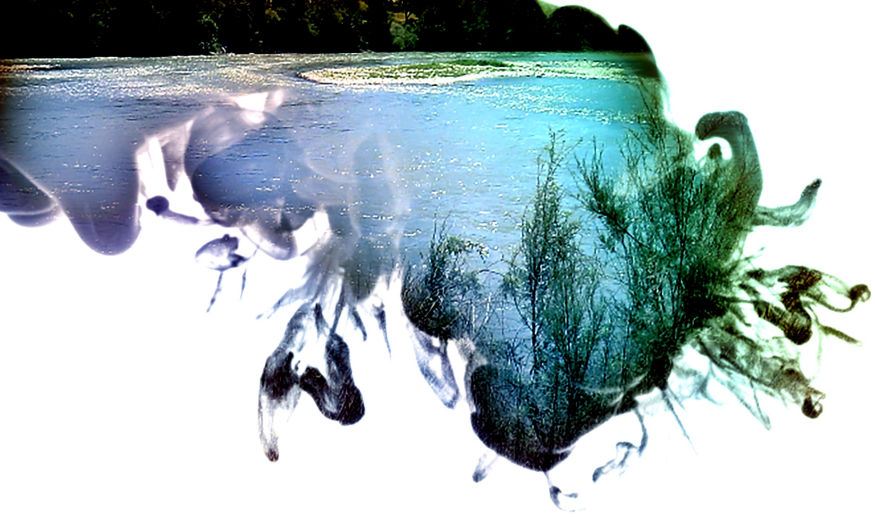
In such a paradigm, the formal components of the architectural and urban composition play a key role, with the consequence that the recovery of the fluvial ecological health does not necessarily find a priority place among the objectives at stake, becoming easily a mere completion factor (mimetic or evocative) of an aesthetic reconstruction process. Because of this the river space remains ecologically altered and the city remains a factor of discontinuity, rather than a place that "welcomes" the watercourse as a foundational element and identity, molding the urban features to (at least some of) the fluvial dynamics.

Sometimes such a waterfront design strategy turns out to be an obligatory choice, for example when the improvement of the ecological status of the urban stretch of the watercourse would entail costs and/or social externality disproportionate in comparison with the direct and indirect benefits deriving from an environmental restoration action. Other times, however, re-naturalization is a practicable alternative, but the choice falls on other "traditional" intervention options just due to the cultural background of designers rather than planning choices that (wrongly or reason) neglect or minimize environmental aspects.

It is therefore appropriate to clarify how the waterfront design approach cannot always be defined similar to that of river rehabilitation (CIRF, 2006), as the goal of improving ecological status tends not to be central or even targeted in the related initiatives. One can recognize in waterfront design, on the other hand, a strong vocation to urban regeneration of degraded areas, in some cases just with cosmetic or environmental mitigation measures. This statement does not deny the validity of the approach in question, but certainly introduces the need for a classification useful to properly define the features of different strategies for solving the problematic relationship between river and city.

2 URBAN RIVER RESTORATION PARADIGM

By adopting an ecosystem approach, to integrate or even replace the already mentioned "waterfront design" concept, we introduce the opportunity and feasibility of a recovery

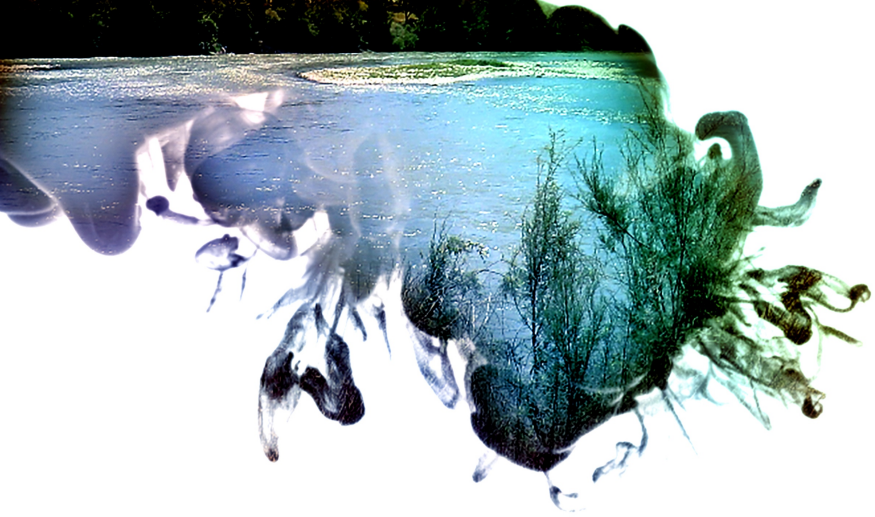


of urban rivers from an ecological point of view. This is the approach of Urban River Regeneration (URR). This paradigm looks at the city as an organism in continuous transformation and therefore probably still capable of molding, even only partially, to the (social and legal) demand of nature around the watercourse within the urban space. Basically this is a matter of identifying ways to enhance river ecological status and at the same time to re-think the development of the city.

What connotation can an environmental requalification intervention take in urban river stretches? Which attributes of the ecological value of a watercourse can be addressed by an environmental improvement strategy in such fluvial systems? Which measures, structural or not, can contribute to river rehabilitation in urban context? The answer obviously cannot be unequivocal: it is particularly necessary to consider the territorial context, also from a socio-economic point of view, and the same environmental peculiarities of the river. However, there is the possibility of identifying a set of environmental restoration measures that can be applied also in heavily modified contexts such as urban ones.

The URR paradigm as defined above is characterized by obstacles but also by opportunities. The areas along the river corridors often constitute one of the largest reserves of residual naturalness in urban areas. In this sense the urban rivers can become an opportunity for redemption for the cities, today strongly characterized by an expansion often not rational, with widespread sprawl phenomena and consequent unsustainable consumption of soil and generation of negative environmental and socio-economic externalities. The acknowledgement of the river at the same time as an ecological system and an urban place, although apparently obvious, still requires particular attention. A first (cultural) step might be the recognition that an URR process can determine the revitalization of many downtown areas, but also (and possibly above all) of suburbs and peri-urban areas, provided that the ecological value and functionality of the watercourses are maintained or recovered in an organic way.

It is clear that URR targets complex goal, as it deals with process that involve urban, ecological, social and economic issues. In this sense URR must be considered as part of the urban planning process (Binder, 2008). It is necessary to implement new planning methods, able to guarantee an active participation of stakeholders at urban/catchment scale. Negotiated planning is a tool that can play a key role for combining local and catchment strategies, that usually find significant meeting points right in the urban



nodes. The watercourses must however be rehabilitated in relation to the built urban landscape (even modifying it). The river is revitalized to revitalize the city (CIRF, 2006).

Given the relevance of an ex-ante economic assessment of the intervention alternatives, it is nevertheless possible to identify some river restoration measures that could be implemented into urban contexts, or densely urbanized area, without requiring costs that are disproportionate to the benefits obtained. Hereafter some of those measures are broken down by specific objective.

Improvement of the chemical-physical water quality:

- adoption in urban buildings of the principles and techniques of sustainable sanitation;
- refinement of centralized wastewater treatment plants with appropriate tertiary processes (preferably natural systems in ecological connection with the river environment);
- remediation of contaminated sites (in-situ, on-site or off-site, based on the specific fluvial geomorphological dynamics that might be reactivated);
- improvement of urban drainage through appropriate treatment systems (preferably natural) of stormwater.

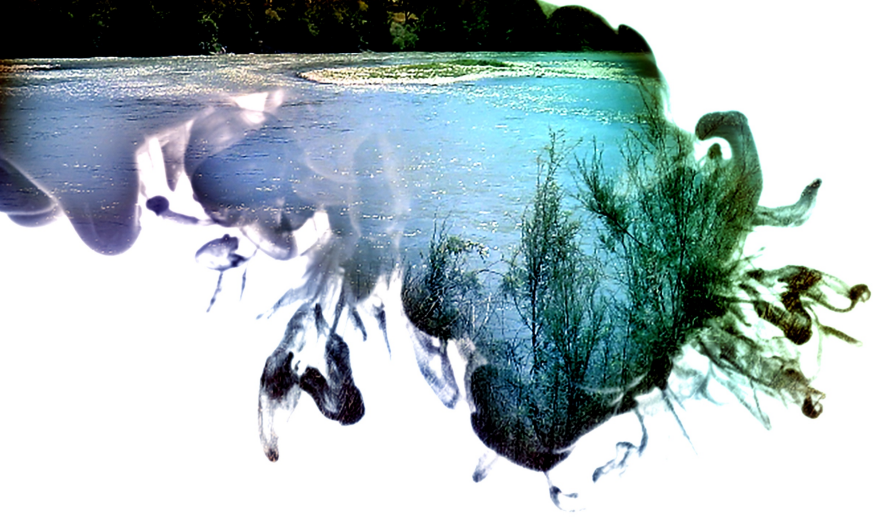
Improvement of the hydromorphological quality:

- daylighting of culverted fluvial reaches;
- modification or removal of obsolete or non-functional river barriers;
- enhancement of the geomorphological condition;
- controlled restitution (eg. with “sleeping” longitudinal barriers) of riparian areas to river dynamics;
- realization of controlled flooding lamination site in the (upstream) peri-urban area.

Improvement of biological water quality:

- realization of fish passages (where appropriate and relevant for the protection of fish fauna);
- creation of riparian habitats.

As a general criterion, however, the recovery of the self-organizing and self-regenerative capacity of the watercourse should be pursued, identifying primarily those measures able to enhance the hydrological and geomorphological processes as a prerequisite for



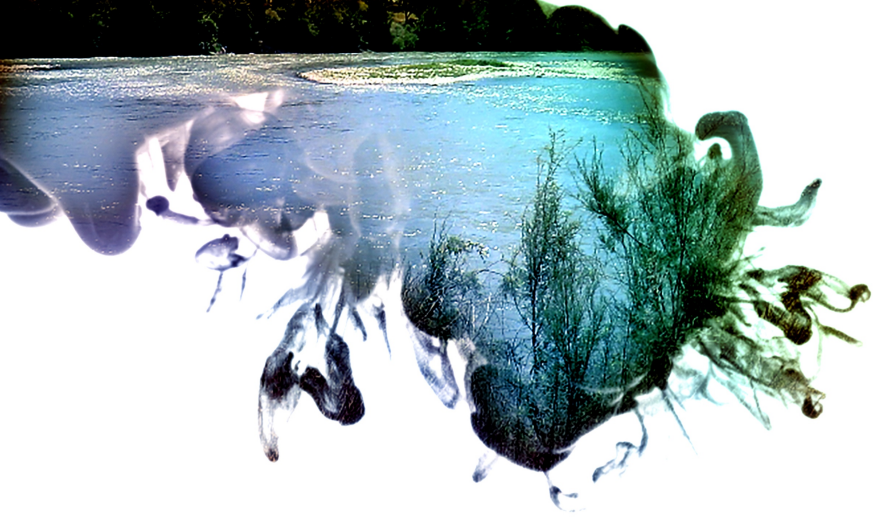
the spontaneous generation of habitats, the increase in self-purification capacity, the flora-fauna rebalancing and the ecological connectivity.

A particular aspect that must be considered when favoring the return of nature in the city is that of recreational opportunities and public safety. It is well known that urban areas characterized by amenity are particularly suited for hosting vandalism and social hardship (Chapman, 2009). A river corridor through any city, characterized by vegetated fringes periodically flooded, is typically not very accessible. Moreover, under flood conditions the watercourse carries waste materials coming from upstream (including urban drainage systems), constituting a degradation factor in aesthetic-perceptive terms and contributing to the further marginalization of urban riparian areas. These factors contribute to the deterioration of the image of the river. Because of this, river maintenance works have to be implemented, typically resulting in frequent sediment dredging and vegetation cutting that penalize the ecological status of the river and can constitute an inhibiting factor for the same URR initiatives.

The active involvement of citizens in a URR project could play a key role for recovering the memory of the river and re-discover its values. Therefore it should be considered a relevant step for allowing a restored river in an urban area to become an appealing place and the community to adopt an attitude of respect and care for its own fluvial heritage. Fostering the adoption of urban river stretches by the local community (in its various organizational forms) and the implementation of an accessibility system that takes into account the needs of public safety, can make urban river to be an integral part of the urban fabric instead of an element "beyond" of the urban front. This result can be obtained by appropriately opening intervisibility fronts between the urbanized areas and the river, by organizing events along/on the river or by inserting reversible structures for the riverbed and riparian area use.

3 TO (NOT) CONCLUDE

Urban River Restoration (URR) pursues the objective of enhancing the ecological status of watercourses, including chemical-physical, biological and hydro-morphological quality. This is a distinguished paradigm from the typical approach of the waterfront design, which aim mainly at the formal regeneration of urban rivieras, although those two approaches should be integrated. URR, in particular, adopts an ecosystem approach, paying attention to the needs of the watercourse intended as a continuum

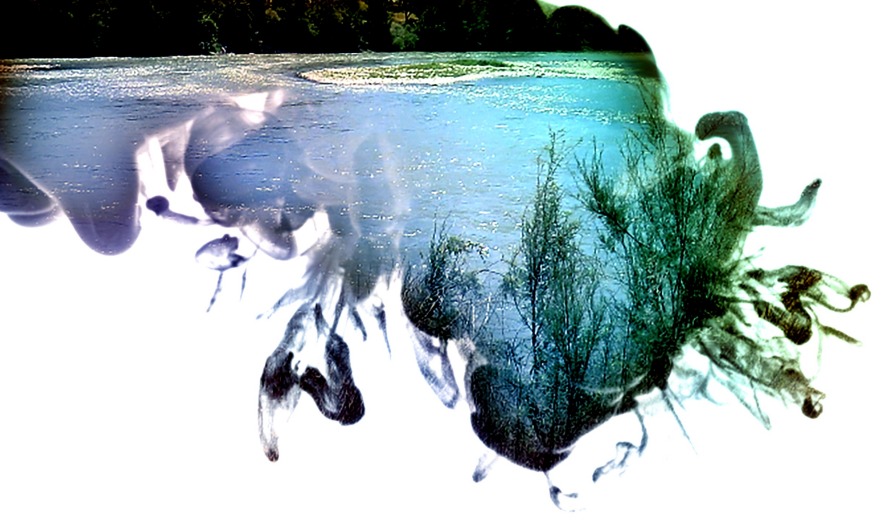


through the city. Cities have to be considered for their socio-economic and cultural values, but at the same time they are requested to respect the evolutionary dynamics of the watercourse. In this sense, the motivation for URR is not only linked to the value of the watercourse itself, but it can be an opportunity for the city in terms of real estate development of the riparian areas, economic re-launch of depressed neighbourhoods, improvement of quality of residents' life and reduction of flood risk.

In densely urbanized areas, however, it is not always possible to tend towards the ecological reference state of the watercourse, as different factors can contribute to make restoration costs disproportionate. These include – amongst others - water pollution and contamination of sediments and soils. Other factors may negatively affect the possibility of implementing an environmental improvement strategy in urban areas, including the unavailability of riparian land (due to high economic value or to the presence of cultural heritage sites) or the risk for public safety linked to the realization of unattended green areas. From these considerations emerges the need to integrate UR in urban planning processes, also activating appropriate negotiated planning actions for the active involvement of all stakeholders (public and private). In particular, the recovery among the citizens of the river's memory could be an important prerequisite for the success of any URR strategy.

In general it is possible to identify (also from the experience found in several case studies at international level) a set of river restoration measures definable “close-to-nature”, which - properly contextualised - can be applied in many urban contexts.

Those measures concerning water pollution reduction and land reclamation, reactivation of fluvial spaces, rebalancing of the geomorphological dynamics and of the hydrological regime must be considered priority (where relevant). The degree of environmental improvement that can be achieved depends on different boundary conditions, often very restrictive for an ecosystem approach to the watercourse. However, appropriate economic analysis should be developed within the decision-making process and the reasonable alternatives carefully evaluated. Among these, the URR paradigm must always be adopted where possible, while any intervention of (further) pressure on the river must be avoided where not necessary. In any case, compromise solutions between the engineering-architectural approach and the ecosystem approach can also be considered, provided that it should not outcome just as a mere environmental cosmetics. Whenever possible, priority should be given to the recovery of environmental processes before forms.



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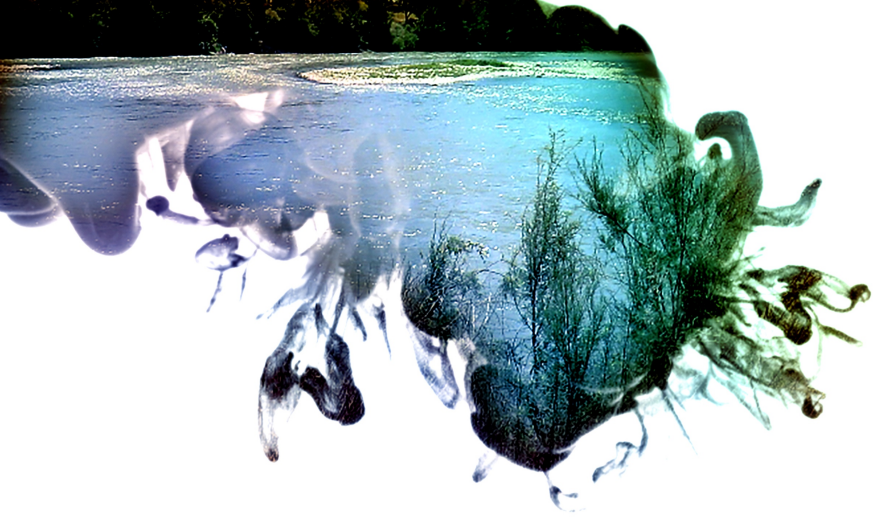

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