Urban River Restoration in the Global South – problem analysis and suggestions by the UNESCO Chair for River Culture / Fleuves et Patrimoine

Restauration des rivières urbaines dans les pays en développement – analyse du problème et suggestions par la Chaire UNESCO Fleuves et Patrimoine / River Culture

Wantzen, Karl M.

UNESCO Chair River Culture – Fleuves et Patrimoine, CNRS UMR 7324
CITERES, University of Tours, France, http://www.unesco-chair-river-culture.eu/

RÉSUMÉ

La conservation de la diversité des milieux aquatiques (diversité comprise à la fois en termes biologiques et culturels) dans les villes des pays en développement est particulièrement difficile en raison d'une série de facteurs : 1) L'étalement urbain et l'occupation informelle de l'espace sous l'effet de l'exode rural, et de la croissance exponentielle de la population urbaine ne répondent pas aux critères et normes d'une planification rationnelle. 2) La simultanéité de toutes les formes de dégradation des rivières. 3) Le changement climatique qui touche plus particulièrement les pays tropicaux (précipitations massives, sécheresses prolongées). 4) La migration de réfugiés fuyant des zones politiquement instables pour se concentrer dans les villes provoque une demande massive et peu prévisible de services écosystémiques fluviaux, tels que l'approvisionnement en eau potable et l'évacuation des eaux usées. 5) Des formes de gouvernance inadéquate se concrétisant, entre autres, par un manque d'argent public et de régulation juridique, par le poids du népotisme et des lobbies étrangers rendent les projets de restauration difficiles. 6) L'absence d'une culture de la restauration des rivières urbaines dans les pays en développement. Ce texte est dédié à une mise à jour du Concept de River Culture (Wantzen et al., 2016) et propose des préconisations pour surmonter la crise des diversités fluviales, biologiques et culturelles que connaissent les fleuves et rivières des villes des pays en développement.

ABSTRACT

The conservation of water-bound diversity (both in biological and cultural terms) in cities of the Global South is particularly difficult due to a range of factors. 1) Urban population growth, as well as sprawl and squatting due to rural exodus growth often overrun a concept-based planning. 2) Fast development of societies unleashes the entire historical development of man-made river degradation very fast, *i.e.*, all problems for environmental restoration occur simultaneously. 3) Hydrological conditions, especially in Tropical countries, are particularly hit by Global Change (massive rainfall events, prolonged droughts, increased stochasticity of hydrological events). 4) Migration of fugitives from politically instable areas into the cities causes badly predictably and massively increasing demands for riverine ecosystem services such as drinking water supply and waste water disposal. 5) Governance problems, *e.g.*, lack of public money, lack of legal reinforcement, cronyism and lobbyism from abroad make restoration projects difficult. 6) Concepts for urban river restoration in developing countries are virtually absent. In this paper, which is an update of the River Culture Concept (Wantzen et al. 2016), suggestions are made to overcome the crisis of biological and cultural diversities of urban rivers in the Global South.

KEYWORDS

Conservation, River Culture, Urban Rivers, UNESCO, Global South

1 URBAN RIVERS IN SOUTHERN COUNTRIES – AN ECOLOGICAL PANDEMONIUM

Rivers and streams in countries of the Global South are most often literally "forgotten" by urban planning. They become transformed into canals (often even covered by concrete), their banks and riparian zones are used as dumping sites (relying on the next flood that carries the garbage away), or become inhabited by the poorest part of the population, which has neither the political power nor the technical skills to develop the banks in a sustainable way. For example, in the City of Cuiabá, Brazil, several urban streams and their riparian zones were covered by concrete to create space for roads to avoid massive traffic jams during the Football Championship in 2014 (fig. 1).

Fig. 1. A strongly polluted urban stream in Cuiabá, Mato Grosso, Brazil, about to be covered by concrete.

The conservation of water-bound diversity (both in biological and cultural terms) in cities of the Global South is particularly difficult due to a range of factors.

1. *Urban population growth, sprawl and squatting due to rural exodus.*
   Even under "normal conditions", urban growth is disproportionately high in developing countries as compared with North America and Europe (but see point 4). Traditional forms of riverbank settling by fishermen etc. often become replaced by illegal squatters that do not have any legal support and can be moved away by the next wave of urban sprawl (Wantzen et al. 2016, Kondolf & Pinto 2017). As a consequence, urban development often follows an opportunistic pattern without planning, and streams and their riparian zone serve as a "tactical reserve" for occupation.
2. *Fast development of societies unleashes the historical development of river degradation at a time.*
   In the Global North, different types of pollution and degradation have occurred during centuries, and mitigation strategies could be developed one by one. Developing countries face all these problems, such as organic and toxic pollution, simultaneously (see graph in Wantzen et al. 2016).
3. *Hydrological conditions, especially in Tropical countries, are particularly hit by Climate Change*.
   Seasonal tropical climate provides a range of problems for the urban water management: Torrential rainfall events (>> 50mm/h) favor the construction of steeply inclined, sealed surfaces and large canals to avoid flooding; prolonged droughts require the establishment of minimum flows in these canals to transport wastewater and solid waste out of the cities to avoid hygienical problems. These measures reduce the infiltration of rainwater to the groundwater, thus they worsen the drinking water problems during the dry season. Moreover, surface runoff from rain often runs into treatment plants, resulting in untreated overflows into rivers. Climate Change (CC) increases both problems and also the stochasticity (lacking predictability) of hydrological events, and CC effects are is disproportionately high in the Tropics, according to the IPCC predictions.
4. *Migration of fugitives causes increasing demands for water supply and waste water disposal*.
   In the past decades, many cities in developing countries face an enormous immigration of fugitives from politically instable areas due to war and terrorism, and, increasingly, from areas that have become inhabitable/uncultivable due to CC and agricultural mismanagement. In addition to the above-mentioned problems (see 1.), demands for riverine ecosystem services such as drinking water and waste water disposal are skyrocketing. In Kabul, Afghanistan, the population is expected to double to 9 million until 2057, and groundwater-level declines may reach tens of meters in the next years, risking a collapse of the urban water supply (Mahdi & Wantzen, unpubl.).
5. *Governance problems make integrated river management and restoration projects difficult*.

In a recent interview of students from 16 nations of the International Master Course on Sustainability and Urban Planning at Poly'Tech Tours, the most common answers concerning "why there is no decent integrated management and restoration of urban rivers in developing countries" where e.g., lack of public money, lack of legal reinforcement, ignorance of the problem by the politicians, cronyism and lobbyism from abroad (Wantzen, unpublished). In the view of the planners, the major concern of urban river management are still the hydrological issues (see 3.), there is hardly any awareness of biodiversity and ecosystem functions (considered to be abundant outside the cities), water quality (treatment plants are considered to be working in accordance to the amount of public money invested for them, see for example the City of Bogotá, Colombia https://www.youtube.com/watch?t=301s&v=usWI4UUXsT4&app=desktop), or the linkage between human wellbeing and ecosystem health (as evidenced by strongly polluted streams in public parks).

6. *Concepts for urban river restoration in developing countries are virtually absent*
'Development' means 'economic growth' for most urban planners. An international workgroup on "Ecohydraulics and dam removal/sound management" and recent workshops organized by the UNESCO Chair gave impressive insights on contrasting views concerning river management across the North/South divide, e.g., at a time when 'dam removal' receives increasing interest in the USA and in Europe, the benefits of dams for flood control (in Africa) or the economic feasibility of investments in small dam projects (in Latin America) dominate the planners' views in the South.

   A recent literature review on river restoration in Tropical countries (urban and rural) revealed that most of the few projects that had been found are concerned with water pollution and hygienical problems (Wantzen, unpublished). The river is seen purely as a source of water for different usages, the approach of the "Stream and its Valley" (Hynes, 1975) has not yet (or very little) been integrated into the conceptualization.

2 SUGGESTIONS FOR URBAN RIVER RESTORATION IN TROPICAL/EMERGING COUNTRIES

The problem known as "Science/Policy-Gap", has been largely addressed elsewhere, however it is still far from being settled. For the case of river management, the River Culture Concept (Wantzen et al., 2016) assigns this phenomenon *i.a.* to the lacking *empathetic* relationship between man and his environment. Human perception of impaired and polluted rivers as "ugly, smelling, or dangerous" (during several human generations) has broken the empathetic link (often expressed in romanticism, religious idolization of rivers etc.), enabling humans to develop a "care" affection to rivers. The River Culture Concept therefore proposes to tackle the problem of environmental degradation in rivers from two sides at the same time: a scientific-technical and an empathetic-spiritual approach.

For *rural* river restoration in tropical and emerging countries, the general roadmap is relatively clear. Several concepts have already been developed (e.g. Pringle et al. 2008, Moulton et al. 2006, Wantzen et al. 2006, cited in Wantzen et al. 2016), and many of them are ready for application, provided that an adaptation to the regional bio-geological, hydrological and climatological settings was made. Very often, enforcement of existing laws (e.g. the Brazilian Forest Code, Siqueira et al. 2016) and the public decision to keep parts of the river continuum entirely free of dams (e.g. Pringle et al. 2008), and the principle of *"espace de liberté"* (space for river dynamics), can solve a large parts of the rural problem.

The restoration context for *urban* streams in developing countries is different. In urban streams, most impacts derive from urbanization itself, including: Surface runoff and hydropeaking from a sealed catchment; Deposits of dust and garbage on the banks causing toxic flushes and clogging after rain events; Waste water often not sufficiently treated, occurring in large amounts of very variable chemical composition and timing; Streams being entirely canalized, rectified and often even buried; Heating up of streams due to lacking shadow, water withdrawal, and power plants; Specific toxic and septic pollutants (hospitals, chemical industry),… to name a few of the major impacts. All of them already imply the technical solutions to tackle these problems, or measures to avoid unnecessary impact.

Concerning the problems mentioned above, suggestions for solutions are as follows:

1. *Urban population growth, sprawl and squatting* The Brazilian state of Recife was one of the first to protect territories of slums (favelas), thereby halting their continuous removal and reconstruction. Legal solutions need to be adapted for urban riparian zones that have been squatted, and riparian usages need to be redefined, recovering traditional adaptations to flood pulsing (see Wantzen et al. 2016). However, cities worldwide are beginning to designate flood-protection areas (see 3).

There is a fundamental conflict between providing housing for these poor residents and preserving the floodplain for its functions and simultaneously keeping people out of harm's way.

2. *Simultaneous occurrence of environmental problems.* Only fast transfer of depollution and restoration technologies can help here, moreover, innovative, cost-efficient solutions applying the concepts of hydroecology (Zalewski) and 'ecosystem-bionics' principles (Wantzen et al. 2016 and citations therein) need to be further developed for the urban context.
3. *Hydrological conditions under Climate Change*. These problems need to be settled in the headwater areas far above most cities by 'going against the flow', in order to reduce the crest of the flood wave (and the droughts) before they reach the cities. Inside the city limits, increased percolation of rainwater in unsealed areas (green-blue corridors, parks) can lower the risks of floods and droughts. Buildings that have already been built upon in high-risk flood areas need to be dismantled (cf. "Hausmannism" in Paris in the 19th century) to create multiple-use floodplains.
4. *Migration of fugitives*. The carrying capacity of cities that are already homing fugitives or that are susceptible to be target of mass migrations in the future must be determined, and the trail routes of the fugees need to be coordinated by an intergovernmental masterplan. By all means, envisageable catastrophes such as the breakdown of the water supply in Kabul or in parts of Jordan must be avoided. These problems go far beyond the urban aspect of planning.
5. *Governance problems*. The geographical catchment should become the central unit for all kinds of territorial decisions, specifically on water use (Wantzen et al. 2016). This means for cities that political decisions need to be "streamlined" with upstream and downstream residents, resulting in a transboundary participatory management by active citizens. Moreover, city planners need to be trained in ecosystem functioning and learn about the necessity of riverine ecosystem services.
6. *Concepts for urban river restoration in developing countries.* Generally, analyses on the motivation for restauration and lists of measures developed e.g. in Central Europe (see review by Zingraff-Hamed, 2018) can be envisaged for adaptation in tropical/developing countries given that the specific regional situation has been respected (see points 1-5 as a yet incomplete list). Participatory rural/urban appraisal (Ricaurte et al. 2013, cited in Wantzen et al. 2016) and tangible modelling approaches (Vollmer & Grêt-Regamay et al. GEC 2013) are needed to make such projects more comprehensible by the local population. At many sites, it is too early for 'restoration' where rivers are still being actively degraded and pollution is uncontrolled. Successful projects need to be highlighted, but publications, specifically on the non-tangible ecosystem services of urban rivers, are scarce.

3 CONCLUSIONS

Urban streams and rivers of emerging/tropical countries are envisaging a pandemonium of environmental stressors, many of which need to be tackled on a geopolitical and catchment perspective rather than from urban/regional planning. The River Culture Concept (Wantzen et al. 2016) provides some general suggestions how to harmonize man and river and to preserve biological and cultural diversities in riverscapes. Here, we add some suggestions for restoring urban streams, however the database of successful cases is yet small and much experimental work, including the contributions by riparian dwellers as active citizens, is still needed.

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