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Regenerating the Socio-Ecological Quality of Urban Streams: The Potential of a Social Learning Approach

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Introduction

Accelerated and unplanned urban growth and poor sanitation infrastructure, coupled with inequity and poverty, are factors directly associated with the degradation of urban streams (UN-Habitat 2016; WWAP 2015). Cities in the so-called Global South are particularly affected by this phenomenon (Capps et al. 2016; Wantzen 2018; Wantzen et al.

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2019). The scale and severity of this problem mean that there is an urgent need to rethink approaches and processes in order to find appropriate solutions to regenerate urban streams and promote more sustainable urban environments. The regeneration of urban streams is a complex challenge that demands multi-stakeholder action in collaborative, multi-disciplinary and learning-oriented platforms out of which joint solutions to socio-ecological challenges may emerge (Agramont et al. 2019; Silva-Sánchez and Jacobi 2016; Wantzen et al. 2019; Warner et al. 2008; Wehn et al. 2018).

This chapter seeks to identify potentialities and challenges in using the social learning approach as a framework for the multi-stakeholder interactions involved in initiatives for the regeneration of urban streams in contexts of socio-ecological vulnerability. The analysis is built on the case study of the Taquara Stream, located in the city of Porto Alegre, in south Brazil. This case study comprises a self-organised group of citizens—composed of members of the local community, the public sector and educational institutions—acting to re-establish the socio-ecological quality of the Taquara Stream and watershed, an area largely occupied by informal settlements. Firstly, we contextualise and problematise the issue of urban stream degradation, focusing on the Brazilian context. Secondly, we provide a brief literature review on social learning, and, finally, we describe and discuss the case of the Taquara Stream as an example of a social learning–oriented process to demonstrate the potential contribution and challenges this approach brings within processes for the regeneration of urban streams in vulnerable areas.

Urban Rivers and Streams in the Global South and Brazil

Urban rivers and streams and their banks are fundamental ecological structures for the sustainability of cities. They are essential areas for the protection and maintenance of biological diversity, connecting green areas within urban environments (e.g. through greenways), preservation of water quality, flooding reduction, provision of recreational and leisure

uses that allow people to interact with nature, and environmental education activities (Ahern 1995; Flink and Searns 1993; Hough 2002; Newman and Jennings 2008; Spirn 1984). Increasing attention has been given in recent years to the need to restore rivers and streams in urban environments, as evidenced by multiple projects and initiatives around the world (Bernhardt et al. 2005; Tunstall et al. 2000; Wantzen et al. 2019). The concept of greenways, for example, has been extensively applied as a strategy for the requalification of urban streams and their banks (Fabos 1995; Searns 1995; Hellmund and Smith 2006). The rewilding of streambanks (Rhoads 1999) and the implementation of depollution processes based on ecological principles and ecosystems functioning (Lyle 1996) are seen as sustainability-oriented approaches to dealing with this challenge, and are increasingly widespread (Wantzen et al. 2016). At the same time, it has been also recognised that actions towards the regeneration of urban streams demand collaboration between different social actors in a multidisciplinary process that considers urban water bodies as socio-environmental systems characterised by the complex integration of factors such as ecology, water supply, landscape recovery, community memory, sanitation, housing etc. (Silva-Sánchez and Jacobi 2016).

Ecology-oriented regeneration strategies are well established in the so-called Global North, while, in the Global South, they are still relatively new (Wantzen et al. 2019). In the Global South factors such as rapid urbanisation, poverty, the growth of slum populations occupying riparian zones, the inability or unwillingness of local and national governments to deal with the issue of social housing for the poor, social conflicts around land and resources, inadequate waste-management policies and infrastructure, a lack of financial resources to invest in needed social and physical infrastructures, poor management of water resources, inefficiencies in environmental governance systems and lack of transboundary action are all significant factors limiting the implementation of these projects (Capps et al. 2016; Wantzen 2018, Wantzen et al. 2019; WWAP 2015). Furthermore, populations inhabiting riverbanks have little chance to participate in decision-making processes and tend to lack the political power and technical skills to develop urban stream areas in a sustainable way (Wantzen et al. 2019).

In Brazil, the degradation of urban rivers and streams is a pressing problem in many cities. This issue is usually related to conditions of social and environmental vulnerability, which are connected to poverty, the presence of informal settlements or slums—reported in 97.3% of Brazilian municipalities with more than 500,000 inhabitants (IBGE 2009)—precarious housing conditions, riparian forest suppression, huge deficits in sanitation infrastructure provision, the direct disposal of sewage and solid waste in water bodies, the exposure of populations to risks—such as landslides and floods—and waterborne diseases (ANA 2018; Maricato 2000; Moser 1998; Tucci 2005). The National Water Agency points out that water quality is very low along more than 110,000 kilometres of river due to an excess of organic load. Along 83,450 kilometres of river, it is no longer possible to capture water for public supply due to pollution, and along 27,040 kilometres, water can only be captured with the use of advanced treatment methods (ANA 2019). It is worth noting that the current Brazilian government intends to address the complex issue of sanitation in Brazil by privatising the sector; the text that establishes this legal framework was approved by the Chamber of Deputies in December 2019 (as noted in a Folha de São Paulo newspaper article on 12 December 2019). Privatising the sanitation systems points, however, to the implementation of top-down solutions and rising prices for the service—thus penalising the poorest segments of population—without guaranteeing the systems' improvement (Faria et al. 2005; de Sousa et al. 2017).

Vulnerable groups that inhabit urban river and streambanks in Brazil are, to a great extent, socially marginalised, excluded from effective political participation in decision-making processes (Acselrad 2015) and deprived of access to formal urban areas (Rolnik 1999). This situation is engendered by complex factors such as the striking social inequality that marks the Brazilian context, uncontrolled urban growth, lack of efficient housing policies and an absence of public power to limit the occupation of unsuitable areas (Balbim 2016; Maricato 2000, 2003). The great imbalance in income distribution in Brazil leads to marked socio-spatial inequalities, as segments of the population unable to acquire land eventually occupy illegal and lower market value areas—usually environmental preservation areas such as wetlands, steep hills and riverbanks—where

there is no basic sanitation, and the implementation of such services is difficult (Rolnik 1999). In terms of political ecology, this situation reveals how the disharmonious relationship between social groups engenders environmental inequalities (Swyngedouw et al. 2002) related to the disputes over land access that arise in contexts of capitalist urbanisation (Denaldi and Ferrara 2018).

Concerted actions aimed at recovering urban rivers and streams in socio-ecologically vulnerable areas must therefore address specific economic, cultural, political and environmental features of these contexts so as to generate legitimate solutions that are technically appropriate, economically viable, socially acceptable and environmentally sound. Successful experiences of wastewater management and collection in contexts of financial resources constraint, as experienced by most countries in the Global South, point to the importance of expanding decentralised systems and low-cost, innovative place-based solutions that are technically easy to implement (e.g. local wastewater treatment, biogas production for reusing and recycling wastewater) (WWAP 2015). Furthermore, ensuring that communities directly affected by water-related problems can participate in decision-making processes is crucial for producing legitimate responses that fit local sociocultural contexts (Gallo et al. 2016). It is particularly important for the success of restoration projects in lower-income countries that actions not only offer feasible and effective short-term solutions to people who live in precarious situations along the banks of urban streams and rivers but also engage stakeholders in a broader debate that goes beyond purely technical approaches (Wantzen et al. 2019).

In this context, it is critical to create inclusive processes to facilitate the participation of marginalised social groups in collaborative action towards the transformation of their realities. In contexts of deep social disparities, collaborative efforts to improve the socio-ecological quality of urban rivers and their surroundings might create opportunities for dialogical interactions among diverse stakeholders and disadvantaged social groups. Such processes are likely to generate individual and collective critical reflections and knowledge exchange among participating actors as well as empowerment and greater autonomy of involved communities in local resource management (Jacobi 2013). From this standpoint, collaborative

practices, dialogic learning processes and knowledge integration are central aspects in fostering transformations towards more sustainable practices and values to promote changes in local realities (Lotz-Sisitka et al. 2015) and to regenerate socio-ecological systems (Wahl 2016). In this context, social learning appears as an important theoretical framework that can inform processes with this aim.

Social Learning

The development of responses towards sustainability can benefit from a critical assessment of dominant collective mindsets that, often unwillingly, normalise or invite unsustainable behaviour and stand in the way of collective action on socio-environmental issues (Keen et al. 2005; Sterling 2011). From this perspective, the conception of sustainability encompasses both a subjective and a technical process. As a subjective process, it requires learning and critical reflection on values, views and concepts that underlie decision-making, and that are associated with unsustainable patterns of production and consumption, and unequal and exclusionary social structures (Abson et al. 2017; O'Sullivan and Taylor 2004; Röling 2002; Wahl and Baxter 2008). As a technical process, it demands the selection and explanation of specific knowledge and parameters that can guide the development of practical solutions that fit a specific social, ecological, cultural and political context (Macintyre et al. 2018; Šūmane et al. 2018). Social learning is a valuable approach for connecting the two as it allows us to think about how to engage groups in a critical assessment of knowledge and collective reflection on entrenched views, beliefs and values, and encourages meaningful conversations to produce innovative practices towards the construction of a sustainable future.

Wals (2011: 181) highlights four main aspects of social learning for sustainability: (1) it uses the diversity of views within a group as a way to foster co-creative processes; (2) it is based on processes aimed at creating opportunities for individual and collective reflection and reflexivity; (3) it unfolds through social cohesion and social capital to facilitate change in complex situations; and (4) it counts on the 'power of collaborative action

that strengthens the (unique) qualities of each individual'. Social learning implies the promotion and intensification of learning processes that can lead to transformation, both individually and collectively, stimulated by dialogue and cooperation among a diverse group of people that share a common goal.

Diversity is a key element in social learning processes, as it is from the plurality of perspectives and the confrontation of divergent views in a conducive environment that critical learning processes can converge, and views, mindsets and values may be transformed (Wals and Heymann 2004). However, in complex social systems where people with different backgrounds and attitudes are brought together, social learning will not necessarily unfold automatically. It is based on a relational approach in the sense of establishing social connections, and depends on a favourable social environment, often informal, wherein dialogical interactions can unfold (Souza et al. 2019). Dialogue construction requires the willingness of all involved to communicate as equals in a process of a relatively open conversation that welcomes a diversity of views and conflict—when properly managed—as driving forces for collective learning (Wals and Bawden 2000). Diversity is, therefore, a potential force for learning, allowing participants to create new knowledge when the different perspectives, experiences, ideas and values of individuals are integrated in an enriching way through dialogical interactions (Loeber et al. 2009).

Integrating diversity into symmetrical dialogical practices is not, however, an easy task, as this depends on a climate of mutual trust and overcoming, or at least acknowledging and questioning, power imbalances among actors participating in the social learning process (Schusler et al. 2003). Hence, skilled facilitation is also considered an important factor in social learning processes as it can contribute to reducing power imbalances by creating equal opportunities for participation (Ernst 2019). Social learning also requires building trust among participants (Rist et al. 2009). In a group environment where there is mutual trust, dialogue can be deepened as participants feel more confident in expressing and questioning views (Rist et al. 2006).

Social Learning and Collaborative Projects

Social learning is directed towards problem-solving in specific contexts, where groups or communities are operating in new, uncertain and unpredictable circumstances (Wildemeersch 2009). It emphasises the learning that arises from practical experiences, recognising the reciprocal influence and transformation that result from dynamic relationships among individuals, and between individuals and the environment (Souza et al. 2019). The engagement of groups and communities in collaborative projects in the context of complex contemporary social and environmental challenges represents an opportunity to initiate social learning processes, especially when it is recognised that exclusively regulatory, authoritarian and technical approaches are inadequate in addressing challenges within complex systems (Mostert et al. 2007).

Projects focused on regaining the socio-ecological quality of urban streams in vulnerable areas call for comprehensive approaches that must take into account social and biophysical features as well as the technical knowledge needed to design practical responses. They require the construction of relationships among diverse stakeholders and the critical engagement of directly affected communities as legitimate groups in defining territorialised agendas (Gallo et al. 2016; Machado et al. 2019). The involvement of affected social groups as well as other stakeholders—such as representatives from the public sector and other civil society organisations—in collaborative action and learning practices is a key factor in promoting systemic and environmentally and culturally appropriate responses, as well as capacity building and greater autonomy of participants in local resource management (Hoff 2011).

When utilising social learning to help communities move towards sustainability, two kinds of social differences can be distinguished: healthy or desirable ones and unhealthy or undesirable ones. Healthy differences include variety in vantage points, values, ways of thinking and connecting that might increase the richness of the learning process and the chance of creative outcomes. These differences are only healthy when the people who are included in the learning process experience a certain level of trust, social cohesion and respect. Unhealthy differences, on the other

hand, include disparities in agency and access to resources and power. Sustainability-oriented social learning needs to become transgressive in order to overcome such inequalities and to be able to include those who are marginalised. Here, transgressive refers to disrupting the structural mechanisms that keep inequality and associated differences in place, while empowering and equipping communities to take action (Bengtsson 2019). Social learning can help to build trust, commitment and social cohesion that can develop the capacities communities need to overcome structural inequality (Sol et al. 2013).

Another aspect that needs to be highlighted in a context of socio-ecological vulnerability marked by poverty and a lack of both basic sanitation infrastructures and the resources to solve problems locally is that the required solutions are unlikely to be achieved through exclusively community-based efforts. Complex problems such as those related to urban water system regeneration in vulnerable areas require a combination of top-down and bottom-up actions. Such contexts often demand complex technical interventions, which are generally top-down and not guided by reflexive interaction among the diverse actors involved (Smith 2008). Conversely, bottom-up initiatives emerge from community reactions to local challenges and have the potential to bring forth innovative solutions from locally available material, cultural and human resources, while promoting autonomy and increasing the ability of populations to deal with socio-ecological problems in their territories (Seyfang and Smith 2007). Nevertheless, the search for a balance between top-down and bottom-up approaches is key to concurrently meeting the ecological and social challenges involved in working towards sustainable justice, equanimity, community autonomy and regenerated ecosystems (Hopkins 2008).

Finally, it is also important to acknowledge that the ability of participants to direct the actions of a group in the search for sustainable responses is affected by the available resources and institutional arrangements, which might eventually restrict the possibilities of adequately responding to problems (Loeber et al. 2009). Contextual factors such as rules, governance systems, knowledge capacity and inter-stakeholder conflicts and tension will greatly influence social learning processes towards sustainability (Medema et al. 2014).

The Regeneration of an Urban Stream in Lomba do Pinheiro, Porto Alegre, Brazil

Lomba do Pinheiro is a neighbourhood located in the city of Porto Alegre, South Brazil (Fig. 3.1). It mixes densely populated nuclei and areas of prominent environmental value, such as native fields, woods, hilltops, watercourses and springs (PMPA 2013). The various springs found in the area compose the so-called Ring of Springs of Porto Alegre; most of them are located in the Saint-Hilaire Municipal Natural Park, a nature conservation unit adjacent to the neighbourhood (Menegat et al. 1999). Over the past few decades, Lomba do Pinheiro has been heavily occupied by informal settlements (PMPA 2013). Unplanned and informal urban growth has led to severe environmental degradation in some parts of the territory, mainly due to a lack of sanitation infrastructure and the occupation of streambanks (Oliveira and Oberrather 2010). A local initiative has been launched to recover a degraded urban stream, the Taquara Stream, involving representatives of the local community, the public sector and educational institutions. It is focused on the co-creation of solutions and the progressive implementation of improvements to the local situation using a participatory and learning-oriented approach.

This case was the subject of a participatory research project conducted by the lead author of this chapter. The research applied a range of methods, such as in-depth and semi-structured interviews, focus group conversations and participant observation. The participant observation was carried out during a period of approximately 18 months (between May

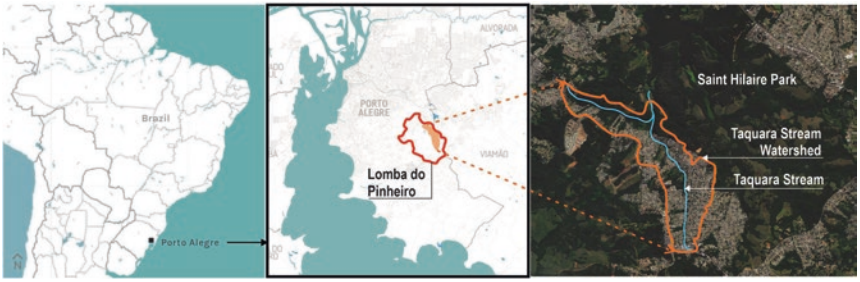

Fig. 3.1 Porto Alegre, Lomba do Pinheiro and the Taquara Stream watershed

2016 and December 2017). Individual and focus group interviews were conducted with a limited number of participants from the group leading the initiative—selected for their high attendance at meetings, relevant roles in organising actions in the community and ability to foster connections with other collaborators. This group was composed of 11 people (including residents, technicians and representatives of educational institutions). In the following sections, we analyse the case of the Taquara Stream, based on the main results of this research.

The Taquara Stream

The Taquara Stream, with an approximate length of 2800 metres, is located in the oldest and most urbanised part of Lomba do Pinheiro (see Fig. 3.1). Data from 2010 indicate a population of around 20,000 people, mainly with low incomes, living in the area encompassed by its watershed (IBGE 2010). Several interrelated issues have led to the degradation of the Taquara Stream over the past decades. Suppression of riparian forest due to occupation of the marginal strips has caused erosion and siltation of the stream bed. Inadequate or non-existent sanitation infrastructure—in spite of infrastructure work carried out by the city's water and sewage department over the past decade—means that wastewater is directly discharged into the stream (Fig. 3.2). Additionally, it has been verified that solid waste is being directly dumped into the watercourse and along its banks—despite the existence of regular household waste collection in the region. The risk of flooding is higher when accumulated waste descending the watercourse during heavy rain becomes trapped in certain channelled sections of the stream, and recurrent flooding has been observed. Moreover, the high level of pollution in the Taquara Stream has a direct impact on public health in the region, causing an elevated incidence of waterborne diseases (PMSB 2015).

The precarious socio-ecological conditions of the Taquara Stream are not an isolated case in Porto Alegre, where there are several watercourses in the same situation. The city's water and sewage department has been expanding sanitation infrastructures over the past few decades in order to improve water quality in urban streams. However, solutions are mostly

Fig. 3.2 Risk situations and discharge of effluents and solid waste in Taquara Stream. (Source: Souza 2019)

based on end-of-pipe centralised treatment facilities, which require large investments of capital (Ashley and Cashman 2006) and do not adequately meet the demand for sanitation in the poorest neighbourhoods of the city. Moreover, these responses are typically top-down and non-systemic—as they are mainly focused on solving a specific aspect of the problem rather than dealing with the complex interactive factors associated with it—and non-participatory, and thus unlikely to produce locally legitimised solutions (Smith 2008).

The first community mobilisations seeking solutions for the Taquara Stream took place in 1995, from an initiative created by a local community association. Between 1999 and 2009, Porto Alegre City Hall developed, through an intersectoral action in partnership with the Federal University of Rio Grande do Sul (UFRGS) and the community of Lomba do Pinheiro, the Integrated Project for the Sustainable Development of Lomba do Pinheiro, which included a linear park project as a strategy to recover the Taquara Stream and its watershed (PMPA 2003). However, this project was not completed due to a lack of political support and administrative discontinuities.

A Local Initiative for the Socio-Ecological Regeneration of the Taquara Stream

In 2015, a group of citizens—mainly connected to the Lomba do Pinheiro Community Garden, a key site for the articulation of actions related to public health issues in the neighbourhood—performed a diagnostic walk along the Taquara Stream. This mobilisation led to the creation of the Taquara Stream Watershed Working Group (WG) to seek solutions to the problem. The WG is a non-institutionalised group composed of community members (local leaders and residents), public sector technicians (with the most active participation from members of the health and water and sewage departments) and members of local educational institutions (local schools and UFRGS). The group also includes hybrid figures, that is, technicians with close connections to the community and representatives from educational institutions who live in the neighbourhood.

It is noteworthy that local leaders engaged in this initiative have a long history of acting in local social movements. Most technicians have been involved with issues affecting this community for many years and demonstrate personal commitment to the cause, and participants from educational institutions work with participatory research approaches at the interface of formal and informal education. These seem to indicate a preference of involved stakeholders for using participatory-oriented processes to deal with local problems. Additionally, the fact that most technicians are involved in tackling health issues and the participants' affinity with ecological perspectives have directly influenced the initiative's focus and approach. The WG members share the understanding that solutions to the complex socio-ecological problems found in the Taquara Stream and its surroundings depend on joint and collaborative efforts and integrated technical and learning-oriented actions. In this context, the WG has developed various actions in the territory since 2015, promoting a broader critical reflection on local issues, raising awareness and mobilising the local community and stakeholders, and improving local livelihoods and ecological conditions.

Results and Discussion

In this section, we address three key aspects of the Taquara Stream case that are relevant to our analysis. We first present the approach used in the initiative, introducing the normative knowledge adopted to guide problem-solving (e.g. rewilding streambanks and diverting streams represent two divergent technical strategies), and the social learning approach utilised to guide stakeholders' interactions. Then, we address the local community and stakeholders' engagement and interaction, focusing on the participatory and dialogical spaces and activities created to promote stakeholder interactions, as well as obstacles to cooperation that were identified. Lastly, the social learning practices verified in the leading group are analysed; at this point we address factors that enabled dialogical interactions and collective critical reflections among the participants of the initiative.

Approach Used in the Initiative

A general approach to the Taquara Stream initiative was defined by the WG members and is schematically illustrated by the chart in Fig. 3.3. This approach was set in order to guide group interactions, provide parameters to analyse local issues and design solutions, and evaluate outcomes of the process. The chart interconnects the initiative's guidelines, its general and specific goals, and short, medium and long-term coordinated actions performed by diverse collaborators. Social learning and ecological principles were adopted by the WG as the main guidelines for the movement.

The social learning approach is in line with the learning perspective advocated by the WG. It emphasises a symmetrical and inclusive way of interacting both among WG members and between these members and the local community (here we refer to the population inhabiting the Taquara streambanks). Social learning–oriented practices sought to create opportunities for the critical participation of social groups commonly excluded from the debate on issues concerning their territories in inclusive dialogical spaces where different world views could be appreciated

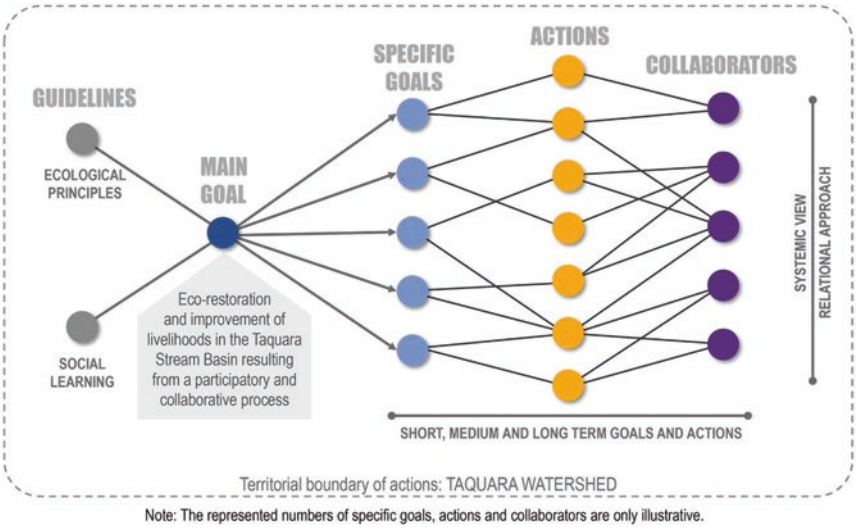

Fig. 3.3 WG approach to actions towards the regeneration of the Taquara Stream. (Adapted from Souza 2019)

and acknowledged (Balazs and Lubell 2014). The participation of disadvantaged communities in social learning processes tends to promote the critical reflection of these groups on the roots of their socio-ecological issues and to broaden their repertoire of solutions to local problems, thus enhancing their capacity building and autonomy in the management of their territories (Coudel et al. 2017). Such learning also enables the integration of knowledge brought by the various social actors involved (Murti et al. 2019). Furthermore, it can contribute to government representatives learning about community needs and perspectives on different water solutions, enabling them to identify the best way to address local issues and develop solutions tailored to local views (Balazs and Lubell 2014).

The ecological principles, on the other hand, highlight the need for life-supporting and life-enhancing practices for a balanced coexistence between human society and nature, as well as the importance of fostering a sense of co-responsibility among stakeholders (Capra 2002; Du Plessis and Brandon 2015). In line with innovative approaches to the regeneration of urban streams (Wantzen et al. 2019), these principles provide ecological parameters for the design of bio-inspired and low-cost

solutions as well as a basis for the critical analysis of traditional responses to this type of problem. These principles provide normative knowledge and objective criteria to inform decision-making towards sustainability-focused solutions from the standpoint of ecosystems' supportability and minimisation of environmental impacts. For instance, sewage treatment solutions informed by these principles tend to differ from conventional centralised systems (Lyle 1996). They are usually smaller scale, implemented near effluent emissions and may be based on natural water purification systems such as bio-remediators (Hough 2002; Lyle 1996; Newman and Jennings 2008). Furthermore, considering that transportation greatly affects the costs of wastewater management, less energy-intensive decentralised systems that treat wastewater near the source, and the use of simple technologies based on recycling water and nutrients—which may also be associated with energy production, water reuse and local income generation—can lead to investment savings that are particularly important in economically constrained contexts (WWAP 2015).

Notwithstanding the benefits brought by small-scale alternative systems, the WG recognises that the pressing local demand for sanitation infrastructure compels the use of routine technical solutions—which are mostly large scale and centralised—since alternative practices are hampered by the lack of regulation. This points to a need to change and update norms, following a broader critical discussion on the sustainability of routine solutions within different institutional levels and government sectors (Medema et al. 2014), so that a wider range of options might be legitimised. The application of this principle could not, therefore, be observed in practice in the Taquara case, as technical actions implemented in response to the initiative were restricted to the emergency connection of some residences to the existing sewage system; the lack of regulation and resources meant that alternative solutions could not be tested.

Local Community and Stakeholders' Engagement and Interaction

Based on the approach presented earlier, the WG carried out several actions with different scopes and scales in the community of Lomba do Pinheiro. They aimed to create channels of dialogue with stakeholders and the local population, promote critical thinking on local issues, encourage residents' engagement in the movement and improve conditions at specific locations along the Taquara Stream. Several activities were carried out, such as collaborative map-making, diagnostic walks, lectures, and circle and one-to-one conversations with residents, among others. In social learning–oriented processes, the use of diverse participatory methodologies is key in order to sensitise and mobilise stakeholders in collaborative efforts towards sustainability (Brouwer and Woodhill 2016).

In cases involving marginalised populations, it is critical to understand the drivers that generate engagement and prioritisation of local environmental conservation. Marginalised groups are more likely to actively engage in sustainability-oriented social learning when they feel that the learning process recognises their understanding of their predicament and their own local circumstances, and when the learning, and those who support and facilitate it, open up spaces for participation, dialogue and building a common cause, while acknowledging the structural barriers to change. Monitoring and evaluating the changes that occur in the relationships and capacities within the community, as well as changes in socio-ecological terms, are critical for sustaining this engagement. Often, these changes are not felt or seen because such transformations can be subtle or slow, but on the occasions when they are noted and shared, they can be motivating and empowering (Wals et al. 2009). Additionally, re-establishing an empathic and emotional connection between the community and the local hydric ecosystem is key to promoting community engagement and fostering pro-environmental behaviour, and a culture of care towards the river (Ives et al. 2018; Wantzen et al. 2016).

The WG performed small-scale actions in specific areas of the watershed either to promote concrete improvements (such as the cleaning of

Fig. 3.4 Small-scale actions (A, B and C) and thematic events (D, E and F). (Source: Souza 2019)

specific sites through joint efforts), to establish conversations with residents or to diagnose socio-ecological conditions. These actions produced relevant outcomes—such as the regeneration of the Taquara Spring (Fig. 3.4)—and also revealed barriers to broader engagement of the most vulnerable population inhabiting areas along the Taquara streambanks. These barriers to dialogue construction included: (1) fear among these

groups of being forced out of this territory due to illegal occupation of the riparian zone; (2) a lack of trust in actions involving the public sector due to perceived institutional negligence in meeting community's basic needs over time; and (3) the presence of drug trafficking in various locations, preventing communities living in areas controlled by traffickers from participating. These circumstances are common in vulnerable areas in Brazil and clearly expose the structural problems (Acselrad 2015) intrinsic to the harsh socio-environmental conditions around urban streams. These factors add complexity to the task of building the effective, inclusive approaches necessary to produce optimally legitimated solutions with the wide participation of local populations (Souza 2019).

The WG also promoted thematic events aimed specifically at expanding the local debate and creating opportunities for a wider knowledge exchange among the local community and stakeholders. The events included lectures and debates about research outcomes developed by supporting groups from local educational institutions and UFRGS on a variety of topics such as sanitation, water quality, waterborne diseases, land occupation patterns and the history of the area. These events stimulated the engagement of educational groups, as they created a means for integrating scientific information into the local process. The events were key moments in producing a boundary-crossing movement throughout a process that helped integrate local and technical knowledge (Engeström et al. 1995; Scholz and Steiner 2015), as requested by the projects for the socio-ecological regeneration of urban streams. Results from on-site research performed by supporting academic groups also led to the implementation of routine water monitoring by the health surveillance sector. This demonstrates the potential for connection between universities, schools, community and public sectors not just in terms of updating knowledge and constructing transdisciplinary approaches but also for broadening possibilities for generating new practices and routines (Peters and Wals 2013).

The outcomes of these actions were discussed in WG meetings, allowing for a better understanding of the local problems, as well as helping to identify new issues and to adjust strategies for future actions. The sequence of actions thus enabled 'learning by doing'. Agramont et al. (2019) call attention to the great epistemological differences among groups brought

together in learning-oriented practices for water-related problem-solving in vulnerable areas and the importance of 'learning by doing' to overcome these disparities and integrate stakeholders in diversified ways. In this sense, a variety of interactive methods adapted to the local situation, developed by the participants themselves and guided by a social learning–oriented approach aimed at capacity building and empowerment of marginalised social groups, is essential in these cases (Phuong et al. 2018).

Social Learning Practices Within the Leading Group

The WG meetings included the planning of actions, conversations about the local problems and opportunities to critically evaluate activity outcomes (Fig. 3.5). Regular meetings (held biweekly or monthly) in a relatively small and diverse group (8–15 people), a friendly atmosphere and a balanced participation of group members were observed as facilitating conditions for the social learning process in the WG.

Informal interactions and a perceived egalitarian atmosphere between participants were also cited as favourable factors for the development of social learning–oriented practices in the group (Rist et al. 2006; Schusler et al. 2003). The egalitarian atmosphere, even in a group of people with very diverse backgrounds, was related to the perception of shared values amongst participants—which were also associated with perceived mutual trust and open communication among group members (Souza 2019). Also, the creation of opportunities for equal participation and the organisation of meeting dynamics benefited from the active facilitation of one participant. Her role was essential in organising practical aspects of the

Fig. 3.5 WG meetings at a resident's house. (Source: Souza 2019)

process and ensuring a balanced space for all participants to speak, which reveals the importance of facilitation in social learning–oriented practices (Ernst 2019), especially in contexts marked by power imbalances.

These aspects are fundamental to the search for joint and systemic solutions for the regeneration of urban streams, since the multiplicity of interests and perspectives underlying these processes can potentially generate excessively conflicting environments (Silva-Sánchez and Jacobi 2016) that might hinder collective learning. In the case of the Taquara Stream, divergence and diversity were drivers for learning since participants interacted in socially favourable conditions that were conducive to collective reflection and reflexivity (Wals 2009). The equalisation of diverse languages coexisting in the WG—popular, academic and technical—was also promoted by the group interactive space and facilitated knowledge exchange amongst participants. Community representatives in the WG also perceived that popular knowledge was respected, and this was cited as a stimulating and encouraging factor for their active participation in the movement. Furthermore, the interactive space provided by the WG also enhanced the relational capacities of group participants; this is particularly relevant in a context of deep social asymmetries, where a rebalancing of social forces is required to promote a more symmetrical communication between social actors.

Despite the reported positive factors, barriers to a more comprehensive collective learning process were also observed. A lack of engagement in the WG from specific public sector departments—such as the urban sanitation and housing departments—and the perceived absence of specific knowledge to deal with some local issues—such as violence in the area—appeared as barriers to a broader understanding of the problem. This calls attention to the need for institutional learning (Phuong et al. 2018), in order to raise technicians' awareness of the importance of co-constructing solutions along with communities and the need for transformations in institutional structures to facilitate participatory processes to tackle sanitation problems.

Lessons from the Taquara Stream Case

Table 3.1 recapitulates elements of the literature review and summarises lessons learned from the case study of the Taquara Stream, as presented earlier.

Table 3.1 Synthesis of the contents observed in the case study

Approach used in the initiative	Local community and stakeholders' engagement and interaction	Social learning practices within the leading group
Desirable characteristics (drawing from literature review)		
Socio-technical approach focused on sustainable solutions Technical and socially inclusive processes to support multi-stakeholder decision-making Sustainable parameters for decision-making and localised solutions	Promotion of inclusive and emancipatory participatory spaces where communities can engage in learning partnerships Embracing diversity and complexity Construction of transdisciplinary knowledge Fostering autonomy and co-responsibility among directly affected social groups Integration of subjectivities and cultural and environmental specificities in counter-hegemonic processes.	Promotion of reflexive processes for the transformation of views, values and mindsets Spaces for dialogical interaction Diversity as a driving force for collective learning Balanced participation of representatives from diverse social actors Trust building
Taquara Stream case		
Facilitating conditions		
Use of ecological principles to guide the design of sustainable solutions, low-impact and nature-integrated responses inspired by ecosystem functioning Social learning as a guiding principle to facilitate a relational approach and dialogical interaction between stakeholders	Use of diverse participatory methodologies for critical community engagement Actions at different scales involving different audiences, 'learning by doing' Thematic events to broaden the debate among stakeholders and the community Research carried out by schools and university on practical issues Research outcomes indicating issues to be monitored by the public sector	Regular meetings in small groups Egalitarian atmosphere based on perception of shared values among members Friendly atmosphere and informal interactions facilitating open communication and collective critical reflection Perception of trust among participants, facilitating dialogical interactions Facilitator in the group ensuring equal opportunities for participation

(*continued*)

Table 3.1 (continued)

Approach used in the initiative	Local community and stakeholders' engagement and interaction	Social learning practices within the leading group
Hindering aspects		
Lack of regulation on alternative systems for sustainable sewage treatment Urgent demands in a context of extreme need, requiring quick responses leading to replication of conventional technical solutions	Lack of community trust in actions involving the public sector Drug-related violence preventing communities living in areas controlled by traffickers from participating Community fear of being forced out from their land	Absence of specific knowledge to deal with local issues Lack of engagement from specific departments of the public sector in the WG

Conclusion

Actions for the regeneration of degraded urban streams in contexts of socio-ecological vulnerability call for inclusive problem-solving approaches to promote systemic and legitimate responses. The role of learning-oriented participatory processes is fundamental to generate dialogical spaces in order to enable individual and collective critical reflection on complex water-related issues, foster the co-responsibility of the social actors involved and arrive at collectively designed solutions. These processes can also lead to the capacity building and empowerment of local communities in the creation of territorialised agendas for the reversal of socio-ecological degradation of urban streams. Social learning can contribute in these contexts to the improvement of collaborative processes and coordinated actions, focusing on (1) the transformation of individual and collective views and practices; (2) bridging technical and socio-emancipatory approaches; and (3) the co-creation of local solutions aiming to improve the social and environmental conditions of urban streams, as well as social justice, equity and the well-being of communities inhabiting these areas.

The initiative on the Taquara Stream, led by the Taquara Stream Watershed Working Group, created conditions for the development of a social learning–oriented process that enabled a more balanced relationship between the local community, members of the public sector and educational institutions, facilitating the critical participation of these actors in the production of socially and environmentally sound actions and responses. The group also facilitated cross-sector articulations, which were made feasible by the participation of representatives from different public sector departments. Additionally, it is noteworthy that the approach advocated by the WG sought to transform prevailing top-down logic by promoting a dialogued process and educational activities to engage the local community and stakeholders in a critical debate in order to promote legitimate jointly designed solutions. This initiative demonstrated the potential of innovative and participatory learning environments to transform traditionally disadvantageous power relations and engage diverse stakeholders in social learning practices, thus making decision-making processes more democratic and inclusive.

This process did not occur, however, in an environment free of contradictions, and it was necessary to find a balance between the ideal responses from a sustainability point of view and those that were feasible, given contextual constraints and the urgent need for solutions in the face of extreme circumstances. Additionally, we emphasise the particularities of social learning processes, depending on the contextual conditions in which they unfold. Social asymmetries, specific circumstances of environmental degradation, economic constraints and political and institutional configurations, among others, influence and shape the learning processes according to existing possibilities and needs.

From a broader perspective, participatory initiatives towards the regeneration of urban streams are connected to water governance processes. Regenerative participatory water governance stimulates cooperation and collaboration between different sectors (e.g. the world of science, governance, civil society and of work). In this context, social learning furthers communicative practices that encourage cooperative and non-directive engagement of the various actors involved, stimulating what we might call a reflexive collaboration. Initiatives that seek to increase dialogue on the water crisis, vulnerability, ecological degradation of hydric ecosystems

and the uncertainties inherent in the unsustainable model of society we are building bring to the foreground the weaknesses of the current governance processes used to tackle these problems and the potential for self-organised citizen actions. In terms of water justice, such reflexive movements offer the chance to expose and mediate power imbalances, which are conditional for establishing ecologically sustainable urban rivers and streams and more equitable access to water resources.

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