



EMPOWERING QUITO'S LOCAL STAKEHOLDERS FOR DISASTER RISK REDUCTION BY APPLYING THE CONCEPT OF NATURE- BASED SOLUTIONS TO THE *QUEBRADAS*

TANNYA PICO & ALEXANDER JACHNOW



ISOCARP INSTITUTE
Centre for Urban Excellence



EMPOWERING QUITO'S LOCAL STAKEHOLDERS FOR DISASTER RISK REDUCTION BY APPLYING THE CONCEPT OF NATURE-BASED SOLUTIONS TO THE QUEBRADAS

TANNYA PICO¹ & ALEXANDER JACHNOW²

1. Pontificia Universidad Católica del Ecuador and ISOCARP Institute

2. Namibia University of Science and Technology (NUST)

INTRODUCTION

In response to the escalating impacts of climate change, urban areas worldwide need to find innovative approaches to increase their resilience. As Nature-based Solutions (NbS) combine the characteristics and potential of natural assets to address environmental and societal challenges this approach has gained substantial attention. The development of various solutions under the umbrella concept of NbS has been considerable in recent years, however, significant barriers still exist to its effective implementation and its potential to empower communities for disaster risk reduction (DRR) in a climate change scenario.

Cities in the Global South, such as Quito, Ecuador, are particularly vulnerable due to rapid urbanization, socio-economic inequalities, and fragile ecosystems. Quito is prone to climate-related disasters, including landslides, floods, and droughts, which are magnified by its mountainous terrain and rapid expansion of informal settlements. While national and municipal governments have made efforts to mitigate these risks, the complexity of the challenges necessitates greater involvement

of local communities. Community empowerment in disaster risk reduction (DRR) represents a critical pathway for fostering resilience, as it enables citizens to contribute to decision-making, implement locally relevant solutions, and build adaptive capacities.

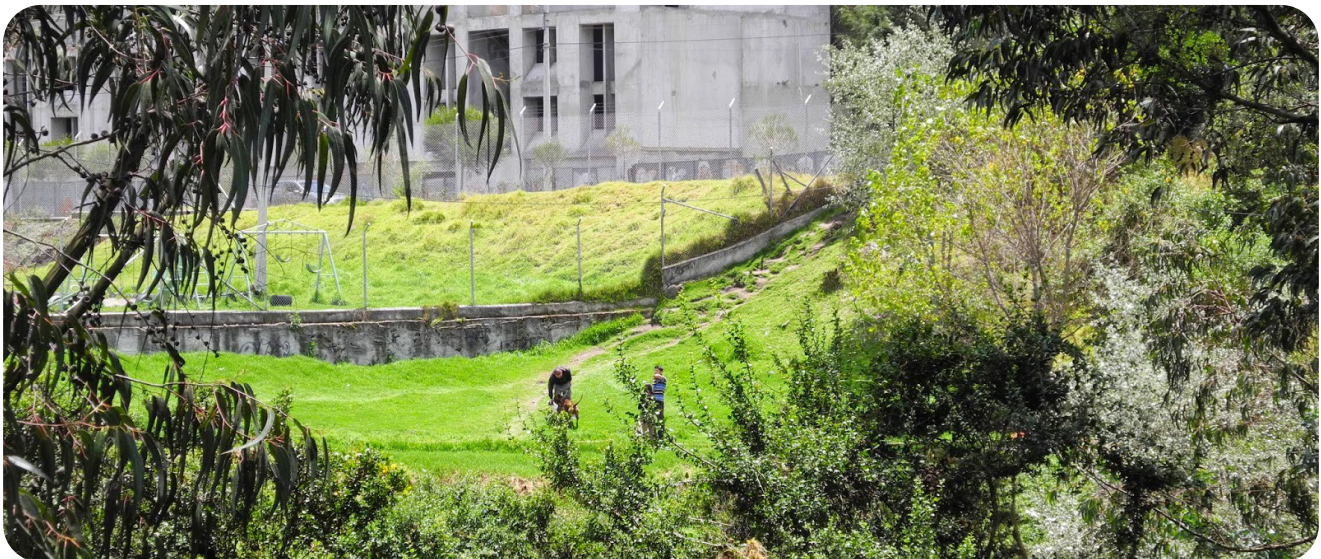
We examine the role of stakeholder empowerment in addressing the DRR for climate impacts in Quito, Ecuador, with a particular focus on the *quebradas* (ravines). As critical natural and ecological features, the *quebradas* are central to urban water management, biodiversity conservation, and disaster mitigation. However, they are increasingly threatened by urban encroachment, deforestation, and climate change. This study highlights the interconnectedness of environmental, social, and governance dimensions in managing the *quebradas* and explores how the empowerment of local stakeholders—residents, community organizations, local governments, and private actors—can foster sustainable and equitable adaptation strategies. Unfortunately, national and local policies are not yet taking this role fully into account and the



quebradas still suffer from degradation, it reflects a broader tension between rapid urbanization and environmental sustainability, highlighting the need for comprehensive urban planning strategies that prioritize the protection and restoration of these critical ecological features.

This paper looks into bottom-up understandings of the *Cooperativa Alianza Solidaria*. A low-income community that undertook a self-managed restoration of the *Quebrada Ortega*, located next to their neighborhood in the South of Quito. The community restored 550 meters of the *quebrada* Ortega to create a safe and clean public linear park with the additional value of leaving flooding

space in their banks. Even without knowing the term of NbS, or even the full notion of climate change, they use the *mingas* (a traditional practice of voluntary collaborative work) as the main strategy for cooperation. Drawing from the case study, absorptive capacities and participatory action research, this paper identifies pathways for enhancing local agency, promoting community collaboration, and integrating traditional ecological knowledge with innovative solutions. The findings underline the importance of participatory governance in addressing the vulnerabilities of the *quebradas* while reinforcing the resilience of Quito's urban communities to climate change.



THEORETICAL FRAMEWORK

NATURE-BASED SOLUTIONS AND DRR

Over the last decades, as the study of climate change has deepened, several concepts have become a subject of study. The notion of Nature-based Solutions (NbS) provides an integrative theoretical framework, in which concepts such as biodiversity conservation, natural capital, or ecosystem services are included, together with

inputs from governance, policymaking, and biodiversity conservation practices (Convention on Biological Diversity, 2004; Gomez-Baggethun et al., 2010; Daly and Farley, 2011; Nesshöver et al., 2017).

NbS are defined as cost-effective strategies in



coping with climate change effects that cover a wide range of actions and interventions, which are characterised by their multifunctionality, as they aim to provide environmental and socioeconomic benefits (Cohen-Schacham et al., 2016; Nesshover et al., 2012). They constitute an interface for climate action that makes use of natural resources to provide positive outcomes to mitigate the effects and adapt to climate change effects (Cohen-Schacham et al., 2016; Nesshover et al., 2017).

Disaster risk reduction (DRR) represents a critical societal challenge addressed within the broader framework of NbS. Among the various NbS approaches, ecosystem-based disaster risk reduction (Eco-DRR) stands out as a strategy specifically designed to mitigate risks associated with natural hazards. In his literature review, Nehren, et. al, (2023) states that while the concept of NbS in the context of natural hazards has gained significant traction in academic discourse, relatively few studies focus on specific case studies or the implementation of NbS in defined

geographic contexts. Although many articles reference natural hazards, they often prioritize other societal challenges unrelated to disaster risk reduction (DRR) or remain confined to a conceptual discussion. A closer examination reveals that prior to 2015, no research explicitly employed the term “nature-based solutions.” Instead, earlier studies predominantly used frameworks such as sustainable land management (SLM), integrated water resources management (IWRM), and integrated fire management (IFM), which, despite predating the NbS terminology, align with its broader principles. Since 2015, however, the term NbS has been increasingly adopted in literature related to natural hazards, though it is often employed as a general label rather than to describe a distinct methodological approach.

Nevertheless, recognizing community-led NbS into DRR strategies is essential for building resilient and sustainable cities in the face of escalating natural hazards and climate change impacts. NbS not only mitigate risks by leveraging the protective functions of ecosystems, such as reducing flood risks, but they also provide co-benefits, including biodiversity conservation, recreational opportunities, carbon sequestration, and enhanced human well-being. Unlike traditional engineered solutions, NbS are adaptive, cost-effective, and capable of addressing complex, interconnected challenges in a holistic manner.

KNOWLEDGE, TRANSDISCIPLINARITY AND ACAPs

Knowledge is the understanding of a certain subject acquired by a person or people in general via experience or study. Such a definition implies a broad sense of types of knowledge and sources and therefore, poses a tension between disciplinary knowledge and the need for a more integrated, holistic approach. While

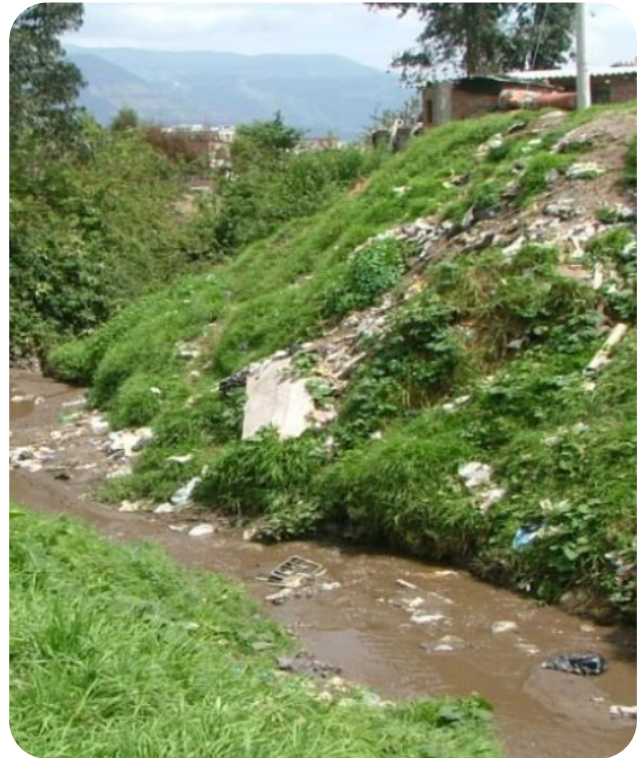




traditional disciplinary boundaries may not be sufficient to address complex issues as they lack other types of non-disciplinary knowledge, more integrative approaches may present important challenges related to collaboration and resistance. One step for solving these challenges is the transdisciplinarity approach, based on the interaction of five knowledge cultures (Brown, 2010). While conventional approaches tended to establish disciplinary boundaries of knowledge, strengthening knowledge specialization, the interaction of disciplines and the integration of various types of knowledge has proven to be key in understanding complex realities and solving problems. Such an integration implies recognising the existence of different types of knowledge and knowledge sources, such as general information, data, lived experiences, legal frameworks, etc.

However, Brown's model does not fully address the practical challenges and limitations of implementing transdisciplinary approaches in complex contexts, such as potential conflicts, power dynamics, and practical difficulties that may arise when attempting to integrate knowledge from such diverse sources. In that sense, the ACAPs model is presented as complementary, since by proposing the different phases of knowledge absorption, the model is also based on collaboration and knowledge integration and therefore accounts for the mitigating factors that may affect this process.

For this research, both models are integrated. On the one hand, under the framework of transdisciplinarity, this research acknowledges that no NbS initiative can be effectively implemented lacking a common knowledge framework for decision-making and action; fragmented interaction among stakeholders results in difficulties for effective implementation and therefore, collaboration among different knowledge cultures, and therefore, stakeholders, is key for facilitating



Quebrada Ortega before its transformation.

knowledge integration. On the other hand, the ACAPs model proposed by Zahra and George (2002) is used to understand the different stages in which the knowledge cultures interactions happen and further contribute to the absorption of new knowledge and, consequently, in reaching each initiative's objectives. The ACAPs model introduces a holistic perspective, as it accounts for both the four stages of knowledge absorption and the contingency factors that influence the valuing and the exploitation of new knowledge into each initiative.

THE QUEBRADAS OF QUITO

Due to its location, Quito has a subtropical highland climate with two rainy seasons each year, in March/April and later in October. These rainy periods are often accompanied by violent thunderstorms (Neill and Jorgensen, 2016). The rainfall at high elevations feeds the headwater ravines, known locally as *quebradas*. However, these ravines



are typically steep, with depths of around 15 to 20 meters, and only carry water during intense precipitation events (Peltre, 1989). At one point, Quito had approximately 182 (Figure 1) ravines within its urban area (Metzgerand and Bemúdez,

1996). Unfortunately, many of these ravines have been severely impacted by the city's rapid urban development. Over the years, they became filled with garbage and debris, leading to blockages and hindering the natural flow of water.

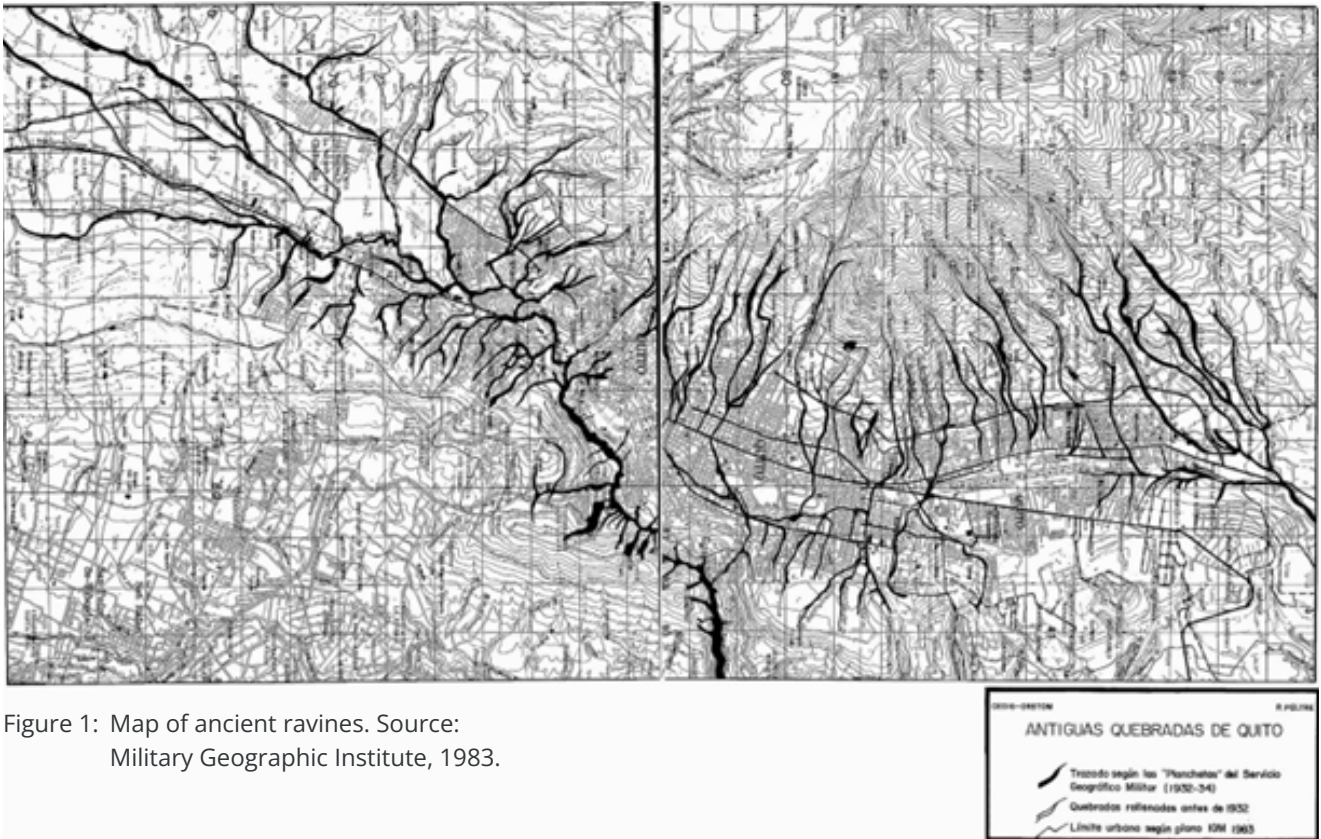


Figure 1: Map of ancient ravines. Source: Military Geographic Institute, 1983.

Furthermore, large areas of the city are covered with water-resistant surface materials such as concrete, which prevent rainwater from recharging the groundwater by soaking into the soil or slowly flowing into the main streams. Instead, the rainwater is forced to flow rapidly over the urban roads, collecting garbage and dirt and carrying more surface pollutants (Serra-Llobet et al., 2013). Consequently, there are major concerns regarding the risks associated with groundwater contamination. Every year during the rainy season, disastrous events are reported, caused by flooding, landslides, and damage to the water drainage system (Aragundi, 2016). Moreover, due to changes in precipitation patterns resulting from

climate change, there is likely to be an increase in the current discharge in the tropical Andes (Buytaert, 2008). This increase will exacerbate the dangers associated with filled ravines, leading to greater runoff in urban areas (Perrin, 2001).

The *quebradas* of Quito, which historically served as vital ecological corridors and natural drainage systems, have experienced significant degradation due to the pressures of urban sprawl. Originally, these ravines provided essential ecosystem services, including water filtration, flood regulation, and biodiversity conservation. But during the city's history, the unplanned expansion of urban areas led to their encroachment and ecological disruption.



The morphology of the colonial urban matrix overlaid urban expansion with the ravines or the Pichincha volcano's slopes and indigenous forest reserves (Cuvi, 2017). The surroundings of the city used to serve for deer, rabbit, and bird hunting, and the *ejidos*, formerly communal lands for agriculture, were declared property of the Spaniard King and the municipality of Quito, for what mountains and water resources were no longer at the service of locals but almost only for the upper classes (Cuvi, 2017). One of its consequences was the drying and filling of the city ravines, to provide more available land for urban sprawl (Terry, 1834; Orton, 1870).

During the second peak of Quito's urban sprawl, around the 1940s and 1950s, more ravines were dried to connect the old city with the new housing developments that surrounded it. Other water sources, such as the Machángara River, were used as a sewer for wastewater and other toxic substances (Aragundi, 2016). Urban development has resulted in the infilling and channelization of many *quebradas*, reducing their hydrological functions and altering natural water flow patterns. Additionally, informal settlements and infrastructural development on steep slopes have increased soil erosion, sedimentation, and the risk of landslides. These processes are exacerbated by inadequate waste management, which has led to the accumulation of solid waste and pollution in the ravines, further diminishing their environmental quality.

The historical exclusion of Quito's *quebradas* from urban planning poses severe dangers, as highlighted by the catastrophic landslide in the areas of La Comuna and La Gasca, northwest of Quito, in January 2022. This tragedy, triggered by intense rainfall, caused 28 dead, 1 missing, 52 injured, 170 people affected, 53 families affected, 60 public properties destroyed, 52 private properties affected, among others. The material

that came down from the upper part of the El Tejado ravine, located on the slopes of Pichincha, travelled a distance of more than 2.8 kilometres from the zero zone of the landslide (Ortiz 2022), carrying with it large masses of mud, rocks, animal remains, garbage and even logs from deforestation in the ravine itself, among other materials. This event underscores the urgent need to incorporate *quebradas* into Quito's disaster risk reduction plans as key components of flood control and slope stabilization. Without such integration, the city remains highly vulnerable to future disasters, particularly in the context of increasing climate variability and urban sprawl.

As an attempt to change the pattern and protect the *quebradas*, in 2012, Quito's local government recognized the challenges posed by the city's ravines and their importance in the city's adaptation plan to climate change. This was achieved by declaring the ravine system a Natural and Cultural Heritage of the city through Municipal Ordinance 350 of 2012. This designation provides a legal framework and allocates public resources for conservation and restoration efforts. The ravines'





recovery plan encompasses various aspects such as environmental and risk management, landscape improvement, and the development of recreational and ecological corridors and green spaces. The city's ravine system has also been included in the Urban Green Network of the Metropolitan Development and Zoning Plans (DMQ, 2012). Recognizing the crucial role of the ravines in the city's sustainability plans presents an opportunity to foster community identity, self-esteem, culture, and integration through a strong and active citizen participation model (Serra-Llobet et al., 2013).

The responsibility of implementing the ordinance was given to the *Empresa Pública Metropolitana de Agua Potable y Saneamiento* (EPMAPS), which is the

Metropolitan Public Company of Water Supply and Sanitation. The first step taken by the company was to commission various studies to restore the urban ravines, starting with the southern part of the city. However, the implementation of the restoration plan has been delayed due to budget constraints and the high cost of operationalizing solutions to address water contamination.

Overall, historically, the *quebradas* of Quito have increasingly been perceived as marginal spaces rather than integral components of the urban landscape, leading to neglect of urban planning initiatives. This neglect undermines efforts to integrate them into sustainable urban development frameworks, exacerbating their degradation.

CASE STUDY OF COMMUNITY EMPOWERMENT IN QUITO

QUEBRADA ORTEGA: A BOTTOM-UP RAVINE RESTORATION INITIATIVE

The selected case study initiative has been part of the pool of greening initiatives identified as NbS in the Urban by Nature project funded by the Horizon 2020 EU program in Ecuador. The initiative, led by ICLEI, aims to strengthen international cooperation on sustainable urbanization between the EU and CELAC (Community of Latin American and Caribbean States). The primary objective is to increase the natural reproduction of ecosystem resources by improving the peri-urban habitats and promoting a paradigm shift towards public awareness of natural wealth and co-creation processes by residents (Robrecht, 2019).

The remarkable bottom-up case is carried out by an organized group of citizens named *Cooperativa Alianza Solidaria*. Located in the South of Quito,

(see Figure 2) they decided to undertake a self-managed ravine restoration process. The community restored 550 meters of the *quebrada* Ortega to create safe and clean public linear parks. The main strategy for cooperation was *mingas*, a traditional approach to communal cooperation in the Andes where community members bring their resources together to achieve common goals (Brown, 1999; Danver, 2015; Smith et al., 2016). For eighteen years, the residents cooperated every Sunday to restore the ravine, converting it from a garbage dump into a natural space with ecological trails, playgrounds, and bike paths. This collective effort was completed in 2003, and the community assumes responsibility for its maintenance to this day.



Figure 2: Ortega Stream restoration initiative location. Source: Author, 2022.

The community created a platform, the *Cooperativa Alianza Solidaria – Coovias* (Cooperative Solidarity Alliance), a grassroots, non-profit organization that launched its operations in the 1990s advocating for housing rights of the low-income population. The cooperative focused on acquiring affordable land to provide housing to families that previously were inhabiting land without property title. In consequence, one of the areas negotiated with the local government was the acquisition of six hectares of legalized land in Quitumbe that were located next to a highly polluted ravine. Thus, they started the long process of building their homes and cleaning the ravine for their use, understanding that their goal was two-sided: build affordable housing while improving the life quality of their surroundings (Jácome, 2016).

The Ortega ravine restoration initiative has received local and international recognition as a replicable model for its accomplishments in both societal and environmental domains. Studies indicate that successful urban ravine restoration initiatives are heavily reliant on citizen

engagement, participation, and self-management. The involvement of the community is crucial and reflects a local commitment. It has proven to be more sustainable than approaches that merely rely on scientific analysis and technical design. With the community fully motivated and engaged, they support and maintain the restoration efforts over time and develop the most adequate solution out of the incremental improvements and observations (Wantzen, 2019). Therefore, participation, room for trial and error and community education should be essential parts of the strategy in any initiative design, providing sensitization and qualification processes to promote active development of long-term stewardship (Williams and Stewart, 1998; Egan et al., 2011). This has specifically contributed to DRM as nature is restored in ways that increases the resilience of the environment, provides measures against flooding and landslides and contributes to improved health conditions of the community.



METHODOLOGY

This research applied a hybrid methodology blending the shared principles of action research and case study. These approaches are complementary to each other, as both involve an in-depth exploration of a specific social situation, context, or problem. In both approaches, researchers work collaboratively with participants to develop a shared understanding of the issues at hand and to co-create knowledge that can inform practical solutions (Waterman et al., 2001; Yin, 2018). Furthermore, both methodologies emphasize the importance of context adaptation and the need to use a wide range of research methods to collect and analyse data, such as interviews, observations, and documental reviews.

This study was implemented through six stages after the research problem and objectives were defined: a) literature review and construction of the conceptual framework, b) the design of the methodological strategy based on action research principles, c) fieldwork d) data organization and analysis, and e) data analysis for case study profiling and identification of trends.

It is important to highlight that during fieldwork we used participatory workshops aiming to create a space for dialogue, where the initiative's actors can share their experiences with the purpose of learn from each other, and finally, to explore the relevancy of the concept of NbS in their current work. With that in mind, and given that NbS knowledge entails both theoretical and practical knowledge, the session consisted on the following three sections:

- **CONCEPTUAL-THEORETICAL MODULE:** introductory module - after each initiative's brief presentation - in which the main researcher presented the concepts of climate change and nature-based solutions in a keynote

intervention. The concept was briefly explained based on international ordinances, with a focus on how it applies in the context of Quito.

- **MANAGEMENT MODULE:** addressed the management issues and resource challenges faced by initiatives that advocate for NbS. The local government representative provided insights on the tools available to tackle these challenges during the session via a keynote talk. An academic representative presented the tools available specifically to seek resources for the financing of its initiatives.
- **ACTION MODULE:** provided the participants with the opportunity to apply the acquired knowledge by assessing their own initiative and designing strategies to further engage with the NbS concept. This took the form of a two-part intervention, with a review of the initiative by the members; and mixed group sessions in which all the participants exchanged experiences and ideas on how to create an action plan for the initiative.



Minga at the quebrada Ortega.



This structure opened the opportunity to first present the initiative from their own perspective, experience, and language (individual and local community knowledge). Then, the researcher explained the theory of the concept of NbS and the identified links with the case study (specialized knowledge). Furthermore, there were three invited speakers who talked about how NbS could be a key element in regards of the local climate change awareness, the city's climate planning and the funding and research opportunities (organizational knowledge).

RESEARCH FINDINGS

Ecological and societal objectives are closely linked, as societal objectives can have ecological benefits for urban ravines by increasing public consciousness and support for broader environmental challenges. This, in turn, can lead to greater civic participation beyond environmental issues (Smith et al., 2016). The Ortega ravine restoration initiative has resulted in diverse outcomes, such as the construction of wide green terraces that serve as public spaces and flooding areas during the rainy season. This holds significant potential for disaster and risk management by enhancing natural drainage systems, leaving extra room for water, reducing flood risks, and mitigating the impacts of landslides, while simultaneously fostering ecological resilience and community safety.

Regarding the perception of the members of Ortega ravine restoration initiative related to the NbS standards, a particular outcome emerged. When asked about the main benefit resulting from the initiative, a common view among interviewees was not only the personal enjoyment of having a recreational area next to their homes. They also that having succeeded in the restoration of the ravine built their confidence as a community and their sense of ownership, as they feel proud

that they achieved transformation with their own hands in a project that is a benchmark worthy of replication in the city.

Community members have developed a profound connection with the ravine, utilizing and enjoying its natural beauty and recreational opportunities. By fostering a sense of shared responsibility and encouraging active participation, the public can become more informed and engaged in supporting the restoration project.

"For me, the ravine is my big yard. The patio I have in my house, ..., I open my door, I walk, and there I have the green, the colours, the birds, the bicycle path, if I want to walk along the paths I do it, I heard how the river sounds, the water sounds, I find it fascinating. We have had yoga classes in those spaces and tried to optimize it and use it that way. Although it is a space open to the public without any problem, we do not intend to close it. Hopefully, it will not be destroyed, and there will be no need to close it; for now, we have not thought about it." [OSM01, 2021]

The project exemplifies the power of community engagement, self-management, and active participation in achieving successful restoration outcomes. Through collective efforts and the traditional Andean approach of *mingas*, community members transformed the ravine into a clean and safe public space with ecological trails, playgrounds, and bike paths. The Ortega ravine restoration initiative not only focused on environmental objectives but also contributed to societal goals. It fostered a sense of belonging, pride, and community identity among the residents of Quitumbe.

When asked about the societal challenges (European Commission, 2015) that their initiative



addresses, the Ortega ravine restoration initiative's members ranked air quality, green space, and water management and as the most important. While they acknowledged that their efforts contributed to tackling various societal challenges to some extent, the emphasis placed on air quality suggests that the members of the initiative recognize the detrimental impact of air pollution on the surrounding environment and the health of the local community. By restoring the Ortega ravine and its surrounding ecosystem, they aim to mitigate pollution sources and enhance air quality in the area.

Furthermore, the high ranking they gave to green space availability highlights the significance they attribute to creating and preserving natural spaces within the community, mostly considering their main aim which is focused in creating housing solutions for communities. This recognition aligns with the growing awareness of the numerous benefits that green spaces provide, including improved mental well-being, recreational opportunities, and biodiversity conservation. Water management also emerged as a key challenge deemed vital by the initiative members. The restoration and management of the Ortega ravine play a key role in ensuring efficient water resource utilization. By revitalizing the ravine, the initiative has contributed to enhance the ecological functions and contribute to improved water quality and availability in the area.

For the respondents, climate change is not ranked as one of principal challenges addressed by their initiative, this concurs with significance lack of awareness about the topic. Regarding their understanding about the existence of municipal climate policies, 60% of the Ortega ravine restoration initiative's members are not aware of the public plans for climate change in Quito. As a result, most of the respondents do not link

the efforts being made on the restoration of the Ortega ravine with addressing climate adaptation, even though they are familiar with the effects it has on the community.

On the other hand, 40% of the respondents are aware of the public plans for climate change in Quito. This portion of the public is knowledgeable about the ongoing efforts to address climate change, the importance of ravine restoration, and the positive impact it can have on the environment and the community. This level of awareness indicates that a considerable segment of the initiative's members is actively engaged in staying informed about the efforts being made to combat climate change in their city. This awareness reflects also a deeper understanding of the interconnectedness between environmental sustainability and the overall resilience of the community.

While most of the respondents might recognize the ravine's impact on the community, they may not be on the same level of awareness regarding the comprehensive efforts being made to climate change adaptation in the restoration of their ravine. However, the local government has publicly recognized their contribution to the environment.

"We have been given these environmental awards from the municipality itself, which we have achieved for consecutive 3 years, and we exhibit them here (communal house) ... I think that this has created awareness, not only among us but also among other neighbours who have also been enthusiastic and want to do something similar"

The community members involved in the restoration project can now proudly say, "I did that," as they played an active role in transforming the ravine and creating a positive impact on their



neighborhood. The initiative not only improved the living environment but also created recreational opportunities, strengthened community bonds, and elevated the perceived value and reputation of Quitumbe.

“The sense of belonging is created, and it is already built when people left because of the need to have a house; some still come to the ‘mingas’ once or twice a month. So now everybody says, ‘I did that,’ they feel proud, ‘I constructed that,’ even if they do not come to the ‘mingas’ again, but they feel part of a process so strong that now they make us feel proud of Quitumbe (low-income neighbourhood), as I said it is a sense of belonging “Where do you live? “I prefer to live in Quitumbe than in Villaflora or in Chillogallo, or Guamaní (middle-income neighbourhoods); that is, Quitumbe is a source of pride. But because we make a difference.” [OSM01, 2021]

According to Raymond et al. (2017), to further enhance the effective impact of the initiative, it is crucial to frequently engage stakeholders and communicate the co-benefits associated with the NbS project. This can involve raising awareness among the public, fostering a sense of shared responsibility, and promoting active community participation. Regular engagement with stakeholders is essential for the success and sustainability of the initiative. By involving key stakeholders such as local residents, community groups, local government, and relevant organizations, the initiative can benefit from their diverse perspectives, expertise, and support.

Moreover, clear communication of the co-benefits associated with the NbS initiative is vital to gain public support and engagement with key stakeholders. The Ortega ravine restoration

initiative capitalises in communicating important outcomes such as improved living environment, recreational opportunities, and strengthened community bonds; the project can inspire and engage a wider audience. Therefore, the initiative has reached the stage five in the Raymond et al.’s. (2017) seven steps NbS implementation scale.

The governance approach of bottom-up decision-making and community participation reflects the scepticism expressed towards the municipality’s actions and lack of trust in top-down governance. The community’s self-managed restoration process demonstrates the power of grassroots initiatives and community engagement in achieving tangible outcomes. The residents took ownership of the Ortega ravine restoration project and invested their time and resources to transform the ravine, resulting in a successful outcome.

“The municipality... we never want them here because we know how the municipality acts, but they come anyway... in the end it is only political speeches, right? Barrera (former mayor) came to make a show of declaring the ravine as a heritage site. And as I said, after a few months, it turned out that they had not taken any action.” [OSM01, 2021]

The municipality’s involvement is viewed as superficial and insincere. To effectively implement a bottom-up governance approach, the municipality should prioritize transparency, open communication, and active engagement with the community. This includes regular dialogue, consultation, and cooperation with residents and organizations. However, this has not been the case for the community members of the Ortega ravine restoration initiative, which constantly highlight during the interviews, their unpleasant relationship with the local government. The smallest percentage



is assigned to the local government, indicating the perceived lack of substantial involvement and trust in their actions. On the other hand, the highest percentage is assigned to themselves, emphasizing the community-driven nature of the initiative.

Moreover, they also identify their relationship with other types of stakeholders such as academia and international organizations, however, when discuss this topic in more detail, these stakeholders appear after the implementation of the initiative. For example, on several occasions the academia approached them to include them as a good practice case study. And they refer to international organizations because as “Alianza Solidaria” housing cooperative they belong to an international group of cooperatives; however these stakeholders do not contribute to the development of the NbS initiative.

The initiators and community members involved in the Ortega ravine restoration initiative have a strong relationship through their housing cooperative, “Alianza Solidaria.” This group is entirely self-sufficient and cohesive, with a predominantly horizontal social structure. While a representative committee exists, decision-making is conducted through a parliamentary process. With a history of



Quebrada Ortega before the transformation.



Minga at the quebrada Ortega.

18 years of existence and based on field observation and data analysis from informants, the Ortega ravine case is in the fifth NbS stage (Raymond et al., 2017), which corresponds to frequently engaging stakeholders and communicating benefits. During the ravine restoration process, the community required a synergy of organizational knowledge and community knowledge to achieve the successful outcomes. Organizational knowledge refers to the Alianza Solidaria Cooperative norms and regulations which must be followed by all affiliated members. On the other hand, community knowledge encompasses the insights, experiences, and local wisdom of the neighbours, especially hands-on skills which are determinants for the NbS implementation. In this particular case, the two types of knowledge cultures contributing to the development of the initiative come from the same community.

The interaction between these two knowledge domains plays a crucial role in the development of effective implementation of the Ortega ravine restoration in all stages. Organizational knowledge is critical formalizing the participation of the neighbours, understanding the regulatory aspects, taking into consideration that under



their membership agreement, the *mingas* are mandatory. Moreover, community knowledge is invaluable in identifying culturally significant features of the ravine, it provides insights into the social dynamics, cultural nuances and traditional practices that were integrated into the restoration efforts.

The initiative benefits significantly from the fusion of both types of knowledge cultures. By combining the resources and rules of their organization with the local insights and traditions of their own community, ensured a sense of ownership. This synergy fosters the long-term and community-oriented success of the NbS which is more likely to withstand the test of external uncertainties.

Leadership in crucial driving change, inspiring collective action, and achieving transformative outcomes. Ortega ravine restoration initiative members emphasize the significant role played by a visionary and influential leader in shaping their actions and motivating others to participate in creating positive change.

"I insist on the leadership of our president because if he didn't manage to convince us in a good way that this was important, nothing of this would happen; it just wouldn't happen [...] our leader should always be mentioned here. He was the man, the visionary leader for everything that has happened. From a very young age, he has been an insatiable reader, and that gave him many tools to be able to see the world in a different way and to bet on it as well. That one, the other also in that he had travelled a lot around the world and that also filled him with ideas to be able to look for ways" [OSM01, 2021]

According to the member's perspective, the success of their initiative has highly depended on its leader's ability to effectively communicate the importance and significance of their actions. It is possible to infer that without the leader's influence, the achievements described would not have been possible, highlighting their pivotal role in motivating and mobilizing others. While, it is evident that the initiative members are also influenced by their leader's legacy, the sustainability of the initiative was put to the test when, due to COVID-19, its leader died in 2020.

"Solidarity is not only about seeking support to help a person survive, but also about joining together to solve collective problems'. With this principle, Fabian (our leader initiator) took generations by the hand and invited us to dream. Today we say thank him for transforming collective dreams into reality. Farewell, leader, and friend" [OSM01, 2021]



DISCUSSION AND CONCLUSION

The Ortega ravine restoration initiative stands out as an example of a successful community-led effort to restore an urban ravine system, and it also exemplifies the concept of nature-based solutions. The project was spearheaded by residents who sought to acquire affordable and legal land to provide housing solutions for low-income households. While the initiative aimed to create affordable housing, it also included the restoration of the ravine, which had been heavily polluted and neglected over the years. The Ortega ravine restoration initiative has gained recognition as a replicable model for its achievements in both environmental and societal domains. This project highlights the potential of nature-based solutions and community participation in urban restoration initiatives to enhance environmental and societal objectives simultaneously. The success of the Ortega ravine restoration initiative underscores the importance of community engagement, participation, and self-management in the restoration of urban ravines and serves as an inspiration for future community-based restoration projects.

However, there are still ecological challenges that need to be addressed in the area. Firstly, the introduction of exotic vegetation in the project has compromised the native riparian vegetation that surrounds the ravine. Additionally, the observed species such as insects and crows that feed on garbage, are not an indication of fauna restoration. Moreover, the milky-coloured appearance of the running water indicates that despite the progress made, the water still carries significant levels of contamination from upstream land discharges (Serra-Llobet et al., 2013). To address this issue, new strategies such as creating oxidation lagoons are being considered. These lagoons could improve the water quality by providing an adequate water flow volume, increasing the vegetative cover, and strengthening the overall functionality of the ecosystem.

On the other hand, the presence of empowered leadership strongly supported by a community emerges as a foundational pillar in the early phases of the NbS initiative. Visionary individuals, backed by their community, set the stage for a





successful start of the initiative. As empowering leaders create a supportive environment where stakeholders feel empowered to take ownership of their work, make decisions, and contribute to the NbS initiative. These leaders believe that involved stakeholders can make valuable contributions and should be given the autonomy and authority to do so. According to the collected evidence, and in alignment with the available literature, empowering leadership is associated with several positive outcomes, including a motivated workforce, enhanced stakeholder engagement, innovation, and collaboration.

Moreover, by comprehending the role of knowledge and transdisciplinarity, the involved stakeholders can more effectively tackle environmental

challenges, promote sustainable development, and harness nature's potential to benefit both humanity and the planet. Embracing the principles of NbS, moving beyond conceptual deliberations, and capitalizing on urban nature can pave the way for a greener, more resilient, and prosperous future. Collaborative endeavours, knowledge sharing, and funding mechanisms can serve as conduits to bridge existing gaps and cultivate greater sustainability and resilience in our cities.

Empowering local stakeholders with knowledge of NbS can significantly enhance Quito's resilience, by integrating the *quebradas* into the NbS framework and focusing on disaster mitigation. This research's findings reveal that bottom-up initiatives with strong social cohesion, have the potential to play an important role in the urban planning related to DRR for climate adaptation. They foster transdisciplinary collaboration. Communities equipped with better awareness of the risks and opportunities that climate change presents, can co-create and implement adaptive strategies tailored to the unique environmental and socio-economic contexts of the city.

Strengthening the knowledge of Quito's local stakeholders on NbS and DRR is key to improving climate resilience. By integrating natural solutions into urban planning, fostering collaborative governance, and prioritizing ecosystem restoration, Quito can not only reduce its vulnerability to climate-related disasters but also enhance biodiversity, community well-being, and adaptive capacity. Empowering local actors with these tools ensures a more sustainable and equitable approach to addressing climate change challenges in the city.

This article was presented at the 'Nature in the City' Annual Event in December 2024 at Sciences Po University, Paris (France). To learn more about the 'Nature in the City' project, visit <https://www.sciencespo.fr/ecole-urbaine/en/the-lab/action-research/nature-city/>



ABOUT THE AUTHORS



Tannya Pico is Project Manager at the ISOCARP Institute. She is an architect with 24 years of experience in architectural design, construction, research and higher education. She has work experience in the United States, Spain, Netherlands, Germany, Mexico, Ghana and Ecuador. She has worked for international organizations such as the Global Center of Adaptation, UNDP, GFA, and GIZ on diverse topics such as sustainable urban development, design and implementation of higher education programs, capacity building for municipalities, and research for climate adaptation and resilient infrastructure. Tannya holds a PhD in Urban Governance and Development from the Institute for Housing and Urban Development Studies (IHS) at the Erasmus University Rotterdam in The Netherlands. She works on HORIZON 2020 research projects on Nature-based Solutions in urban environments and has been an evaluator of BIODIVERSA research project proposals, both programs funded by the European Commission.



Dr. Alexander Jachnow is an urban development specialist with almost 30 years of working experience as a researcher and advisor in the field of urban capacity development. His work mainly focuses on enhancing institutions and their capacities by improving urban management practices and policy frameworks. He works on urban policies, planning and strategies, including policy research and National Urban Policies. He advises and collaborates with organizations and DC agencies such as Cities Alliance, DFID, European Commission, GIZ, KfW, OECD, SDI, UN Habitat and UNESCO, and local and national governments worldwide. Alexander led the Urban Development Technical Facility for the European Commission in Brussels, which is the first

facility that supports EU Delegations worldwide in engaging in urban development processes in partner countries in Asia, Africa and LAC. He strongly advocated to support the creation of relevant urban knowledge on Nature-based Solutions for a sustainable future.

PHOTO CREDITS

cover: Cooperativa Alianza Solidaria

all page photos: Cooperativa Alianza Solidaria



REFERENCES

- Aragundi Sheika, M., Mena Alexandra, P. and Zamora Jenny, J., eds., 26 – 30 September 2016. Historical Urban Landscape as a Descriptive Feature for Risk Assessment: the 'Quebradas' of Quito , [FICUP An International Conference on Urban Physics]. Quito – Galápagos, Ecuador.
- Brown, A., Dayal, A. and Rumbaitis Del Rio, C. 2012. No title. *Environment and Urbanization*, 24 pp. 531.
- Brown, V. A., 2010. Collective inquiry and its wicked problems. *Collective inquiry and its wicked problems*. 2010. Tackling wicked problems. Routledge. pp. 61-83.
- Buytaert, W., Célleri, R. and Timbe, L. 2009. Predicting climate change impacts on water resources in the tropical Andes: Effects of GCM uncertainty. *Geophysical Research Letters*, 36 (7), pp. L07406-n/a. Available at: <https://api.istex.fr/ark:/67375/WNG-P89PTK2C-T/fulltext.pdf>.
- Cohen-Shacham, E., Walters, G., Janzen, C. and Maginnis, S., 2016. Nature-based Solutions to address global societal challenges . Switzerland: Available at: <https://portals.iucn.org/library/node/46191>.
- Cuvi, N., 2017. Las ciudades como mosaicos bioculturales: el caso del centro histórico de Quito. *Etnobiología*, 15 (1), pp. 5-25.
- Daly, H. E. and Farley, J., 2011. *Ecological economics: principles and applications*. Island press.
- DMQ, D. M. (., 2012. Plan metropolitano de ordenamiento territorial. *Nuevo Modelo Territorial*, pp. 35-58.
- Egan, D., Hjerpe, E. E. and Abrams, J. 2011. Why people matter in ecological restoration. *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture*, pp. 1-19.
- EU, 2014. *Horizon 2020 in brief: The EU Framework Programme for Research & Innovation*. Luxembourg: Available at: doi:10.2777/3719.
- Gómez-Baggethun, E., De Groot, R., Lomas, P. L. and Montes, C. 2010. The history of ecosystem services in economic theory and practice: from early notions to markets and payment schemes. *Ecological Economics*, 69 (6), pp. 1209-1218.
- Jácome, V., Cabrera, B., Taco, B., Castro, A., et al., 2016. *Economía social y solidaria. Reflexiones desde sus actores*. Quito, Ecuador.
- Nesshöver, C., Assmuth, T., Irvine, K. N., Rusch, G. M., et al., 2017. The science, policy and practice of nature-based solutions: An interdisciplinary perspective. *Science of the Total Environment*, 579 pp. 1215-1227. Available at: <https://www.sciencedirect.com/science/article/pii/S0048969716325578>.
- Metzger, P. and Bermúdez, N., 1996. *El medio ambiente urbano en Quito*. Municipio del Distrito Metropolitano de Quito, Dirección General.
- Peltre, P., 1989. Quebradas y riesgos naturales en Quito, período 1900-1988. *Estudios De Geografía*, 2 pp. 45-91.
- Perrin, J., Bouvier, C., Janeau, J., Menez, G., et al., 2001. Rainfall/runoff processes in a small peri-urban catchment in the Andes mountains. *The Rumihurcu Quebrada, Quito (Ecuador). Hydrological Processes*, 15 (5), pp. 843-854.



Raymond, C. M., Frantzeskaki, N., Kabisch, N., Berry, P., et al., 2017. A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas. *Environmental Science & Policy*, 77 pp. 15-24.

Serra-Llobet, A., Tàbara, J. D. and Sauri, D. 2013. The Tous dam disaster of 1982 and the origins of integrated flood risk management in Spain. *Natural Hazards*, 65 pp. 1981-1998.

Secretaría Nacional de Gestión de Riesgos y Emergencias (SNGRE) - Dirección de Monitoreo de Eventos Adversos. Informe Nro 11 - Aluvión. Report, Quito. 2022. Available at: <https://www.gestionderiesgos.gob.ec/wp-content/uploads/2022/02/Informe-de-Situacion-011-Aluvion-Quito-08022022.pdf>

Smith, R. F., Hawley, R. J., Neale, M. W., Vietz, G. J., et al., 2016. Urban stream renovation: incorporating societal objectives to achieve ecological improvements. *Freshwater Science*, 35 (1), pp. 364-379.

Terry, A. R., 1834. *Travels in the Equatorial Regions of South America, in 1832*. Cooke & Company.

Wantzen, K. M., Alves, C. B. M., Badiane, S. D., Bala, R., et al., 2019. Urban stream and wetland restoration in the Global South—A DPSIR analysis. *Sustainability*, 11 (18), pp. 4975.

Waterman, A. H., Blades, M. and Spencer, C. 2001. Interviewing children and adults: The effect of question format on the tendency to speculate. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, 15 (5), pp. 521-531.

Yin, R. K., 1984. *Beyond Method: Strategies for Social Research*. Beyond Method: Strategies for Social Research.

Zahra, S. A. and George, G. 2002. Absorptive Capacity: A Review, Reconceptualization, and Extension. *The Academy of Management Review*, 27 (2), pp. 185-203. Available at: <http://www.jstor.org/stable/4134351>.