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# Co-Creating Urban Resilience by Community Engagement in Central Asia

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## 1 ABSTRACT

Mountain cities in Central Asia face growing climate-related challenges, including ecosystem degradation, water vulnerability, exposure to natural hazards, and the loss of green infrastructure. Responding to these pressures, the Naryn Urban Resilience Programme (NURP) demonstrates an integrated model of low-carbon, climate-responsive, and community-driven urban development. Drawing on the NURP case, this paper explains how collaborative processes (co-creation) among residents, municipal actors, investors, and technical experts build urban resilience in Naryn.

The NURP introduced multi-level capacity-building programmes for residents, municipal departments, and local businesses, focusing on sustainable landscape design, slope and riverbank stabilisation, public-space management, and the use of climate-resilient local flora. The NURP activities include nature-based solutions (NBS), circular landscape practices, community engagement, and GIS decision-support systems to strengthen Naryn's adaptive capacity. Community engagement activities led to the formation of a local expert group that facilitated co-design, stewardship, and ongoing dialogue between residents and authorities, strengthening social resilience and shared ownership of public spaces. Using NURP cases, the paper analyses which institutional arrangements amplify or inhibit co-created resilience interventions.

The findings show that the combination of participatory greening, native-plant-based NBS, and digital planning technologies creates a practical pathway toward resilient, energy-efficient, and climate-adaptive urban development. The Naryn case highlights the importance of co-governance structures, blended learning approaches, and local ecological knowledge for sustaining NBS in resource-constrained mountain environments. The paper concludes by outlining how lessons learned from the NURP could be applicable across similar urban contexts in Central Asia and beyond.

Keywords: participatory planning, urban resilience, nature-based solution, community engagement, greening

## 2 INTRODUCTION

Urban areas across Central Asia are becoming increasingly sensitive to climate-induced hazards, including extreme temperature variability, water scarcity, flooding, and ecosystem degradation. These challenges are particularly acute in the remote and mountain cities, where limited institutional capacity and ageing infrastructure intersect with rapid socio-economic transitions. In this context, strengthening urban resilience has emerged as a strategic priority for sustainable urban development. To support the enhancement of resilience in towns/cities across Central Asia, SECO and AKDN agencies have been engaging with the governments of the Kyrgyz Republic and Tajikistan to develop a model aligned with international best practice in the delivery of Urban Resilience Programming in Central Asia. The Naryn Urban Resilience Programme (NURP) aims to build local capacity and implement nature-based and data-informed solutions to strengthen urban resilience in Naryn.

Nature-based solutions (NBS) play a crucial role in enhancing urban resilience by leveraging natural processes to address contemporary environmental challenges. Growing empirical evidence supports the hypothesis that participatory NBS models not only improve sustainability but also enhance acceptance and overall social performance. Puskas, Abunnasr & Naalbandian (2021) have identified that co-created green spaces improve social connectedness and, therefore, better neighbourhood relationships and higher levels of civic participation. In addition to their social effects, NBS projects designed and managed by the community also contribute to long-term environmental sustainability. Ferreira et al. (2020) have argued that projects developed and owned by local stakeholders are more likely to be well-maintained in the long run, thereby reducing the risk of degradation or abandonment. Despite the growing prominence of NBS in urban resilience agendas, a key concern remains that many NBS initiatives are comprehensive engineering

interventions that are difficult for local communities to manage or sustain independently. There is a notable scarcity of empirical studies examining how resident engagement can effectively scale NBS down to levels that are adaptable, usable, and manageable by local communities, with a particular emphasis on capacity building and sustained community participation.

Building on these identified gaps, this paper examines the NURP in Kyrgyzstan as an in-depth case study of co-creating urban resilience through community engagement and nature-based approaches. It investigates how participatory processes embedded within the NURP shape the design, social acceptance, and overall effectiveness of NBS-oriented interventions at the local level. In doing so, the study addresses three interrelated research questions (i) how local community needs drove NBS adoption to increase community engagement, and (ii) which institutional and socio-cultural factors enable or constrain co-creation processes in mountain urban contexts. By systematically addressing these questions, the paper advances the literature on participatory urban planning and community engagement for strengthning resilience, while offering empirically grounded insights for policymakers and practitioners working in Central Asia and other transitional urban environments.

## 3 LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The involvement of residents in the planning and implementation of nature-based solutions (NBS) is firmly grounded in collaborative governance theories and socio-ecological resilience frameworks, which emphasise the interdependence between institutional structures, local knowledge, and adaptive capacity. Within this literature, scholars conceptualise participation not as a procedural add-on but as a core mechanism that builds trust and delivers long-term resilience outcomes. They argue that when actors operationalise engagement mechanisms in meaningful ways, these mechanisms align interventions more closely with local priorities and everyday practices, thereby increasing both their legitimacy and effectiveness. Empirical studies demonstrate that successful urban greening initiatives increasingly rely on participatory assessment frameworks to evaluate not only environmental performance but also the quality and depth of community engagement, ensuring that local perspectives actively shape project design and implementation rather than merely being consulted ex post (van der Jagt et al., 2022). Therefore, the way participation is structured and enacted is decisive in shaping both trust-building processes and the governance capacity of NBS initiatives, thereby setting the conditions for more advanced and equitable forms of co-creation to emerge.

Co-design and co-implementation models are particularly emphasised as critical pathways for building public confidence in NBS interventions. Ferreira et al. (2020) argue that projects developed in collaboration with local stakeholders are more likely to generate a sense of ownership, which in turn supports sustained maintenance and long-term environmental outcomes. Through such processes, communities move from being passive recipients of top-down policies to becoming active co-producers of urban resilience. Digital participation tools increasingly support this shift by broadening access to planning processes, lowering participation barriers, and enhancing inclusivity across different social groups (Frantzeskaki et al., 2019). Any tools aligned to local communities' actual or developed capacities can strengthen transparency and feedback loops, further reinforcing trust between residents and implementing institutions.

The quality of participation, however, remains uneven across urban contexts mainly because development continues to be imposed from the top by developers or subject experts without careful attention to local circumstances. Arnstein's Ladder of Participation provides a practical analytical framework for distinguishing between symbolic forms of engagement and genuine citizen power, ranging from tokenistic consultation to complete citizen control (Frantzeskaki, 2019). Despite widespread rhetorical commitment to participation, many NBS initiatives remain situated at lower rungs of the ladder, where communities are consulted but retain limited influence over decision-making. This governance imbalance raises critical concerns about equity and inclusivity, particularly in socioeconomically diverse or marginalised urban areas. Tozer et al. (2020) caution that when participatory NBS governance fails to address power asymmetries, it risks reinforcing existing socio-spatial inequalities by systematically excluding disadvantaged groups from meaningful involvement. There is a growing need to move beyond formalised consultation toward creating the institutional conditions necessary for trust, inclusivity, and genuinely community-driven NBS co-creation processes.

Scholars increasingly converge on the argument for embedding inclusivity in the institutional design of NBS governance rather than treating it as a secondary objective. Moving participatory processes beyond symbolic

engagement toward material empowerment – where communities can shape priorities, propose interventions, and co-plan implementation – has been shown to enhance both the social acceptance and durability of urban greening initiatives. Aligning NBS actions with locally articulated needs not only enhances contextual relevance but also fosters trust, a prerequisite for deeper forms of co-creation. Over time, this trust can enable local stakeholders to initiate and lead collective actions, such as the co-planning of green neighbourhoods, thereby strengthening urban resilience through locally grounded, socially legitimate NBS interventions.

Taken together, this body of literature provides the theoretical foundation for a bottom-up analytical framework that integrates collaborative governance, socio-ecological resilience, and participatory planning theories to examine how NBS are co-produced in practice through systematic assessment of those needs, targeted capacity-building, and inclusive engagement mechanisms. Within this framework, local communities are understood not merely as beneficiaries of environmental interventions but as key actors whose knowledge, capacities, and agency are central to the sustainability and resilience of urban systems. Applying this perspective to the Central Asian mountain town case enables an examination of how aligning actions with locally articulated needs can foster trust and enable residents to move beyond passive participation toward the co-development, stewardship, and long-term maintenance of green infrastructure. The study positions bottom-up participation not only as a governance principle but as an operational strategy for embedding NBS within local socio-institutional contexts, thereby enhancing their legitimacy, durability, and contribution to urban resilience outcomes.

## 4 NARYN CASE STUDY

Naryn town represents a distinctive and analytically valuable case for examining community engagement in nature-based and resilience-oriented urban interventions. Located in the south-eastern part of Kyrgyzstan, the town has an estimated population of 41,681, according to the 2022 Population and Housing Census of the Kyrgyz Republic. Nestled within a high-altitude mountain landscape, Naryn extends as a compact, linear settlement of approximately 25 km along the Naryn River canyon – the largest tributary of the Syr Darya, which flows across multiple Central Asian countries. Its mountainous geography, climatic sensitivity, and physical isolation – approximately 5 hours by road from Bishkek – render Naryn particularly vulnerable to climate change impacts while simultaneously making it a manageable, clearly bounded setting in which to pilot and test community engagement mechanisms.

Naryn is undergoing a period of transition marked by ongoing urban planning activities, development projects, and existing tourism and agricultural economic activities. Recognising both its vulnerabilities and its development potential, several international partners have initiated substantial investments in the town and the wider oblast. Within this context, the Naryn Urban Resilience Programme (NURP) is a five-year planning and proof-of-concept initiative aimed at developing the institutional structures, systems, and local capacities required to transform Naryn into a model resilient mountain town. The programme explicitly links government planning and investment frameworks with initiatives led by communities and national and international partners, creating a platform for bottom-up engagement alongside formal governance processes.

Beyond its physical characteristics, Naryn occupies a unique socio-cultural position within the country. Often referred to as the “original town of the Kyrgyz,” it holds substantial symbolic value for its residents, many of whom express great pride and attachment to their hometown. This strong place-based identity suggests a latent potential for collective action and civic engagement. However, before the initiation of the NURP, observed levels of local activism and organised community participation remained relatively low, highlighting a gap between social attachment and active engagement in urban development processes. This contrast makes Naryn particularly relevant for investigating how trust-building and capacity development can activate community participation in practice.

Naryn’s role as the economic, social, and political hub of the oblast further amplifies the significance of the NURP intervention. The town faces compounded pressures from climate-induced natural hazards and demographic change driven by urbanisation, while also contending with limited economic opportunities. These conditions, combined with its compact urban form, challenging hazard profile, and alignment with ongoing SECO and AKDN initiatives, led to its selection as a showcase for resilient urban planning and development. Recent municipal actions, such as housing and public space projects, improvements to transport and education infrastructure, and reforms such as the acquisition of underutilised industrial land for

public use, underscore the town's readiness to experiment with participatory, community-driven approaches to urban resilience.


Fig. 1.

### 4.1 Identifying Local Capacity by Needs Assessments

To operationalise community engagement and align nature-based interventions with local needs, the Naryn Urban Resilience Programme (NURP) adopted an evidence-driven, bottom-up approach centred on systematic surveys and needs assessments. Since its launch in 2022, the programme has conducted a series of citywide and neighbourhood-level assessments to capture residents' lived experiences, risk perceptions, and development aspirations. There are several early diagnostic efforts to inform technical planning but also to create an entry point for dialogue between local communities, municipal actors, and programme implementers, thereby laying the groundwork for trust-building and participatory governance.

A significant milestone in this process was the launch of the Integrated Habitat Assessment (IHA) in 2023. The IHA combined social, economic, and environmental datasets, including multi-hazard exposure, hydrological conditions, geo-botanical characteristics, forestry and soil profiles, demographic trends, and sociological indicators. When analysed in combination, these layered datasets generated a composite spatial index that identified hazard exposure, demographic sensitivity, infrastructure service gaps, and environmental hotspots across Naryn. This integrated analytical framework enabled NURP to translate complex ecological and social risks into spatially explicit insights that could be communicated to both technical experts and residents, strengthening the transparency and relevance of planning decisions.

Building on this analytical foundation, NURP conducted a targeted needs assessment for nature-based solutions between June and August 2024, explicitly linking data-driven risk analysis with community capacity and willingness to engage. Through diagnostic missions and capacity-building sessions, the programme assessed not only local awareness of NBS but also residents' readiness to participate in community, public, and entrepreneurial activities related to urban greening and landscape-based resilience. These engagements introduced participants to basic principles of urban and landscape design while exploring how locally adapted NBS could respond to Naryn's specific environmental and socio-economic conditions.

The findings revealed a critical structural constraint: a severe shortage of highly qualified landscape design professionals and firms with experience in applying NBS, especially those capable of working with native species and mountain ecosystems in Kyrgyzstan. This capacity gap emerged as a key barrier to translating community interest and locally identified needs into high-quality, sustainable interventions. At the same time, the assessment highlighted an opportunity for targeted capacity development, strengthening local skills and knowledge could enable residents and local actors not only to receive externally designed interventions but also to co-develop and maintain green infrastructure. In this sense, the surveys and needs assessments

functioned as more than diagnostic tools; they became a central mechanism for aligning NBS actions with local needs, addressing institutional and capacity constraints, and advancing the conditions for meaningful co-creation in Naryn.

### 4.2 Catalogue of Kyrgyz Flora

The University of Central Asia (UCA) team co-implementing NURP paid dedicated attention to addressing the historical erosion of local flora resulting from Soviet-era urban planning practices, which introduced non-native and often maladapted plant species across Central Asian cities. In Naryn, this legacy has contributed to the gradual displacement of indigenous vegetation that is better suited to the town's harsh mountain climate and fragile ecosystems. Recognising the ecological and cultural significance of restoring locally adapted species, NURP initiated the development of an illustrated catalogue of climate-resilient plants designed to guide both residents and municipal authorities in making informed, context-sensitive planting decisions.

The catalogue responds directly to Naryn's specific climatic conditions and ecological characteristics, while also advancing the notion of a distinctly "Kyrgyz" landscape that reflects local identity, heritage, and environmental knowledge. It documents a carefully curated selection of native and climate-resilient species, including eight tree species, 13 shrubs, 13 grasses, and 2 vines that can thrive in Naryn's urban environment. Beyond their aesthetic value, these species provide measurable ecosystem services, such as reducing dust pollution, improving air quality through carbon sequestration, and enhancing overall urban ecological stability. By foregrounding plants that are both environmentally functional and culturally resonant, the catalogue aligns ecological restoration with place-based identity.

High demand for the catalogue led to its translation into both Kyrgyz and English, underscoring its relevance not only for local communities but also for planners, designers, and external partners involved in urban development. As a participatory tool, the catalogue plays a dual role: it addresses technical knowledge gaps in plant selection while simultaneously empowering residents to engage more actively in urban greening initiatives. By enabling informed choices rooted in local ecology, the resource supports a shift from externally imposed landscaping norms toward community-driven restoration practices. Consistent with existing research, engaging communities in selecting flora has been shown to enhance ecological awareness, foster a sense of ownership, and improve long-term maintenance of public green spaces (Raymond et al., 2021). In the context of Naryn, the catalogue thus functions as both an ecological corrective to historical planning legacies and a trust-building mechanism that anchors nature-based solutions in local knowledge and stewardship.

### 4.3 Addressing Knowledge Gaps through Targeted Capacity Building

Early engagement activities under the NURP revealed a significant shortage of local knowledge and technical expertise related to urban greening and the use of locally adapted flora. While residents and municipal actors expressed strong interest in improving public spaces and environmental conditions, many lacked practical understanding of landscape design principles, plant selection for mountain climates, and the maintenance requirements of nature-based solutions. This knowledge gap – shaped by decades of externally driven planning practices and limited access to professional training in the region – emerged as a critical constraint on meaningful participation and effective implementation of NBS.

In response, NURP designed a targeted capacity-building strategy aimed at transforming interest into informed and actionable engagement. To overcome barriers related to remoteness, time constraints, and uneven access to formal planning processes, the programme adopted a hybrid engagement model combining face-to-face workshops with online surveys, digital polls, and mobile-based learning tools. Such an approach aligns with participatory NBS governance literature, which emphasizes that strengthening local capacities is a prerequisite for the long-term success and maintenance of urban greening interventions (Kabisch et al., 2016). All online lectures were recorded and made publicly available on YouTube, allowing participants and other residents to revisit the material and extend learning beyond the formal training period.

The capacity-building initiatives targeted municipal officers, forestry personnel, and community members, with the explicit objective of enabling local stakeholders to co-develop, implement, and manage urban greening projects. Launched in 2024 and continuing to date, the training programme covered both foundational and applied topics, including plant grafting, pest and disease management, efficient irrigation

techniques, and public space improvement using locally adapted nature-based approaches. By combining technical instruction with hands-on application, the programme operationalized a "learning by doing" approach, which has been shown to be particularly effective in enhancing the performance and confidence of community-based sustainability initiatives (Frantzeskaki et al., 2019).

The practical outcomes of this approach became evident within a relatively short timeframe. After six months of training, participants collectively identified five underutilized open spaces in Naryn and developed site-specific greening proposals, leading to the planting of 60 saplings in two of the town's most environmentally vulnerable locations and the organization of a jointly led tree-planting event formally acknowledged by the Mayor's Office. These outcomes illustrate how targeted capacity building – grounded in local needs and reinforced through practical application – can convert limited initial knowledge into sustained community engagement, strengthen trust between residents and institutions, and establish the foundations for locally driven and maintainable urban greening in Naryn.

### 4.4 Mudflow Collectors as a Community-EndorsedNBS

The implementation of mudflow collectors in Naryn provides a further illustration of how local stakeholder engagement mechanisms were applied in practice and how NBS-aligned interventions contributed to tangible urban resilience outcomes. Findings from the 2023 Integrated Habitat Assessment (IHA) identified mud and debris flows as one of the most severe natural hazards affecting the town. The assessment mapped seventy-four ravines to the south and six to the north of Naryn that pose direct flood risks to residential areas, roads, and critical urban infrastructure. In total, eighty-eight mudflow sites were classified as high-risk, exposing both human life and property to recurrent hazards. These results were communicated to municipal authorities and local stakeholders, forming the basis for joint prioritisation of intervention sites.

Rather than applying a purely engineering-led response, NURP aligned technical recommendations with local knowledge and institutional capacities. The IHA proposed constructing mudflow baffles, reinforcing channel banks, and developing mudflow storage reservoirs where appropriate. These recommendations were discussed with municipal services, residents of exposed neighbourhoods, and representatives of the Ministry of Emergency Situations, enabling a shared understanding of risk and intervention options. This process contributed to local acceptance and trust, as stakeholders could directly link the proposed actions to the risks identified through participatory assessment.

The resulting implementation at the Mazar-Bulak and Chygysh-Bulak sites in the eastern part of Naryn marked a key programme milestone. The mudflow collectors employed gabion-based structures – wire-mesh containers filled with locally sourced stone – which serve as nature-based solutions by combining natural materials with adaptive engineering. These structures stabilise slopes, slow debris flows, reduce erosion, and enhance flood management while remaining compatible with the surrounding landscape. Their construction not only reduced exposure to recurrent mudflow risks but also strengthened the protection of nearby residential neighbourhoods and critical urban assets.

The intervention demonstrated how NBS can serve as an entry point for co-creation even in technically complex infrastructure projects. Residents acknowledged the works positively, while municipal authorities and the regional subdivision of the Ministry of Emergency Situations emphasised their strategic value, noting that the facilities could benefit approximately 25 per cent of the town's population and significantly reduce the need for costly household resettlement from high-risk zones. In this sense, the mudflow collectors illustrate how aligning NBS actions with locally identified risks and priorities can build institutional trust, enable cross-sectoral collaboration, and deliver resilience outcomes that are both socially legitimate and functionally effective in a mountain urban context.

### 4.5 Participatory Planning for Urban Greening

The cumulative effects of sustained needs assessments, targeted capacity development, and trust-building engagement under the NURP culminated in a significant governance milestone: an invitation from local government to co-develop the town's future development trajectory. Under the leadership of the First Deputy Governor of Naryn Oblast, a formal Working Group was established to prepare the Green Naryn Five-Year Development Plan. This step reflects what recent studies identify as a critical condition for successful urban greening – namely, the transition from consultative participation toward the meaningful involvement of local populations in decision-making processes, which has been shown to strengthen both project effectiveness

and long-term stewardship (Ferreira et al., 2020; Puskas et al., 2021). As part of this initiative, the Government of Naryn formally requested technical and strategic support from the University of Central Asia and the Aga Khan Foundation, recognising the value of expert input aligned with locally articulated priorities.

To ensure balanced representation and coordinated decision-making, the Working Group includes representatives from the Naryn Governor's Office, the Naryn Mayor's Office, the NURP team, and residents. This institutional configuration reflects a deliberate effort to embed community engagement within formal governance structures, thereby addressing the gap between participation in project implementation and participation in strategic planning. Notably, the invitation to co-develop the town's green future emerged from a demonstrated process of capacity building and collaborative action, rather than from symbolic inclusion, signalling increased institutional trust in community-informed planning.

The integration of nature-based solutions into this participatory planning framework further reinforces their role as both ecological and social infrastructure. By involving residents directly in shaping the Green Naryn Five-Year Development Plan, the process aligns NBS interventions with local values, cultural practices, and everyday uses of urban space – factors the literature associates with greater acceptance and sustained maintenance. In this respect, the NURP experience operationalises key insights from participatory NBS research by translating engagement into shared responsibility and long-term commitment.

Through community-based greening projects, structured training programmes, and sustained stakeholder engagement, NURP has enabled residents to move from passive beneficiaries to co-governors of their urban environment. The participatory planning process thus represents both the culmination of earlier engagement mechanisms and the institutionalisation of co-creation, embedding stewardship of green infrastructure within the social and governance fabric of Naryn and laying the foundation for resilient, locally owned urban development in a mountain town context.

## 5 CONCLUSION

The Naryn case demonstrates that NBS adoption became meaningful and scalable only after aligning interventions explicitly with locally articulated needs, risk perceptions, and capacities. Through iterative needs assessments, participatory diagnostics, and the use of spatial and ecological data, NURP translated abstract resilience goals into locally relevant actions – ranging from native-plant-based urban greening to mudflow risk reduction – thereby strengthening community engagement not as an objective in itself, but as a response to tangible everyday concerns.

The findings further show that engagement deepened as residents moved from consultation to co-development, supported by targeted capacity-building and practical learning. Blended learning approaches – combining digital tools, recorded online lectures, and hands-on field activities – played a critical role in enabling residents to understand, apply, and maintain NBS in a resource-constrained mountain environment. Practical application, mentorship, and site-based experimentation proved especially important in translating theoretical knowledge into durable practice, reinforcing trust and confidence among local stakeholders. In this sense, participation functioned not merely as a governance mechanism but as a learning process through which communities developed the ability to co-create and steward green infrastructure over time.

From an institutional perspective, the Naryn case highlights the importance of co-governance structures in enabling co-creation. The gradual shift from project-level engagement to formalised participatory planning – culminating in the establishment of a multi-stakeholder working group for the Green Naryn Five-Year Development Plan – illustrates how sustained engagement can reconfigure power relations between communities and authorities. Socio-cultural factors, a powerful place-based identity, and local pride in Naryn as a historic Kyrgyz town served as latent enablers of participation. At the same time, initial low levels of civic activism underscored the need for trust-building and capacity development as preconditions for co-creation. Conversely, constraints emerged where technical expertise, financial continuity, or institutional mandates were insufficient to support long-term maintenance, underscoring the need for adaptive management and sustained investment.

Overall, the NURP experience confirms that NBS's success in mountain cities depends as much on social resilience as on environmental design. The combination of participatory greening, native-plant-based NBS, and digital planning technologies created a practical pathway toward resilient, energy-efficient, and climate-

adaptive urban development in Naryn. By embedding engagement as a core operational principle rather than a symbolic exercise, the programme enabled residents to transition from passive beneficiaries to active co-creators of their urban environment. As such, Naryn serves as a reference case for how community-driven, needs-based NBS governance can be operationalised in remote and climatically vulnerable urban contexts, offering transferable lessons for similar towns across Central Asia and beyond.

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Beyond its empirical insights, this study offers both theoretical and practical contributions for cities and towns facing similar environmental, institutional, and socio-economic constraints. Theoretically, it advances the literature on participatory urban resilience and nature-based solutions by demonstrating how needs-driven, bottom-up engagement operationalises co-creation in practice. The Naryn case shows that community engagement becomes transformative when it is anchored in locally articulated needs, supported by capacity development, and embedded within co-governance arrangements. In mountain urban contexts – often characterised by remoteness, limited institutional capacity, and high climate vulnerability – the study highlights the importance of integrating socio-ecological resilience theory with collaborative governance and experiential learning frameworks. It thus contributes a refined understanding of how trust, local ecological knowledge, and institutional openness interact to enable sustained co-creation beyond project cycles.

From a practical perspective, the findings offer a replicable pathway for policymakers, development agencies, and practitioners working in Central Asia and other transitional or resource-constrained regions. Key lessons include the value of combining participatory needs assessments with spatial and ecological data; the effectiveness of blended learning and “learning-by-doing” approaches in building local capacity; and the role of native-plant-based NBS in aligning ecological restoration with cultural identity and community ownership. The Naryn experience underscores that durable NBS outcomes require institutionalisation – through formal working groups, participatory planning frameworks, and long-term investment in training and adaptive management. Taken together, these lessons suggest that cities seeking to scale NBS should move beyond technical replication and instead focus on process replication: aligning interventions with local needs, fostering co-governance, and enabling communities to act as long-term stewards of urban resilience.

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