Transdisciplinary Research in Action in Latin America & the Caribbean

CASE STUDIES

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TransDisciplinary
Academy

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Inter-American Institute
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Research

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Preface

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The world is facing an unprecedented environmental crisis, driven by human activities, leading to complex challenges such as climate change, biodiversity loss, and pollution of soil, air, and water —known as the triple planetary crisis. To safeguard our planet, we must implement widespread and long-term solutions that promote resilient and healthy socio-ecological systems, aligning with the United Nations' Sustainable Development Goals (SDGs).

The Inter-American Institute for Global Change Research (IAI) is a regional intergovernmental organization, with 19 member countries (Argentina, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Guatemala, Jamaica, México, Panama, Paraguay, Peru, United States of America, Uruguay and Venezuela), that aims to provide nations of the Americas with the tools and institutional capacities to better face the challenges posed by global change.

Global environmental change (GEC) is defined by the IAI as the interactions of biological, chemical, physical and social processes that regulate changes in the functioning of the Earth system, including the ways in which these changes are influenced by and impact on human activities. This collaborative, multinational effort is guided by the understanding that global change is urgent, complex, dynamic, and with considerable uncertainties that need to be tackled by appropriate knowledge and evidence.

Innovative science and training approaches are needed to increase institutional and research capacities across the Americas to deal with GEC issues. Following the themes and areas collectively identified in IAI's research agenda, and strategic plan, the Institute supports science that improves the Americas' ability to cope with and thrive under global change, making a positive impact towards the sustainability of the region. Addressing the complexity of GEC requires effective communication and collaboration among scientists, decision-makers, diverse sectors and affected communities across the region. Transdisciplinary science is an important part of those efforts.

Transdisciplinary (TD) science is an approach that is problem driven and solution oriented, integrating knowledge, tools, and ways of thinking from multiple disciplines and actors to provide useful and actionable information for end users from public and private sectors. TD is a pathway to produce and highlight the use of scientific information to inform adaptation and mitigation strategies for key GEC challenges. TD science requires an interactive and iterative co-creation process involving scientists and relevant societal actors, including but not limited to indigenous and local communities' leaders, civil society associations, representatives from the private sector and policymakers at the national, sub-national and local levels. The IAI's TD Academy provides training and skills on TD approaches to inform decision-making in the public and private sectors. It also facilitates sharing information, best practices, and regional dialogue, according to the IAI Open Data Policy.

This case study book is part of a training package of the IAI's TD academy targeted at early to mid-career researchers and other professionals working in governments, academic institutions and private sectors having an interest in TD research on GEC at the science-policy interface. The case studies presented here underpin an open virtual course that aims to enhance the capacity of professionals across the Americas to conduct TD science. In addition, they are a tool to increase the inclusion of underrepresented groups in the IAI's science and capacity building activities, and address other considerations of equity, diversity and inclusion (EDI) in TD practice according to IAI's EDI Policy.

Produced between 2022 and 2024 by an expert team encompassing academics and social actors from the Americas, the work was closely guided by the IAI Directorate and a steering committee composed by transdisciplinary academics and representatives from international and funding agencies and public sectors. The IAI is thankful for the contributions of START International, the Belmont Forum, the IAI Science Advisory Committee, the IAI Science-Policy Advisory Committee and the United States Global Change Research Program to the final version of the online course and case studies book.

The case studies presented here are based in Latin America and Caribbean and are authored collaboratively by scientists, policy practitioners and local societal actors. Reflections and lessons learned from TD projects implemented in the Global South are key to deepening and improving TD practice and scientific research worldwide. The implementation of TD approaches in Latin America and the Caribbean poses specific challenges related to the rising impacts of GEC and deep social inequalities. The region holds a myriad of renewable and non-renewable natural resources in extremely diverse ecosystems, including the largest tropical forest of the world. Such richness is coupled with an outstanding cultural diversity and good technical capacity, making Latin America and the Caribbean a space for vibrant innovation and pathways of hope for a more sustainable future.

We sincerely hope these materials are used worldwide and inspire impactful and equitable partnerships in the co-creation of real-world solutions to GEC challenges.

Introduction

Gabriela Alonso Yáñez
Lily House-Peters

Designing the Transdisciplinary Science Curriculum & Case Study Book

Global environmental change (GEC) has significant and troubling effects across the Americas, impacting resource security, human welfare, and regional adaptability. Confronting these complex and coupled human-environmental challenges effectively requires translating scientific knowledge into actionable policy. Recent research shows a strong correlation between interdisciplinary collaboration—combining diverse scientific fields and knowledge frameworks—and cross-scalar political attention (Hu, Huang, & Bu, 2024). Scholars and funding agencies must go beyond focusing on academic research to enhance the real world applications and solutions-oriented outcomes of interdisciplinary efforts; they must adopt innovative methods focused on community leadership, engagement, and participation throughout the research process. It is also critical that academic institutions and policy-making bodies support initiatives that value and advance collaborative work among scientists, academics, and diverse societal stakeholders.

Transdisciplinary (TD) research collaboration has emerged as a significant field for advancing solutions-oriented research to address GEC issues and develop policies that can be effectively implemented and yield meaningful results. Transdisciplinarity marks a significant shift toward fostering cooperation and designing action-oriented knowledge that addresses the complex, wicked problems faced in the 21st century. The TD approach combines insights from academic scientists in natural science, social science, and engineering—interdisciplinarity—with leadership and contributions across the research project lifecycle from non-academic stakeholders, including policymakers, practitioners, government officials, environmental activists, and local community members. However, numerous barriers still hinder the translation of knowledge into action through collaborative work.

These obstacles include insufficient and inconsistent interactions between scientists and stakeholders; a lack of collaboration in identifying and framing research problems, questions, and hypotheses and setting shared agendas; ineffective communication among researchers, policy-makers, and societal actors; and obstacles regarding structures for research funding and institutional rules for spending and allocating grant funds. Such challenges severely limit shared learning, equitable and community-driven collaboration, and, ultimately, the development of viable solutions to pressing global environmental challenges.

Training and capacity-building interventions improve team performance by equipping members with the leadership and communication skills and ethical frameworks needed for effective collaboration within diverse research teams part of multiple and, at times, divergent knowledge systems, values, and perspectives from various social actor groups. This is especially relevant for teams addressing complex, global socioecological issues often characterized as wicked due to high interdependency, multiple problem framings, potential for conflict across diverse perspectives, and straddling organizational, geographical, and disciplinary boundaries. Building capacity to overcome the challenge of integrating diverse, and at times divergent, knowledge and value systems is central to achieving successful TD collaborations that are just, equitable, and inclusive to the myriad voices and perspectives involved in the research.

In designing the Transdisciplinary Science Curriculum and Case Study Book, the authors have deliberately included epistemic (or knowledge-related) justice and other equity-based research practices, such as those related to gender and racial equity. Epistemic justice is essential to TD research, leading to more effective change. Actively listening to and valuing the forms and systems of knowledge of all social actors, including those who have been historically, or continue to be, marginalized helps to overcome bias in research, identify and dismantle coloniality in patterns of knowledge production and distribution, and promote discourses and practices that value local knowledge and defend the voices of the marginalized (Cumming et al., 2023).

Considering this context, the authors' pedagogical approach for designing the Transdisciplinary Science Curriculum integrates educational theory and research—such as sociocultural learning theory, critical sustainability studies, and social learning—with engaging, active inquiry and knowledge-making practices. A fundamental shift in conceptualizing the relationship between nature and people underpins this curriculum design from a GEC standpoint, moving from the traditional ecosystem service framework to the notion of Nature's Contributions to People (NCP). Conventional Western scientific discourse often frames this relationship around ecosystem services or ecological goods, assigning a commodity value to nature and its functions. This neoliberal conservation approach seeks to monetize ecosystem services to address environmental challenges and financially incentivize conservation, often through mechanisms such as paying for ecosystem services (Bakker, 2010; Dempsey and Robertson, 2012). However, this Western, capitalistic economic perspective ultimately falls short in engaging diverse viewpoints, particularly those of indigenous peoples and local communities, who often do not value nature solely in monetary terms.

The ecosystem services framework has proven too narrow to reflect the broad array of worldviews, values, and knowledge systems regarding the relationship between people and nature and the vast, non-monetary contributions of nature to enhance the quality of life. In response, the concept of NCP promotes a richer understanding of how diverse perspectives on nature can significantly influence context-specific cultures (Diaz et al., 2018; Dean et al., 2021). This shift integrates natural and social sciences and the environmental humanities with authentic community engagement and leadership to foster a more just, equitable, inclusive, and realistic dialogue about our deeply interdependent relationship with the environment. The NCP framework is significant for the TD curriculum as it recognizes the diversity of worldviews and knowledge systems that shape perceptions of and values assigned to nature. It emphasizes the importance of integrating multiple ways of knowing about how humans interact with the natural world.

A primary goal of the Transdisciplinary Science Curriculum and Case Study Book is to give visibility to underrepresented groups, such as women, gender minorities, Indigenous peoples, and ethnically diverse communities, particularly in science and policy. These groups actively engage with and address global change efforts that often remain on the fringes of conventional research and knowledge mobilization and have innovative and unique problem-solving capacities that may be overlooked or ignored in other research and policy-making settings.

Transdisciplinary Case Study Book

This Case Study Book is a significant element of the TD curriculum, which highlights illustrative case studies from the LAC region. The following chapters showcase effective and innovative TD research design and research processes at various stages of project development across countries, including Peru, Brazil, Bolivia, México, Panama, Jamaica, Colombia, and Uruguay.

This collection provides new insights and understanding of multifaceted biodiversity conservation approaches, environmental change adaptation, community-driven health and sanitation system improvements, and beneficial ecosystem management outcomes. Each case study illustrates the significance of local context, community engagement, and leadership in the TD research process, as well as the unique social and ecological conditions that affect the implementation of conservation policies.

In an era where environmental challenges are increasingly complex, especially in the LAC region, it is essential to understand the intricate relationships between shifting political landscapes, culture, and policy. This book explores how these factors shape dialogue and collaboration, ultimately enhancing the effectiveness of policy implementation relevant to local needs. We showcase diverse, authentic TD projects from these countries to advance our understanding of best practices, reveal synergies, and showcase the lessons learned.

The cases included in this book were carefully selected to demonstrate feasible conditions and participatory processes that enable collaborative governance. This framework allows us to include local and traditional knowledge systems in tackling GEC.

These cases illustrate successful collaborative multi-sector networks that have produced cutting-edge scientific outputs while producing knowledge relevant to real-world challenges. This knowledge has proven beneficial for various sectors where these projects are based, facilitating activism and genuine local transformation such as petition writing, organizing demonstrations, effective engagement with authorities, and establishing community-protected territories.

In creating this document, the authors followed ethical guidelines to safeguard the confidentiality and intellectual property rights of Indigenous knowledge custodians, local community members, activists, and vulnerable groups. At the same time, it is crucial to ensure that the voices of these communities are authentically represented. Consequently, the compilation prioritizes the inclusion of local knowledge holders, who are acknowledged as authors of each case description.

This book serves as a repository of knowledge and practice, reflecting genuine TD efforts and the valuable learning experiences of those involved.

Transdisciplinary Case Study Template

This book followed a standardized methodology for data collection. Each selected case explored in these chapters was treated as a case study, which is defined as an extensive and in-depth examination of a social phenomenon within its real-life context (Flyvbjerg, 2011). Case studies are instrumental when the project focuses on capturing context-dependent knowledge, social activities, and the situational conditions that significantly influence human behavior.

This compilation was developed with a case-study approach because the goal was to explore highly situated settings that could only be effectively understood by observing and documenting daily interactions and on-the-ground collaborations.

This approach allowed the authors to explore and analyze various LAC case studies thoroughly and systematically. The case studies highlighted draw on multiple sources of evidence gathered through diverse qualitative methods, including ethnographic fieldwork observations, interviews with various members of case study teams to understand TD project processes, successes, and challenges from different points of view and experiences, network analysis data, and review of case study documents.

The cases were selected from previous pilot research that identified sites where significant TD research collaboration had already been accomplished, as well as substantial involvement of local actors, civil society groups, and Indigenous communities in their traditional territories, and effective partnerships between academic researchers, the private sector and government. The template used to access the data from different case studies is an annex to this case study book.

Source Freepik.

CASE STUDY 1
PERÚ, BRAZIL & BOLIVIA

MAP–Fire: Multi-Actor Adaptation Plan To Cope With Forests Under Increasing Risk Of Extensive Fires

Karla Oliveira
Gabriela Alonso Yáñez
Liana Anderson

Context

Wildfires can be a natural part of some ecosystems, such as savannas, but they are not natural in the Amazon rainforest. Using fires for land-use-driven changes has pushed the humid rainforest toward a tipping point. Wildfires affect rainforests in various ways, such as increasing droughts and carbon emissions, dramatically reducing the capacity to store carbon, and negatively impacting biodiversity. These consequences result in significant social and economic costs on a regional scale (Greenberg, 2022).

Project Overview and Objectives

The transdisciplinary (TD) MAP-Fire (Multi-Actor Adaptation Plan to Cope with Forests Under Increasing Risk of Extensive Fires) project region encompasses Madre de Dios in Peru, Acre in Brazil, and Pando in Bolivia, sharing borders and similar conflicts, as well as boasting significant ethnic diversity, including uncontacted Indigenous groups. The project region suffers from socio-environmental degradation due to deforestation and wildfires (Duchelle et al., 2010). Since the 1960s, intensive land-use changes and mineral extraction have transformed the region, leading to widespread deforestation and the deliberate introduction and integration of fire into the landscape. Concerns over this development model have prompted national and foreign researchers to advocate for alternatives over the last two decades. External actors and researchers have played a crucial role in supporting communities in the region by organizing data and developing projects from both local and regional perspectives.

The MAP-Fire project, funded by the Inter-American Institute of Global Change Research (IAI)'s Small Grant Program (SGP), aimed to advance knowledge and support initiatives to mitigate the risks and impacts of wildfires in the Amazon. The project accomplished several objectives, including understanding current and future scenarios of wildfire impact in the Amazon basin. It required a shared understanding of wildfire behavior and its effects in the socioecological context of a tropical rainforest. This meant coordinating team members across three regions within the Amazon rainforest and developing shared, common knowledge (and language) about what a wildfire is and how to translate this information into a geo-referenced spatial database platform.

Fuente: MAP-Fire.

Key Considerations

The MAP-Fire project team comprised remote sensing specialists, economists, geographers, forest engineers, biologists, educators, and others. The project drew many young scholars from universities in the region to participate. One crucial aspect was knowledge translation of the research outcomes into widely accessible products and formats—that is, all the reports published about the impact of wildfires would need to be prepared for a wide range of readers across society, including youth and school communities.

The team understood that many of the problems related to wildfires could be unproductive without advocacy to benefit grassroots communities. In addition, the MAP-Fire project gathered researchers and managers from diverse parts of Brazil (São Paulo, Acre), Peru and Bolivia. Managing this large team, with members from varied disciplinary backgrounds and quite different social and cultural contexts, called for a designated liaison person, a broker, to promote collegiality and collaboration across diverse team members and with communities.

The project also identified and diagnosed challenges and bottlenecks in operational and community-based fire monitoring and wildfire prevention strategies. The project strengthened the resilience of local populations in the study areas and raised their risk awareness. It also influenced regional conservation strategies by identifying key actors, establishing a common language for fire monitoring and producing various fire warning reports for the entire area (IAI, 2024). The team translated the technical and complicated language of remote sensing into accessible language for elementary school students, which resulted in the publication of the book *É Fogo! [Fire!]* (see Figure 1).

The project distinguished itself through a TD approach, leveraging a wealth of field research conducted by a diverse team of researchers with varying backgrounds, ages, and contexts. Building upon existing partnerships with local organizations in the MAP region, the team proposed a monitoring platform to translate information about wildfires in the Amazon basin to a broader audience (see Figure 2). This platform involved researchers specializing in remote sensing, economics, geography, and other fields, who authored numerous academic papers assessing the impact of wildfires.

Additionally, a subgroup within the team, comprising biologists and educators, worked to translate the outcomes of these research efforts to the broader society, including developing a website with air quality information to guide decision-making.

Figure 1: É Fogo! book cover, designed by the MAP-Fire project team.

Source: MAP-Fire.

Flexibility and adaptability are pivotal when navigating diverse contexts and leading a diverse team. However, these attributes can only lead to success with someone fulfilling the role of a broker: a bridge connecting the entire team while remaining committed to fulfilling the project's and the community's objectives, which may not always be the same.

Despite challenges or uncertainties, commitment ensures that everyone remains steadfastly dedicated to the group's goals. Furthermore, the liaison

must also inspire high trust from the entire team. This trust is crucial because it fosters open communication and a readiness to embrace change. Dr. Liana Anderson, executive coordinator of the MAP-Fire project, commented on this key quality:

> *Trusting the team members, trusting in really acknowledging or understanding the importance of what you were doing for yourself, understanding the implications, and being responsible for the action.*

Figure 2: *Screenshot of the TerraMA2 platform indicating areas with fires in the MAP region.*

Source: http://terrama.cemaden.gov.br/griif/mapfire/monitor/
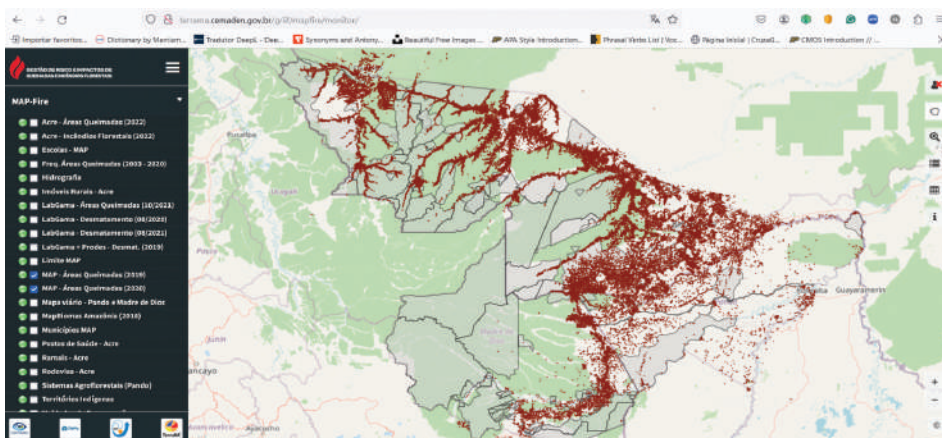
Ongoing Sustainability of the Project

As climate change worsens, the Amazon rainforest faces increasing vulnerabilities to severe droughts and decreasing resilience to cope with critical environmental shifts. Recently, the region has experienced heightened stress from drought, deforestation, and wildfires, which have impacted even its most remote areas (Flores et al., 2024).

The MAP-Fire Platform provides near real-time information on fire occurrences and alerts, including rainfall data, dry days, and forecasts. During the 2021 rainy season, the platform was instrumental in organizing science communication and capacity-building initiatives related to the MAP-Fire project, as ten technical reports were published. This support aided decision-making in the tri-national frontier, where the risk of extensive forest fires is growing (see Figure 3).

Figure 3: *Example of the seasonal fire risk forecast for August-October 2020.*

Source: https://www.iai.int/en/post/detail/multi-actor-adaptation-plan-to-cope-with-forests-under-Increasing-risk-of-extensive-fires#outreach

The ongoing success of the MAP-Fire project hinges on building a cohesive team and having a capable leader who can bridge gaps among partners. An effective project leader must understand each partner's challenges and provide support to all those involved, including the assistance provided during the COVID-19 pandemic. The leader had the TD project management skills necessary to proactively anticipate potential challenges and address conflict. Furthermore, the leader guided the team in effectively communicating with grassroots communities by translating technical terms into language that resonated with their needs, reflecting the project's commitment to epistemic justice.

It is essential to foster ongoing, meaningful collaboration among stakeholders and to ensure that knowledge and resources are shared equitably for the MAP-Fire project to be sustainable in the long term. This includes engaging local communities in conservation efforts, promoting sustainable land use practices, and integrating traditional ecological knowledge into modern fire management strategies. Moreover, the project aligns with a broader regional-scale strategy for territorial protection, suggesting that its outcomes could contribute to the ongoing advancement of this comprehensive approach while ensuring the resilience and preservation of the Amazon rainforest for future generations.

Key Takeaways & Lessons Learned

Commitment to communities does not cease when the project is over. Indeed, it's particularly vital afterwards. The MAP-Fire team recognized the imperative of maintaining enduring relationships with local communities when they face persistent threats like wildfires in the Amazon Forest. The team understood the significance of nurturing these connections over the long term, akin to planting seeds to witness the forest's regrowth, as Dr. Anderson noted:

One lesson learned is that if the project ends and you don't have seeds on the ground, they will not germinate Although the project has produced books and trained teachers to use them, it is crucial to support these educators in guiding conversations about fires using the materials. In the case of fires, we would say, "What about starting to talk about wildfires in general? Because we know that through all of September, fire will be a problem…" So, maybe, in this way, we keep the discussion alive in the community and always find ways to continue it. It requires this "semi-permanent" attention to the problems the project has worked on. And its outputs can continue to be explored and remain alive within the community.

Table 1: *Summary of key takeaways & lessons from the MAP-Fire project.*

TD Skill Competence Area	Takeaway/Lesson Learned
Leadership Roles & Skills	• Designate a lead team member who can act as a liaison and bridge builder (or broker): This role promotes collegiality and collaboration in teams with high membership diversity (i.e., different disciplinary backgrounds, distinct sociocultural contexts, community members, etc.). • Flexibility and adaptability are key leadership traits when navigating diverse team dynamics and research contexts. • Inspire a high level of trust from the entire team. Trust is crucial, as well as fostering open communication and a readiness to embrace change. • Anticipate potential challenges and address conflict proactively.
Science Communication to support Decision-Making & Education	• Create accessible products: Translate research outcomes into widely accessible products and formats that can be used by diverse audiences (e.g., youth, schools, policy-makers), such as the publication of the book *É Fogo [It's Fire]*. • Communicate with grassroots communities effectively: Translate technical scientific and policy language into terms that resonate with local communities' needs. • Build upon existing partnerships with local organizations: The team proposed a monitoring platform to communicate information about wildfires in the Amazon basin to a broader audience.
Community Engagement & Advocacy	• Foster ongoing, meaningful collaboration among stakeholders. • Ensure that knowledge and resources are shared equitably. • Recognize that the commitment to communities does not end when the project ends. Nurture community connections and relationships over the long-term. • Advocacy for grassroots communities' needs may make the research more productive and enhance solution implementation.
Cross-scalar Alignment	• Aligning the project with a broader regional-scale strategy for territorial protection can enhance its impact. • For example, the project effectively influenced regional conservation strategies by identifying key actors, establishing a common language for fire monitoring, and producing fire warning reports for the regional area.
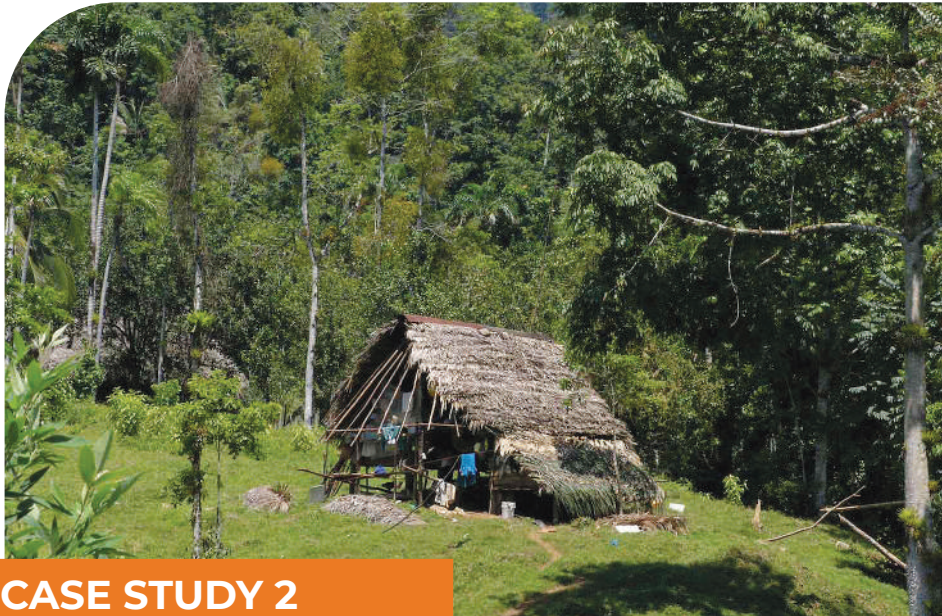
Source: Lon & Queta/Flickr.

CASE STUDY 2
PANAMA

Community-based ecological monitoring and empowerment in Ngäbe communities, Panama

Héctor Turra Chico
Leonor Ceballos Meraz
Olinda Castrellón Sánchez

Context

The *Community-based Ecological Monitoring and Empowerment in Ngäbe Communities* project was developed in the protected territories of San San Pond Sak Ramsar site and La Amistad International Park (PILA). These territories encompass the largest biodiversity in the Bocas del Toro province in Panama (República de Panamá, 2010). Local authorities consider biodiversity conservation especially significant here as it may ensure altitudinal connectivity between these buffer zones (República de Panamá, 2007).

Project Overview and Objectives

Milla Cinco and Buena Selva are the two communities involved in the project. Residents' livelihoods and the biological diversity in their territories have been under threat for several years. This is due to a lack of demographic growth planning and ever more investment projects, such as hydroelectric plants, roads, and banana businesses (Cedeño, 2023). These activities have caused significant deterioration and fragmentation in and between the area's highland and lowland forests and wetlands (Martínez, 2022).

The damage and degradation to the biological corridor between San San Pond Sak and PILA have a direct impact on the altitudinal migration of birds and freshwater fish, as well as the biological connectivity and population viability of terrestrial mammals, such as tapirs, puercos de monte [mountain pigs], and jaguars (República de Panamá, 2007).

For these reasons, the *Institute for Tropical Ecology and Conservation* (ITEC), the *Coalición Ngäbe para la Soberanía Alimentaria* (CONSA) [Ngäbe Coalition for Food Sovereignty], a researcher at the *Centro Internacional de Estudios Políticos y Sociales* (CIEPS) [International Center for Political and Social Studies], and members of the Ngäbe communities started collaborating to address these issues in both territories.

ITEC teamed up with CONSA, an Indigenous NGO, to strengthen the project. CONSA's community and participatory work in local and Indigenous communities in Bocas del Toro complemented ITEC's scientific knowledge and research skills. ITEC—the institution leading the project—has a longstanding relationship with the Ngäbe people and has collaborated with community members on multiple projects for over 20 years. This well-established and successful relationship was a stepping stone to creating the project.

The agreed-upon project objective was to empower Indigenous communities through the monitoring of three key taxonomic groups—freshwater fish, birds, and terrestrial mammals—in the Indigenous territories adjacent to San San Pond Sank, the wetland of international importance,and to the La Amistad International Park (PILA; see Figure 4).

Figure 4: *Milla Cinco community members during a field trip.*

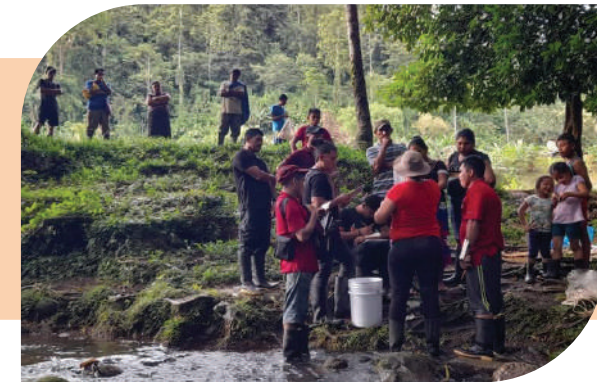*Source: Photo by Olinda Castrellón.*

Sociopolitical Context: Co-Production Challenges and Interests

The project focused mainly on training that would allow community members to monitor key species in their territories. The training activities were carried out with expert researchers from the Costa Rican ANAI Association, a non-profit association dedicated to community and landscape-level initiatives to integrate nature conservation and human well-being, the Audubon Society in Panamá, and the Ramsar Regional Centre for Training and Research in the Western Hemisphere (CREHO) organization. The training included theoretical classes, field trips, and fundamental activities to facilitate the dialogue between Indigenous and scientific knowledge.

One of the main challenges to implementing the project was collaborating with the Buena Selva community at PILA (see Figure 5). This particular community had not participated in the earlier ITEC-led projects that had included other Ngäbe communities. For decades, the Buena Selva community has experienced conflicts with government representatives and frequently rejects the programs proposed by state entities.

Figure 5: *Buena Selva community members participating in a freshwater fish training field trip led by ANAI.*

Source: Photo by Olinda Castrellón.

CONSA's community liaison explained the conflict and lack of trust between communities and government officials, as the circumstances framed her first visit to present the project to the community:

> *Some communities do not have a good relationship with government officials, so when an authority visits them, the community rejects all the programs they propose. Before we started the project, I went there to try to create some connections. When I arrived for the first time, they rejected me too. This is mainly because many projects are developed in Indigenous communities, and the government uses the images of other Indigenous people to build trust with the community.*
>
> *They told me they did not trust me. So, I just listened and talked to them patiently. I felt helpless. I was presenting a project to make connections with science, and being rejected by my people made me feel hopeless. But, in one of the meetings, a person who was the president of the parent-family group in the community stood up and said, "If you feel she is a threat to the community and that she might share information with the ministry, do not worry, I can give access to my land to do this project." That was how we were able to continue with the project.*

The circumstances described above exemplify how more significant sociopolitical conflicts influence transdisciplinary (TD) work. The narrative also illustrates the relevance of mediation and the key role of liaisons with trusted ties to Indigenous communities as critical to facilitating the advancement of these initiatives. Mediation involves navigating the community's mistrust of government entities, their interests, and prior conflicts. This type of work speaks to how conservation and global change initiatives, in general, are embedded "within larger sociopolitical orders" (House-Peters et al., 2023) that add complexity to TD work.

Despite the initial setbacks, community members articulated their interest in participating in the project in two ways:

1) They were interested in learning more about conservation and the species in the areas.

2) They wanted to explore the possibility of creating resources for the community.

A community member explained their idea like this:

> [We want] to study and do our best to understand the animals, fish, birds, and mammals from a scientific perspective and our traditional perspective. We were especially interested in knowing how to use the equipment, the trap cameras.

Other, more significant, current socioeconomic circumstances in the community permeate this interest in learning traditional scientific perspectives about species in both territories. Community members refer to this dimension of their interest as exploring possibilities to obtain resources for the community's livelihood. However, they frequently speak about this dimension in connection to conservation. A community member summarized this idea as follows:

> Our community does not depend on an external economy. We rely on the resources in our surroundings, namely wood, or we do business with what we have at hand. If I bring in a conservation project, we commit, and we will not fish, we will not hunt, I will not cut down trees—but what do we get in exchange? What do we eat? We cannot even farm land because farming needs sun, but if we are not cutting down trees, how can we get sun in this area? We cannot farm in the shade. So, we need to think of a project that sustains the community and creates opportunities so we can train ourselves to ensure conservation.

This quote reflects the complex scenario that Milla Cinco faces when engaging in conservation initiatives in Panamá. The community members frequently comment on conservation public policy-making, seeking a ban on fishing, hunting, and deforestation in different Indigenous territories. However, they also refer to the scarcity of government support and a lack of access to jobs and education in their territories. Together, these circumstances create complex problems for the community. This is the main reason they usually express their interest in conservation, which aligns with their need to access resources that guarantee the community's livelihood (see Figure 6).

Figure 6: *A visit to the Milla Cinco community in July 2023 to learn about the project.*

Source: Photo by Héctor Turra Chico.

Ongoing Sustainability of the Project

This project successfully established community participation in monitoring biodiversity and protecting cultural values within the Ngäbe community of Milla Cinco. As described, this community is in the buffer zone of the internationally significant San San Pond Sak wetland in the province of Bocas del Toro, northeastern Panamá. Given the wetland's ecological importance, which spans 16,125 hectares and is designated as a Ramsar site, the community acknowledges that this territory is essential for the biodiversity and water supply of 56,000 residents. It is recognized as one of the most productive ecosystems globally and one of the most biologically diverse protected areas in Panamá.

The community, particularly women, has actively participated in decision-making on species protection and cultural significance. Activities in Milla Cinco now include monitoring land mammals, leading to the discovery of the Central American tapir, an endangered species that holds significant cultural importance for the Ngäbe. The tapir is vital to the Ngäbe communities as it symbolizes power and strength, and its medicinal properties are highly valued. The bones and hooves of the tapir are used to treat fractures, osteoporosis, and injured ligaments.

Currently, the community is seeking new funding opportunities for tapir protection that respond to local interests and ensure the sustainability of TD conservation initiatives designed by the community and based on local priorities.

Key Takeaways & Lessons Learned

Community members asserted that the training activities carried out in collaboration with ITEC, ANAI, Audubon, and CREHO scientists were the main impact of the project. Community members emphasize that this allowed them to connect scientific and Ngäbe knowledge. A member of the Milla Cinco community explained this idea as follows:

We learned about the scientific animal names, the time when fish and birds migrate, why mammals select certain territories and how to locate them... We knew most of this in Ngäbe, in our language, but I did not know the scientific language.

According to community members, the workshops and practical activities have also helped them think about bringing together their interest in conservation and finding sustainable sources of income for the community. A community member explained that "in the future, we want community ecological tourism"—facilitated by connecting what they have learned in the training and their ancestral knowledge of the territory.

Table 2: Summary of Key Takeaways & Lessons from the Panamá Case Study.

TD Skill Competence Area	Takeaway/Lesson Learned
Leadership Roles & Skills	• Community liaison role: A team member with trusted community ties and strong mediation skills. The liaison facilitates trust building, authentic connections with the community, and listening and responding actively to the community's needs and concerns. • Mediation may involve navigating the community's mistrust of government agencies, their interests, and prior conflicts.
Community Engagement & Partnership Building	• In this case study, a community group had previously had negative experiences with government agencies. • To strengthen engagement and build trust, the team partnered with a well-respected Indigenous NGO with a long-standing relationship with the community and experience with on-site participatory work. • Identify and build relationships with partner organizations that complement and expand the skills of the research team.

TD Skill Competence Area	Takeaway/Lesson Learned
Co-Design of Project Objectives and Goals	• The project objective was co-created with the community to focus capacity building on training and workshops to empower the community to take ownership of the ecological monitoring system. • Co-develop projects that sustain the community and create opportunities for training so that communities can guarantee long-term conservation outcomes, beyond the project lifecycle.
Collective Learning and Practical Skill Building	• Training activities (workshops and practical activities) were co-designed to meet community needs, such as allowing community members to monitor key species in their territories. • Training included theoretical classes and field trips, facilitating dialogue between Indigenous and scientific knowledge. • Learning should be connected to community interests and needs; for example, conservation and livelihood protection should be connected, and desired skills (e.g., how to use monitoring equipment) should be provided.

Source: Freepik.

CASE STUDY 3
JAMAICA

Jamaican Women In Coffee (JAWiC)

Marshalee Valentine

Context

Jamaican Women in Coffee (JAWiC) is the National Chapter of the International Women's Coffee Alliance (IWCA), which shares a mission to connect and empower women within the Jamaican coffee industry, striving for equitable access to resources and the rightful recognition of their valuable contributions. With a commitment to building a sustainable future, JAWiC focuses on enhancing women's roles in the coffee value chain and elevating the production and quality of their coffee for both local and international markets.

Project Overview and Objectives

Our journey began in 2019 with a self-funded pilot field survey involving coffee farmers in the Jamaica Blue Mountains (Birthwright, 2020). The exploration aimed to understand the unique challenges faced by women in the local coffee industry, focusing on vulnerabilities, perceptions, livelihood experiences, and adaptation strategies. The collected data highlighted significant gender imbalances hindering women's professional growth, stifling sector diversification, and limiting personal and professional development. Economic opportunities were constrained by a lack of knowledge, affecting the quality and sustainability of their coffee farms.

As we recognized the potential impact on the local coffee sector, our mission evolved to address these challenges systematically. The insights from our initial survey informed the design of a project that specifically targeted the identified challenges, aiming to benefit the women directly involved and contribute to the sustainable development of entire coffee-producing communities. The Strengthening the Capacity of Women Coffee Farmers Through Training project focused on the renowned Blue Mountain region, known for its high-quality coffee, despite Jamaica's modest overall coffee production.

The project objective was to use the information gathered from the survey to empower women coffee farmers in the St. Thomas and St. Andrew regions of the Jamaica Blue Mountains. This would be achieved by providing hands-on training in soil management, organic farming, pest control, harvesting practices, and environmental management for coffee production. Additionally, the initiative sought to sensitize the national coffee-growing community through advocacy and outreach. The project unfolded in two phases:

- **Phase 1:** 2021–2022 (St Thomas, Jamaica Farming Communities)
- **Phase 2:** 2022–2023 (St Andrew, Jamaica Farming Communities)

Stakeholder Collaboration

JAWiC played a pivotal role in driving the successful implementation of this project, serving as a central coordinator. The Canada Fund for Local Initiatives provided crucial funding and support to implement the project. Agronomists and dedicated skilled volunteers played a key role by facilitating specialized training in essential areas.

The active participation of women coffee farmers was integral, as they shared their invaluable knowledge and experiences and also actively engaged in the learning process, contributing to the project's success.

Additionally, the Jamaica Agricultural Commodities Regulatory Authority offered support by providing extension officers to assist in training, enhancing the overall impact and effectiveness of the initiative.

Implementation Details

Some key features that supported the implementation of this project are described in the following subsections..

Social Learning for Transformative Outcomes

Active community engagement was fostered through situational analysis, promoting a deep understanding of the specific needs of women coffee farmers and building trust within farming communities. In addition, JAWiC contextualized the solutions and information shared throughout the project in initial awareness-raising workshops to help foster change and transformation during the implementation.

Grassroots TD Co-Production Processes

The co-design and co-production process was essential in enhancing the depth and effectiveness of the initiative. Women farmers actively shaped the project through the workshops, helped identify problems and collaborated with agronomists and expert volunteers to create tailored solutions. This process allowed us to deploy lessons learned from Phase 1 to improve Phase 2, thereby ensuring adaptive learning and refinement based on feedback and outcomes (see Figure 7).

Figure 7: *Agronomist Nicheal Dadzie, demonstrating best practices in soil management to coffee farmers in the St Thomas Blue Mountain Region.*

Source: JAWiC.

Communication Mechanisms and Strategies

The project's implementation process involved tailored in-house and in-field training sessions. While technology was used to some extent, the training material presented was adapted for in-field use. To communicate with the stakeholders throughout the process, JAWiC leveraged mechanisms such as publications, video storytelling, and advocacy to ensure challenges identified in the situational analysis and the solutions being carried out were communicated to the stakeholders.

Local Sociopolitical Context: Challenges and Interests

The project faced challenges such as difficulties accessing farming communities, limited female participation, perceived unfair compensation, and a lack of government support. However, consistent communication and overcoming past failures were able to address initial mistrust.

Actionable and Transformative Results

Deliverables were directly tied to the identified issues, including delivering capacity-building workshops, issuing record-keeping booklets, care packages (equipment, seedlings, and inputs), and farm tours. Meaningful feedback was received from beneficiaries of the program:

Leisa said the following: I just look at my coffee farm as just being a coffee farm. But since I've been introduced to JAWiC… it has given me more details of how to take care of my farm, what to look for on my farm, what to expect, how to increase my crop, how to manage my crop, when to spray, to take notes. Like what to take notes on at times like when I spray or when I fertilize. Basically, just manage my farm…better than all I was doing before. So, it has helped me through that process. I've learned a lot, and my management of my farm now has grown since then and my production has grown also…. And the experience that I had with JAWiC, it was great.

Louise had this to say about her participation in the initiative. The training was very interactive. I learned a lot from them, and it wasn't hard for us to understand what they were saying, because they brought it down to our level, because not a lot of us speak straight English… so we can understand what they are teaching us. So, we didn't have a problem with the relationship with JAWiC. It is excellent, because of what they do for us, they try to interact with us, any little thing. They inform us. They call us. They just try to get us involved in everything. They will not do anything without us. They make sure everyone is involved in what they are doing in the training. They make sure everybody is learning because you have some slow learners and some fast learners. So, the relationship with them was very good, and it's still good. We can call them, we can say anything to them. If we went to our farm and we realized that something is not right here, we can call them, any one of them.

Ongoing Sustainability of the Project

Several strategies were implemented to ensure the project's impact beyond the initial interventions:

- **WhatsApp Group:** A dedicated WhatsApp group was established to foster ongoing communication and information sharing among the women farmers and stakeholders. This platform enables continuous engagement, knowledge exchange, and networking opportunities.

- **Community Leader:** A designated point of contact within the group was identified to serve as a community leader. This individual contacts JAWiC and relevant agencies when issues arise, ensuring a direct line of communication and prompt response to community needs.

- **Government Agency Engagement:** Women farmers were encouraged to actively participate in initiatives organized by government agencies such as JACRA and RADA. This involvement informs them about current industry issues, solutions, and available resources.

- **Partnerships with Industry Stakeholders:** Collaborations were established with agencies such as fertilizer and chemical companies. These partnerships inform farmers about new farm management and sustainability technologies, promoting continued learning and adaptation.

By implementing these strategies, we created a sustainable framework for ongoing support, knowledge sharing, and empowerment within the coffee farming communities.

Key Takeaways & Lessons Learned

Despite challenges, the project yielded positive outcomes. To ensure that the assessment of project impacts aligns with the experiences and aspirations of the women coffee farmers, we conducted a monitoring and evaluation survey, where the women expressed gratitude for the knowledge sharing and support (Birthwright, 2022). The survey, conducted eight months after implementation, revealed that most respondents reported improved coffee production, reduced pest incidence, and increased confidence in managing their farms (see Figures 8 and 9).

The women's overall confidence also surged, leading them to offer guided tours of their farms, speaking confidently from a place of enhanced knowledge. Phase 2 of the project received support from the Jamaica Agricultural Commodities Regulatory Authority (JACRA)—the local government authority responsible for coffee—by assigning advisory officers to participate in the training activities. The regulatory body has also since highlighted interest in working with JAWiC to ensure the needs of women farmers are understood and addressed.

Figure 8: *Farmers from the St Andrews region being awarded a certificate of participation by JAWiC board members.*

Source: JAWiC.

Figure 9: *Farmers from the St. Thomas Region and JAWiC board members showing appreciation to the Canadian High Commissioner at their graduation ceremony, after training workshops were completed in 2024.*

Source: JAWiC.

TD Skill Competence Area	Takeaway/Lesson Learned
Trust Building & Conflict Resolutit	• Initial mistrust due to past failures of government initiatives needed to be overcome through consistent communication and engagement. Building trust is essential for the success of such projects. • Community conflicts can hinder participation. Strategies for conflict resolution and community building could be incorporated into future projects.
Community Engagement & Collaboration	• The project's success was partly due to its emphasis on active community engagement and collaboration. This ensured that the project addressed the specific needs of women coffee farmers and fostered trust within the farming communities.

TD Skill Competence Area	Takeaway/Lesson Learned
Co-Design of Project Objectives and Goals	• The participatory approach was highly valuable. • The co-design and co-production process, where women farmers actively helped shape the project's focus, proved effective. This approach ensured that the solutions were holistic and relevant to the challenges faced by the women.
Capacity Building, Advocacy & Gender-Specific Concerns	• The project's focus on capacity building through training in various aspects of coffee farming led to increased knowledge, confidence, and improved farm practices among the women. • Video storytelling and other advocacy efforts helped raise awareness of the challenges faced by women coffee farmers and the project's impact. • Limited participation of women due to household responsibilities was another challenge. Future projects could explore ways to better support women in balancing their domestic duties with their participation in such initiatives.
Monitoring & Evaluation	• The monitoring and evaluation survey provided valuable insights into the project's impact and areas for improvement.

Source: Estación Biológica El Limón.

CASE STUDY 4 MÉXICO

El Limón Community Conservation and Environmental Education Program, México

Gabriela Alonso Yáñez
Alejandro Mata Reyeros

Context

The El Limón Community is located in The Sierra de Huautla Biosphere Reserve (SHBR), an integrative conservation initiative where ecological protection coexists with the needs of the local population. The SHBR was officially decreed in 1999. Since then, it has been co-managed by the National Commission of Natural Protected Areas (CONANP) and the Center for Research in Biodiversity and Environment (CIByC) at the Morelos State Autonomous University (UAEM). This unique arrangement also involves other stakeholders, including 31 communities, local groups, and an NGO.

The SHBR, located in the Balsas River Basin, holds the largest remnant of tropical deciduous forest in central México and is a rich reservoir of species endemic to México. The protection area covers five municipalities in the state of Morelos in central México: Amacuzac, Puente de Ixtla, Jojutla, Tlaquiltenango, and Tepalcingo. The El Limón community is located in Tepalcingo and has 129 inhabitants (see Figure 10). Morelos is one of the most impoverished states in México. For this reason, many youths and adults in the El Limón community emigrate temporarily to the USA in search of employment opportunities.

Figure 10: Tropical dry forest surrounding El Limón biological station.

Source: JAWiC.

Project Overview and Objectives

The main project objective for biodiversity conservation in Sierra de Huautla is addressing agricultural issues and promoting environmental education programs focusing on community-based conservation principles. Community members consistently seek government support to diversify crops and access technical advice that meets farmers' demands. Communities have also requested access to projects that offer capacity building on marketing strategies to support the sale of crafts and traditional goods. This objective is central to community members in El Limón, as traditional practices and symbolic customs are important in daily life. These aspects are evident in the inhabitants' knowledge of medicinal plants and cultural festivities.

Community-based environmental education activities are central conservation goals in the area. The El Limón community hosts a place-based education program and is also the site of the central Biological Station, which is run by University of Morelos staff. These individuals have designed environmental education and community conservation programs with community members.

The El Limón Community Conservation and Environmental Education Program offers a long-term transdisciplinary (TD) project platform (Tauro, et al., 2021). Field stations are suitable environments for TD work since they are not necessarily associated with any specific sector, such as education, academia, policy/decision-makers, or government staff. For instance, the work done in the field station at El Limón includes initiatives conducted through the collaborative efforts of the local community members, who participate as local guides, environmental education curriculum designers, and cultural guides (see Figure 11).

Figure 11: Designing an environmental education trail in El Limón.

Source: Photo of Alfredo Pacheco Arias and Gerardo Pacheco Arias by Alejandro Mata.

Ongoing Sustainability of the Project

México is emerging as a major center for officially recognizing Indigenous and community-led conservation initiatives (Acevedo-Ortiz et al., 2024). However, México's primary official conservation mechanism prioritizes natural protected area models managed by the federal government. These externally driven conservation initiatives have shown limited success.

In contrast, community-led conservation projects in El Limón have been successful. Designed by local community members, these initiatives offer significant conservation benefits and genuinely engage the community. They are not necessarily based on conventional science or government-led templates but effectively support community organizations and strengthen traditional knowledge-based strategies. The partnership between university officials, government representatives, and community organizers in El Limón is engaged in ongoing conversations to improve collaboration and build capacity for other communities in the area to take on leadership roles in managing and designing conservation projects.

The El Limón community has a long history of commitment to protecting their territory. For instance, before the partnership with the government and the university was established, the community did not use live trees for timber and local use. This commitment reflects a deep respect for nature and a desire to preserve the ecosystem. Additionally, the community made a conscious choice to refrain from hunting deer, adhering later to strict legal hunting regulations once the natural protected area was established. This decision underscores their historical commitment to sustainable practices and wildlife conservation.

More recently, the community has implemented specific measures to protect their environment, such as restricting outsiders from engaging in activities that involve resource extraction through surveillance. This policy aims to protect their land and resources while fostering a sense of pride and ownership among community members.

A significant aspect of their culture revolves around protecting traditional practices, including medicine and food. The partnership with a university has proven invaluable in documenting these traditions, ensuring they are not lost to time. This collaboration has also allowed for the official support of various initiatives that enhance local culture and sustainability efforts. Many existing community projects have gained traction through formal channels, contributing to a richer understanding and appreciation of the community's heritage.

The overarching framework for these initiatives is governed by federal legislation, which further solidifies their mission to safeguard their way of life and ensure the sustainability of the conservation projects.

Key Takeaways & Lessons Learned

The strengthening of TD work is evidenced by the engagement of local members as collaborators in the Community Conservation and Environmental Education Program.

This collaboration started when the Biosphere Reserve was established through a collaborative zoning mechanism model that balances sustainable human use and the protection or restoration of biodiversity in human-managed landscapes. As a result, El Limón's local inhabitants currently participate in mechanisms for authentic, equitable, and respectful joint work. Some examples are shared funding management schemes and shared access to decision-making in fund allocation, such as prioritizing community festivities and infrastructure for the community (see Figure 12).

Figure 12: *Field station in the El Limón community.*

Source: Photo by Héctor Turra Chico.

TD Skill Competence Area	Takeaway/Lesson Learned
Leadership	• Share project leadership with community members, including project design and management. • Engage in ongoing dialogue to improve collaboration and build capacity for other communities in the project area to take on leadership roles in managing and designing conservation projects.

TD Skill Competence Area	Takeaway/Lesson Learned
Community Engagement & Collaboration	• University–community partnership helped to document local traditional and cultural practices important to the community. • Achieved official support for initiatives to enhance local culture and environmental sustainability efforts. • Field stations can be suitable for conducting work, as they are often not necessarily associated with a specific sector. • Community members participate as local ecological and cultural guides and environmental education curriculum designers.
Co-Design of Project Objectives and Goals	• Co-design of environmental education and community conservation programs in collaboration with community leaders. • Community-led conservation projects have shown success in offering significant conservation benefits and genuine community engagement and participation.
Capacity Building & Education	• Community-based and place-based environmental education. • Effectively support community organizations and strengthen traditional knowledge-based strategies. • Recognize community concerns and needs, such as intersections of livelihood concerns and ecosystem conservation. For example, capacity building for agricultural diversification and marketing strategies for selling crafts and traditional goods, jointly with technical training.
Cross-scalar Alignment	• Initiatives align with frameworks codified in federal legislation. Improves long-term sustainability of the conservation projects.

Source: Sanear Amazônia.

CASE STUDY 5
BRAZIL

Community-Based Public Sanitation:
Sanear Amazônia Project, Brazil

Karla Oliveira
Carolina Bernardes

Context

Sanitation is one of the biggest challenges facing riverside communities in the Amazon. Since colonization, parasitic diseases (worms, malaria, dengue, and other illnesses) have affected Amazonian peoples (Indigenous peoples, *extractivist* and *ribeirinhos* communities), causing economic and social damage to the region. The lack of access to healthy water quality and sanitation systems, along with practices typical of socially and environmentally vulnerable communities (such as open defecation, defecation in rivers, and the use of latrines and open cisterns), points to a substantial historical health debt owed by the state to these peoples.

The term *extractivist* communities, unique to the rest of Latin America, is used in Brazil to refer to people (peasants) who traditionally gather timber and non-timber products from the forest to sustain their livelihoods. The term *ribeirinhos* communities is often used interchangeably with *extractivist* communities to describe traditional Amazon communities living near wetlands or rivers.

Through a long-term participatory and TD process, community-based organizations and social movements funded by the Brazilian government implemented a community-based public sanitation policy and infrastructure. This project successfully provided quality water and sanitation in the territories of traditional *extractivist* populations in the Amazon, meeting human rights guarantees for these critical services (see Figure 13).

Figure 13: *Traditional community in the Rio Cajari Extractivist Reserve, Amapá State.*

Source: Photo by Karla Oliveira.

Project Overview and Objectives

The main objective of the Sanear Amazônia project was to guarantee access to quality water and sewage disposal for socially vulnerable communities in the Brazilian Amazon. The project supported the community's right to access water of the quality and quantity necessary for their livelihoods. The Sanear Amazônia project has built over 3,000 water and sanitation technologies, benefiting eight traditional territories and approximately 15,000 people. Another 500 technologies will be built to benefit an additional 10 extractive territories.

However, achieving such significant results required a lengthy process involving the design of social technology for water and sanitation access, building these technologies, and educating local families on how to maintain them (Oliveira, Bernardes, & Silveira, 2020). In 2007, the Association of Rural Producers of Carauari (ASPROC), in collaboration with the National Council of Extractivist Populations (CNS), sought support from academics and researchers to develop technology aimed at promoting sanitation in communities within the Médio Juruá Extractivist Reserve, located in the municipality of Carauari. Quilvilene, a member of ASPROC, had this to say about participating in the initiative:

My family was one of the beneficiaries of the Sanear Amazônia Project. Our community was the first to receive the technologies, marking the project's initial phase. In the Mid-Juruá River, numerous lakes are formed that experience six months of drought followed by six months of floods. During the dry season, the lakes accumulate silt, making access to water difficult. This posed challenges for tasks like cleaning fish, washing dishes, and performing household chores. It was a challenging situation. However, after the implementation of the project, our lives changed dramatically, and our community became a model for the initiative, leading to the expansion of this technology to other communities.

Project Challenges

The goal was to develop social technologies for water and sanitation access in approximately 15 communities within the Mid-Juruá Reserve. However, finding researchers sensitive to the communities' demands and cultural and environmental contexts was challenging. After an extensive dialogue process between the traditional communities and academic researchers, the National Council of Extractivist Populations (CNS) began to receive support from researchers at the University of Brasilia (UnB). One member of CNS, Carolina Bernardes, commented on some of the complexities inherent in this project:

At the beginning [of the experimental project], some university scholars were interested in collaborating, but only with the technologies that hadn't already been tried in the Mid-Juruá [River] context. In sanitation, we have an extensive "menu" of technologies. However, if communities chose a latrine, they would have to clean it eventually. Due to the Amazonian environment [flooded areas through most of the year], we adapted a technology better suited to the social end. So, we decided to use a stank latrine that doesn't require operation and maintenance for approximately 70 years.

It was a lengthy process of adapting the social technologies and aligning the project activities with the pace of time in the communities, as well as that of relevant social movements and the timeline of academic research. The reality is academic research often progresses at a pace that may be too fast for traditional communities. Simultaneously, the political timeline of social movements does not always align with that of researchers. Implementing the Sanear Amazônia experimental project required approximately two years of close coordination among partner institutions, from the initial idea to constructing the first technology.

Figure 14: *Sanear Amazônia technology at a house in the Mapuá Extractivist Reserve, Pará State.*

Another crucial aspect during the completion of the experimental project was determining which community would receive the technology (see Figure 14). All partner institutions recognized the significance of directing efforts toward the most vulnerable communities. However, given the showcase nature of the project, it was essential to select communities with a robust social organization. This decision aimed to ensure the success of subsequent experiments.

Source: Photo by Karla Oliveira.

The TD team, comprised of representatives from ASPROC and CNS, and academics from UnB, are actively involved in educating the communities about the technology's proper use, maintenance, and operation. Additionally, to ensure the sustainability of the technologies, the team has encouraged communities to draft a community management agreement for the technologies as part of the implementation. This is an agreement among those who will benefit from technology, specifically representatives of the community association and the social and political actors involved.

Ongoing Sustainability of the Project

A key aspect of the Sanear Amazônia project is forging strong partnerships. It is essential to have support from families, communities, and local organizations to change attitudes and behaviors regarding water and food security. The project encourages the participation of families and the community at every stage, including planning, implementation, monitoring, organization, and assessment. Both individual and collective actions will help enhance participants' self-esteem, independence, and creativity.

Everyone involved in the project believes it will succeed through three primary sources of support: (1) the grassroots efforts of ASPROC, which fosters close connections with communities and trains members to maintain their sanitation systems (see Figure 15); (2) the advocacy of social movements like CNS, which work towards the project's long-term success; and (3) ongoing funding from public, private, and community sources. This initiative aims to ensure that Amazonian communities have the right to clean water and sanitation.

Figure 15: *Mobilization of the Association of Rural Producers of Carauari (ASPROC).*

Source: Photo by Karla Oliveira.

Key Takeaways & Lessons Learned

The scientific results of the Sanear Amazônia project on children's health in the first participating communities showed significant results: morbidity from diarrhea decreased by an average of 65%, morbidity from intestinal parasites was reduced by 22%, and the population's overall quality of life increased. This improvement is reflected by an average reduction of 63% in community dissatisfaction and a 100% increase in the perception of the relationship between improved quality of life and sanitation (Bernardes, 2014). These successful outcomes prompted the CNS to expand the strategy. This initiative thus invited the Brazilian federal government to fund additional technologies in other territories inhabited by extractivist populations across various states of the Brazilian Amazon.

The project underwent expansion in 2014, facilitated by political coordination between the CNS and the federal government. The Sanear Amazônia project was subsequently included in a specific public policy for the Amazon. Currently, the project focuses on evaluating and enhancing public policy to better address the diverse realities of communities in the Amazon. This includes considering technical, environmental, logistical, and community/associative management aspects (Silveira, Dias da Costa & Bernardes, 2018).

Table 5: *Summary of key takeaways & lessons from the Sanear Amazônia Project.*

TD Skill Competence Area	Takeaway/Lesson Learned
Leadership	• Researchers who are sensitive to the community's needs and the unique cultural and environmental context. • Empower the beneficiaries of the research to take ownership and management over the implementation and maintenance of the technologies.
Community Engagement & Collaboration	• A key aspect of the Sanear Amazônia project is forging strong partnerships. • Long-term dialogue-based, participatory process between traditional communities and academic researchers. Project implementation took approximately two years of close coordination among partner institutions, from the initial idea to constructing the first technology.

TD Skill Competence Area	Takeaway/Lesson Learned
Co-Design of Project Objectives and Goals	• The project encourages the involvement of the users of the research and beneficiaries of the technology (e.g. families and community members) at every stage, including planning, implementation, monitoring, organization, and evaluation. • Align project activities with the pace of time in the communities, political timeline of relevant social movements, and academic research and funding timelines.
Capacity Building, Advocacy & Funding	• Train community members to maintain the sanitation system: team members were actively involved in educating communities about the proper use, maintenance, and operation of the technology. • Formulate a community management agreement for the technologies as part of the implementation process. • Partner with local social movement groups with advocacy capacity • Diversify sources of project funding from public, private, and community sources.
Cross-scalar Alignment	• Successful outcomes of the research and implementation were mobilized to request additional funding from the Brazilian federal government to expand to other territories. • Political coordination between academic and government partners facilitated the incorporation of the project's findings into public policy for the Amazon region.

Fuente: Valeria Gaibisso/Flickr

CASE STUDY 6 URUGUAY

The Solís Grande Stream Watershed Protected Area, Uruguay

Héctor Turra Chico
Andrés Fernández
Horacio Cabrera

Context

The Solís Grande Stream watershed covers an area of 1,409 km² in the rugged terrain of the Canelones department and is recognized as a potential conservation area in Uruguay (Gobierno de Canelones, 2019). In 2016, the local authorities in Canelones sought to develop a public policy to enable new mechanisms for territorial organization and create regional protected areas (Gobierno de Canelones, 2020). Local authorities contacted the Eastern Regional University Center (CURE) to facilitate natural and social studies that would support the declaration of the protected area in the Solís Grande Watershed (Maubrigades et al., 2020). One of the primary mandates for the CURE team—months before the official start of the project—was to establish collaborations with the communities in the area, design the project, and take the necessary actions to create the protected area.

Project Overview: Co-design and Participatory Strategies

The focus of the final project, which was developed with community members, was to improve the conservation status of the area, with a particular emphasis on protecting the quality of the water, natural fields, native forests, and cultural heritage—while also promoting sustainable and productive land-use practices. The project's overarching objective was safeguarding and preserving biodiversity in the Canelones department in Uruguay.

The project was designed and implemented in collaboration with community members, CURE scientists, and representatives of the Canelones Government (Intendencia, municipalities, and other local government institutions). Collectively, these groups represented over 10 organizations with different stakes in the area. Their collaboration extended for approximately five years, from 2016 to 2021.

The various actors participated in all project dimensions, including the studies needed to describe the area and develop and deploy a management plan for the protected area (see Figure 16).

Figure 16: *The first session of the Administrative Commission of the Protected Area at the Arroyo Solís Grande.*

Fuente: Foto de Andrés Fernández.

The design and project implementation activities were conducted mainly through a territory-based approach and collective synthesis. These strategies enabled key actors to co-create the project and conduct the biological and social studies now included in the decree that established the limits of the protected area:

- **Territory-based approach.** CURE scientists visited every household in the area to explain the governorship's intentions and capture their perspectives. During these direct conversations with neighbors, scientists asked to be referred to other households. This snowball sampling led them to speak to virtually every neighbor in the area (Fernández et al., 2023).

- **Collective synthesis.** This strategy was used at different times during the implementation to collectively decide on the relevant dimensions of the protected area, such as its geographical limits, objects of conservation, and proposed normative texts. Community members, civil society organizations, representatives of the municipalities and the Canelones Government, representatives, and CURE scientists participated in these meetings. The agreements between these participants were recorded in written agreements that were finally submitted to the Junta Departamental [Department Board], which oversees these participatory processes.

Interests and Commitments

A primary challenge during the original project concerned the different interests and commitments of the neighbors who created the protected area. Some people joined the project expecting financial aid that would help them grow their businesses. In contrast, others felt deeply connected to the territory and sought to establish respectful relationships with it (see Figure 17). A neighbor in the area explained his connection with the territory as follows:

I am not an environmentalist nor a defender of the environment; I am the environment. I am the environment the same as an earthworm, the same as a stream or weed. So, for me, it is really easy to talk, engage in conversation, listen, and try to convince somebody next to me—because I speak for a bee or a bird that does not know how to communicate, or they do communicate, but we humans cannot understand them.

Figure 17: *The wetlands at the Arroyo Solís Grande.*

Source: Photo by Alicia Gutiérrez.

They expressed that the connection they feel with the territory drives their participation in the project; it allows them to explore possibilities to think through key questions, as one participant noted: "What is best for the environment? What are less harmful possibilities? And [we can] discuss different people's ideas for the sake of the environment." However, other people began participating in the project as a way to explore the benefits that accrue to their businesses. This different perspective created problematic situations in establishing the final group that would be part of the initiative. A local farmer introduced these difficulties by referring to the expectations of some farmers:

Many farmers attended the first meetings. I remember that one of the farmers was very clear and said, I am willing to work on this. What are you going to give me in return? Am I going to get a tax cut? What is in it for me? Why would I want to change the way I work? The Canelones Government never provided a clear response [to these questions].

These expectations of receiving benefits and the lack of response from the Canelones Government representatives regarding potential financial benefits were mentioned as reasons why a few initial participants abandoned the initiative in its early stages. A neighbor confirmed these expectations and explained his perception of this situation in the following way:

One of the biggest producers in the area, a potato farmer, is the one that uses the most chemicals on the ground. [This person] was only interested in economic results, which is not necessarily bad because they have a company, they have employees, and they have to maintain their families, machinery in a business that can be very risky… When it is about something that, in the short and long term, will benefit our families, your neighbor's family, and [they] have everything to carry it out, you say, "Well, I do not agree because I will not get a tax cut, for example."

This project has been characterized by these diverse and sometimes divergent interests, which have led several community members to participate in and abandon the initiative. For neighbors, this diversity of interests presents a challenge when creating collaborations and reaching agreements during the different stages of the project. Someone referred to how they addressed these potentially conflict-inducing issues: "talking, looking at one another in the eyes and placing good faith at the center."

These issues speak to the ethical commitments at stake, which frame the relations among different actors in TD projects (Thompson et al., 2017) and thus must be considered to shed light on the challenges of TD-oriented projects.

Ongoing Sustainability of the Project

The ongoing collaboration at Canelones, Uruguay, is managed by the Environmental Protected Area (*Área de Protección Ambiental, APA*) administrative commission. This entity was created in 2018 and includes representatives of the local governments, neighbors of the area, and academics and scientists. The commission fulfills the local governments and academic actors' original mission "to democratize scientific knowledge regarding biodiversity, conservation, natural resources and sustainable development." (Gobierno de Canelones, 2021).

The APA Administrative Commission makes strategic decisions regarding the area's management, planning, and overall administration. It operates as a participatory platform that addresses the needs and concerns of residents, ensuring their voices are central to conservation efforts. Through this governance structure, the commission has fostered enduring collaboration among the various stakeholders involved in the initial creation of the protected area. This collaborative mechanism continues to guide conservation activities within the Solís Grande Stream watershed (see Figure 18).

Figure 18: Cattle grazing in the Solís Grande Wetlands.

Source: Photo by Andrés Fernández.

Factors such as citizen involvement and citizen-based territorial decision-making (Gobierno de Canelones, 2021) are crucial to understanding the sustainability of the collaborations. The local government and academic institutions have advocated for these principles to address biodiversity conservation with cultural, social, and other human considerations. The APA Administrative Commission has empowered local actors to influence environmental decision-making by serving as the primary participatory forum.

Here, participants have contributed to developing alternative environmental indicators that are now used by local governments and as communication tools for advancing environmental policies that reflect the perspectives of local communities.

Lessons Learned & Key Takeaways: Impact and Policy Development

Community members explained that the most relevant impacts of this project were creating the policy that established the status of the protected area and the plan stating how to manage it. One of the neighbors explained that the protected area status had allowed them to "develop a respectful relationship with the environment."

The policy and the management plan have facilitated a new ongoing collaboration between community members and entities in the Canelones Government. Residents considered this new stage beneficial because it allowed them to receive resources to maintain the protected area and develop an economy whereby they can consider "what is best, not for us, but for the environment" at the Solís Grande Stream watershed.

Table 6: Summary of key takeaways & lessons from the Solís Grande Project, Uruguay.

TD Skill Competence Area	Takeaway/Lesson Learned
Community Engagement & Collaboration	• Strong citizen involvement in project framing and decision-making • Scientists used an intensive community engagement method of approaching every household in the area to explain the project's intention and capture residents' perspectives, thus engaging almost every resident in the area.

TD Skill Competence Area	Takeaway/Lesson Learned
Co-Design of Project Objectives and Goals	• Project design and implementation were co-developed with community members, scientists and government representatives. • The shared goal is to create a policy to establish a protected area status and management plan based on common interest to improve the area's conservation status, safeguard biodiversity, and promote sustainable and productive land use practices.
Capacity Building, Advocacy & Empowerment	• Local governments and academic institutions advocated for biodiversity conservation based on principles that recognize and respect cultural, social, economic, and other human considerations. • Local actors were empowered to influence environmental decision-making. For example, participants contributed to developing alternative environmental indicators, which are now used by local governments. • Participants felt seen and heard in the process and that the environmental processes reflected their perspectives and needs.
Conflict Resolution	• Diverse and divergent interests and values created the need for conflict management and resolution. • Neighbors had relationships built on trust and could resolve conflicts ethically.

Source: David Antonio Lopez M./Shutterstock.
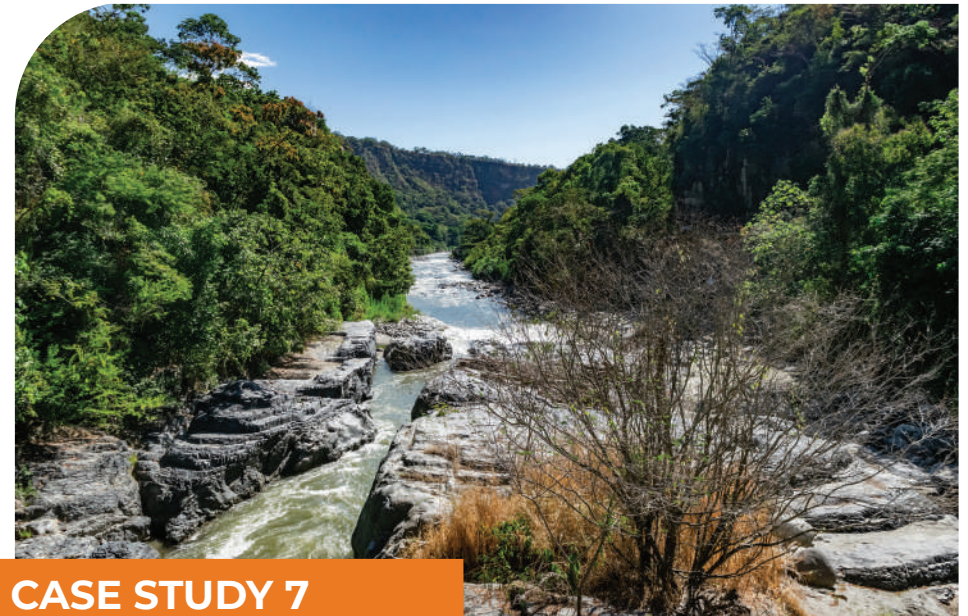
CASE STUDY 7
COLOMBIA

The Social Management Of Water In The Coello And Cucuana River Basins, Colombia

Jorge Rubiano Páez
Amparo Gutiérrez López

Context

A critical social engagement process is underway in the highlands of central Colombia, specifically in the basins of the Coello and Cucuana rivers: Andean ecosystems of high strategic, socio-environmental and economic value for the center of the country (see Figure 19). Notably, several challenges affect conservation and the general well-being of the population in this area: climate change; unsustainable production systems; extractivism, such as open-pit mining, and the poor and inadequate political and civic education of citizens in the region.

Figure 19: *Páramo de Anaime y Chili in Cordillera Central, Colombia, in 2022.*

Source: Semillas de Agua Corp.

Project Overview and Objectives

Peasant communities and urban leaders in the watershed have been participating in a process called Social Water Management in the Coello and Cucuana watersheds since 2005, an initiative based on a participatory research action alliance comprised of Colombian NGOs, research centers, and universities with experience in rural development, environmental research, and social law. Between 2005 and 2012, this participatory process facilitated multidisciplinary work, encompassing a diversity of disciplines and sectors, driven by the following objective:

> *To contribute to collective action at different social and ecological scales in the watershed, to enable a better and greater distribution of responsibility and benefits resulting from the sound management of ecosystems*

The process facilitated an initial and sequential stage of political and civic training of communities, local leaders, and officials, which improved advocacy capabilities by creating more appropriate spaces for citizen participation—for instance, the Citizen Action Conversatory (CAC). The CAC is a legal-political mechanism designed by the Colombian NGO *Asesorías para el Desarrollo* (ASDES). It is informed by three key pillars: 10 constitutional principles; Law 134 passed in 1994, which regulates the development of citizen participation mechanisms in the country; and especially Article 1 of this law, which establishes a window to allow citizen initiatives to pursue actions. Before this mechanism, citizens could not generally take such organized actions.

Collective Action

The CAC mechanism helped community members create binding agreements between communities and institutions to collectively solve social, economic, and environmental problems associated with watershed management. In the words of one veedora [a community member observer] Amparo Gutiérrez, this citizen experience was quite meaningful:

> *The talks allowed us to lose our fear of the institutions and learn that we have rights and obligations—we finally freed our voices and [access] our rights.*

Collective action unfolded in a process that moved from preparation to negotiation in the CACs. The talks included, on one side, small farmers, artisanal miners, fishermen, and urban community leaders, and on the other side, relevant institutions, the private sector, and state financial management entities working as guarantors of the CAC agreements. Together, they joined efforts to solve the problems identified in the Coello and Cucuana watersheds. In addition, the CAC processes also invited all the various actors to co-produce their action plans, emphasizing both existing and their conceptualizations of poverty, well-being, cooperation, shared benefits, hydrology, and access to water (see Figure 20).

Figure 20: *Example of a civic engagement and social learning presentation in 2022 by the Veeduría association to share knowledge and information about threats to the health of the watershed (Note: identifying features have been removed to protect the safety of the members).*
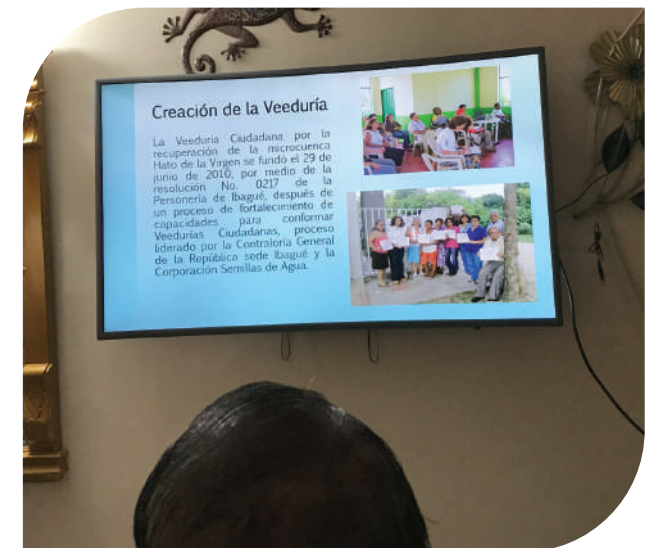
Source: Gabriela Alonso Yáñez.

An inclusive approach that included the actors above strengthened the dynamics in developing the CACs and produced a set of critical thematic axes. This framework allowed them to:

- Prioritize political and civic training.
- Design communication mechanisms.
- Analyze hydrology models of the basin, with and without cooperation scenarios for its conservation.
- Go on field tours and expeditions to learn about the realities of the lower, middle, and upper reaches of the river basin.
- Visit farms undergoing regenerative agroecology processes.
- Develop a strong plan grounded in social law.

Key Aspects of Negotiations

Understanding how the state works—including its powers and using and managing constitutional tools, such as rights to petition, guardianships, and other citizen action tools—was decisive in helping participants demand rights and prepare for negotiations. The negotiation space was configured as an ongoing interaction between civil society actors, local communities, institutions, governments, and universities. The negotiation space facilitated dialogue and enabled participants to align objectives and scope before reaching agreements.

The CAC agreements contributed to designing, adjusting, and adopting municipal and departmental policies to create protected areas in endemic *Páramo* [moorland] ecosystems. They also helped the participants create incentives that would be more just and permanent for conservation, improve land-use and territorial planning processes, and strengthen organizational structures and processes.

Capacity-building strengthened civic and political understanding and skills of collective analysis within the community. Social learning processes—facilitated by community members, NGOs and university researchers—focused on analyzing natural dynamics of earth processes, climate change, and land use, helped citizens better understand the risks of open-pit mining in the high mountain ecosystems in the basins of the Coello and Cucuana rivers (see Figure 21). In 2017, this approach led to another binding constitutional mechanism: the popular consultation of Cajamarca. This citizen initiative managed to ban the implementation of one of the most ambitious and risky mining projects for the high mountains in the center of the country: the La Colosa Regional Mine operated by AngloGold Ashanti Ltd.

Figure 21: 2021 planning sessions and citizen follow-up to the agreements reached at the Citizen Action Conversatory (CAC).

Source: Colectivo ANSUR.

Challenges and Limitations

The main challenges and limitations inherent in these processes of engagement and negotiation focus on three areas:

- **Timespan.** This concerns the urgency of communities to solve complex problems in the short term. However, these processes take time: initiative funding is a long-term process.

- **Gender & Youth.** Equitable and safe participation of women is critical to the focus and fairness of these initiatives. There is also a key need for more young people/youth engaged in the processes to provide stability over time and act as transition figures as new people come on board.

- **Corruption.** Colombia has high levels of state corruption and institutional disorganization regarding environmental and territory-based management. Further, the constant persecution and stigmatization of environmental movements, along with scarce space for advocacy and sharing these struggles and commitments of the communities, create unique contextual challenges.

Key Takeaways & Lessons Learned

This social engagement process, which was implemented from 2005 to 2012, continues today under a structure of citizen monitoring of the CAC agreements called *The Monitoring Committee*. This committee comprises representatives of universities, NGOs, state entities, and financial control bodies. These actors support strengthening, planning, and monitoring compliance with the agreements and any new initiatives that arise as these groups continue to pursue initiatives.

The initiative's sustainability has depended on citizen empowerment and interest in continuing to participate.

This has been and remains dependent on several aspects: their autonomy, the valuation and integration of local knowledge within the strategies; respect for the participants, gender equity; and the strong support and backing of NGOs, such as the Colombian environmental conservation group *Semillas de Agua* and the ANSUR collective [Alliance for Land, Indigenous, and Environmental Defenders].

In summary, the social and political engagement process in the Colombia case study contributes to the development of transdisciplinary research as is related to social learning processes for citizen transformation, long-term capacity building, and collective social strategies for monitoring and follow-up.

Ongoing Sustainability of the Project

It is essential to consider the organization's character, structure, and mission to understand the continuity of the programs started by Semillas de Agua. Since 1994, Semillas de Agua has committed itself to the participatory and ongoing development of social processes, primarily based on the real interests of people and communities. Semillas de Agua members are community leaders and community organizers. Since its creation, the organization has aimed to create well-structured spaces that guarantee inclusion, dialogue, empowerment, and strategies for citizen action across political, social, cultural, and environmental levels.

A key principle of Semillas de Agua is its emphasis on processes rather than projects. This focus involves ongoing analysis and dialogue with communities, helping them develop strategies across short-, medium-, and long-term frameworks. It also clearly defines the co-responsibilities of partners, communities, and support teams.

Since 2005, the organization has worked through multidisciplinary research alliances that have become essential for the sustainability of its programs and processes. This approach emphasizes co-produced knowledge and prioritizes local case data, which are then discussed and applied as frameworks for environmental public policy.

Factors such as *conscious* citizen participation and an understanding of their *duties* and *rights* are crucial for the long-term viability of programs in both rural and urban settings. Communities are increasingly overcoming disparities in access to information and understanding how the state functions, including its rules and competencies. Local actors are starting to recognize their capacity as essential agents of change, understanding that, at least in Colombia, the power to effect change is constitutionally vested in the people, not government entities.

A new notion of participation is emerging, rooted in prior empowerment, equipping individuals with tools for civic and collective action and the rules and processes needed to enforce them, particularly at the state level. From this participatory perspective, sustainability is defined by the communities and individuals who truly feel and believe themselves to be citizens.

The participation of women has been crucial in sustaining this work. In Colombia, women demonstrate the greatest dedication, commitment, and successful outcomes. They have found spaces to voice their concerns and address territorial issues that range from urban to rural contexts. Focusing on their needs—such as those related to rural economies, psychosocial support, and the prevention of gender-based violence—centers on encouraging long-term participation and commitment to their struggles within their territories.

Table 7: *Summary of key takeaways & lessons from the Colombia Case Study.*

TD Skill Competence Area	Takeaway/Lesson Learned
Leadership & Spaces of Negotiation	• An inclusive leadership approach encompassing many actors strengthened the project dynamics. • Strong communication mechanisms. • Negotiation spaces facilitated dialogue and enabled participants to align objectives before reaching agreements.
Community Engagement & Collaboration	• Strong social engagement process and citizen participation based on the goal of creating binding agreements between communities and institutions to collectively solve problems associated with water management. • Participatory research action alliance comprised of NGOs, research centers, and universities with experience in rural development, environmental research, and social law. • A diverse consortium of organizations and actors supported the process of planning and monitoring compliance with the agreements.
Co-Design of Project Objectives and Goals	• A participatory process with a shared goal of collective action to improve accountability for benefits from good management of ecosystems. • Co-design of communication mechanisms. • Shared objective to design and adopt municipal and regional policies to create protected areas in the threatened and highly valued *Páramo* ecosystem.
Capacity Building & Social Learning	• Capacity building prioritized political and civic training to increase social participation • Social learning processes facilitated by community members, NGOs, and university researchers focused on helping citizens better understand risks to the environment and their health

Conclusion

The transdisciplinary (TD) case studies presented here offer valuable insights into the various factors that facilitate practical TD work through integrating knowledge among diverse groups in society, particularly in addressing global environmental change in the Latin America and Caribbean (LAC) region. Throughout the book, the authors emphasize the importance of understanding different conditions, contexts, and participatory processes that lead to models best suited for incorporating local and traditional knowledge systems and diverse values and perspectives in complex socioecological settings, with particular attention to the unique dynamics and perspectives of the global South. These models also help us navigate differing interests and diverse value systems to address local biodiversity implementation gaps in the Americas.

The cases included here highlight local initiatives that effectively promote decentralized environmental policies, emphasizing the inclusion of local and traditional knowledge while recognizing various value systems. Collectively, the cases illustrate the central role of local communities in organizing and leading processes through which these communities mobilize resources to achieve shared biodiversity conservation goals. Each case offers evidence of TD work encompassing a wide range of interactions, situations, and institutions—both formal and informal—through which different networks, comprising individuals, institutions, states, and the combinations thereof, organize various aspects of socioecological life. These cases also show how social learning processes intersect with collaborative work for biodiversity conservation within essential socioecological systems in the LAC region.

This compilation is a unique resource, showcasing authentic examples of transdisciplinary collaboration among scientists, local knowledge keepers, staff from non-governmental organizations, and activists across the LAC setting. The concluding table summarizes key takeaways and lessons learned synthesized across the cases highlighted in the publication. The case study synthesis underscores the importance of meaningful and sustained collaboration, inclusive and participatory approaches, project co-design with community involvement, capacity building and empowerment, and knowledge translation into accessible products as key to achieving impactful project outcomes.

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Table 8: *Summary of key takeaways from a synthesis of the 7 case studies in the book.*

■ **Leadership Roles & Skills**

• Inclusive leadership: Designate a lead team member or community liaison who acts as a bridge builder/ promotes collaboration and trust within diverse teams.

• Be flexible and adaptable: Essential traits for navigating diverse team dynamics and research contexts.

• Build trust: Crucial for fostering open communication and readiness to embrace change.

• Manage and solve conflicts proactively: Anticipate and address challenges and conflicts proactively. Build capacity within the team for conflict resolution.

■ **Community Engagement & Collaboration**

• Meaningful collaboration: Foster ongoing, meaningful cooperation between stakeholders.

• Equitable resource sharing: Ensure knowledge and resources are shared equitably.

• Long-term commitment: Nurture community connections beyond the project lifecycle.

• Advocacy: Advocate for grassroots communities' needs.

• Overcome mistrust: Build trust through consistent communication, proactive and authentic engagement, and with the help of trusted liaisons (bridge-builders).

■ **Co-Design of Project Objectives and Goals**

• Participatory process: Co-create project objectives with the community to ensure relevance and sustainability.

• Capacity building: Empower communities through training and workshops.

• Be considerate of timelines: Recognize potential misalignment of project activities with community, political, and academic timelines..

■ **Capacity Building & Social Learning**

• Incorporate training, education, and community empowerment to improve implementation and long-term sustainability of project outcomes.

• Training and education: Prioritize political and civic training to increase social participation.

• Social learning: Facilitate understanding of complex socioecological problems through training and community-led processes.

• Practical skill building: Co-design training activities to meet community needs and connect conservation with livelihood protection.

■ **Science Communication to Support Decision-Making & Education**

• Accessible products: Translate research outcomes into formats accessible to diverse audiences.

• Effective communication: Translate technical language to resonate with local communities.

• Partnerships: Build on existing partnerships to communicate information effectively.

■ **Cross-Scalar Alignment**

• Align with broader regional strategies: Enhance project impacts by aligning with broader regional or national strategies.

• Policy influence: Mobilize successful outcomes to influence public policy and secure additional funding.

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Annex

Case Study Template:

The template used to gather data from each case is included below. This template can be used by other projects to facilitate coordinated data collection about TD research focused on GEC problems in regions worldwide. The template captures common obstacles faced and lessons learned across diverse TD project settings.

Topics and Questions to Frame the TD Case Study Story

Project name:
• Contact person (Name, Project Role, Profession)
• Geographical scope/Region/ Case Study Location(s)
• Social/ecological problem(s) addressed by the project
Research question(s)
• Case Background
• What is the overall objective of the research?
• Who was involved in your project? (for example, who were the academic, policy, community and funding actors involved?)
Stories on Team Formation
• Tell me about your most vivid memory from the outset of your collaboration. Can you tell us the story of how your team formed? What processes were involved?
Stories on Engagement & Co-Creation Processes
• Stories on Engagement & Co-Creation Processes
• What was your process for identifying and engaging stakeholders?
• How have you integrated different knowledge and value systems into your research/ initiative?
• What are the different collaborative and participatory approaches involved in co-creating your research?
• Ask team members to speak specifically about the co-creation of joint problem-framing. Tell us how your team framed the problem and research questions jointly.

Problem Framing & Problem Solving
• Tell us a story about a time when a challenge arose in your project. Where did conflict emerge? How did you manage it? What was most challenging at different stages of the TD research process? If it was productive or destructive to the TD process. What did you learn from the experience?
Communication & Dissemination of Knowledge
• How do you communicate/disseminate findings to your audiences?
• How would you characterize the outcomes of your project? Can you describe a scientific or technical outcome? Can you describe a policy outcome? Can you describe a community-based outcome?
Scientific Benefits
• What contributions did your project make to advancing scientific knowledge?
Policy Benefits
• How could your project findings contribute to developing new policies or changing existing policies?
• Are there gaps in existing policy, or the implementation or enforcement of policy, that your project sheds light on?
Societal Benefits
• In what ways did your project benefit the communities you work with?
• What other types of real-world benefits did your project contribute?
Evaluation & Assessment
• How do you define the success of the project? Does this definition help to evaluate the project? Has it changed? How so?
• Can you tell us about your assessment strategies? At what stages did you conduct an evaluation? How did you incorporate the lessons learned into your teamwork process?
Intangibles/The Elephant in the Room
• If you were to identify an unaddressed issue (the elephant in the room) during the project, what would it be, and how would you name it?
Project Materials from the Case Study:
• Available video material from your case study? Any copyright issues, permissions, or ethical issues to be aware of?
• Available photo material from your case study? Any copyright issues, permissions, or ethical issues to be aware of?
• Available articles/ texts/ presentations from your case study?

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