Conservation in Ecuador's Sangay-Podocarpus Connectivity Corridor: A Study of Coproductive Capacities

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CONSERVATION IN ECUADOR’S SANGAY-PODOCARPUS CONNECTIVITY CORRIDOR: A STUDY OF COPRODUCTIVE CAPACITIES

By

Gabriel Isaac Oppler

Bachelor of Science, Biology, Haverford College, Haverford, PA, 2017

Thesis

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Approved by:

Dr. Ashby Kinch
Interim Dean of the Graduate School

Dr. Jennifer Thomsen (Chair)
Department of Society and Conservation

Dr. Brian C. Chaffin
Department of Society and Conservation

Dr. Theresa Floyd
College of Business

Dr. Zachary Wurtzebach
Center for Large Landscape Conservation
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ABSTRACT

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Resource Conservation

Conservation in Ecuador’s Sangay-Podocarpus Connectivity Corridor: A Study of Coproductive Capacities

Chairperson: Dr. Jennifer Thomsen

Connectivity conservation, a growing topic across science, policy, and management, is considered an important supplement to protected areas. A diversity of ecological corridors is emerging to restore fragmented landscapes, preserve intact habitats, protect biodiversity, and improve resilience to climate change. Despite increasing expertise and resources for planning corridors, many initiatives face challenges mobilizing science and governance to implement corridors on the ground. In many cases, biophysical science is supplemented with social science to better understand the human elements of connectivity. Similarly, collaboration and partnership are heralded as essential for effective governance of corridors. However, less is known about how these domains interact. One way to view the interplay of science and governance is through the lens of coproductive capacities, a theoretical framework organized around normative, cognitive, social, and material capacities to effect scientifically-informed social change. Given the challenges in implementing corridors, novel tools are needed to integrate science and governance. To advance this effort, my study explores how coproductive capacities support a transition from planning to implementation in the Sangay-Podocarpus Connectivity Corridor (Corredor de Conectividad Sangay-Podocarpus; CCSP), the first corridor formally designated by Ecuador’s national government, linking national parks across a region of extraordinary biodiversity. The landscape is a complex mosaic of land uses and jurisdictions; this complexity is mirrored in the CCSP’s governance model, wherein representatives from government, NGO, and academic institutions collaborate in thematic working groups. I conducted in-depth, semi-structured interviews with stakeholders familiar with the role of science and governance of the CCSP, primarily government officials, conservationists, university researchers, and protected area managers. I collected additional data through field visits around the corridor and from public documents. Findings indicate that the CCSP possesses strong normative capacities, highlighted by a common vision for social-ecological wellbeing in the corridor and shared understanding of threats. Cognitive capacities are supported by biophysical science but lack integration with social science and Traditional Ecological Knowledge. Social capacities vary, depending on the scale of governance concerned. Material capacities are compromised by insufficient and inconsistent funding and human resources. A crosscutting theme, the COVID-19 pandemic has played a significant role in the CCSP’s trajectory since 2020. This study suggests that neither robust science nor collaboration in governance alone are sufficient for implementing corridors. Rather, implementation depends on strong and diverse capacities which are highly interdependent. While this case study is context-specific, it highlights the need for ample, targeted capacity-building resources to support and sustain connectivity conservation that achieves social and ecological goals.
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INTRODUCTION

Ecological connectivity is commonly defined as the “unimpeded movement of species and flow of natural processes that sustains life on Earth” (CMS 2020:1). Connectivity conservation is an emergent strategy concerned with maintaining, enhancing, and restoring the ecological connectivity of ecosystems. Rather than creating or expanding protected areas, this approach prioritizes the connections between core habitats, seeking to knit together Earth’s increasingly fragmented mosaic (Hilty et al. 2020). The physical spaces on the landscape intended to facilitate connectivity are known as ecological corridors, and sometimes alternatively called biocorridors, wildlife corridors, or connectivity corridors among other terms (Gregory et al. 2021; Hilty et al. 2019).a Conservationists have envisioned corridors for almost all landscape types, from enormous tracts of primary forest to areas with human intervention and fragmentation (IUCN WCPA CCSG 2020). By moving beyond protected area designations, corridors present an opportunity to avoid the social harms that stem from excluding people from the land and their livelihoods, sometimes dubbed ‘Fortress Conservation’ (Brockington and Wilkie 2015). Connectivity conservation is a rapidly growing field, with a marked increase in corridor design and planning in the past decade (Keeley et al. 2019). However, many of these corridors are never fully implemented in a way that adequately protects biodiversity while ensuring equity and access to livelihoods for local peoples (Freile, Pardo-González, and Ordóñez-Delgado 2022; Goldman 2009; Green and Sandbrook 2021). This ‘implementation gap’ has been identified in several approaches to conservation (Bormpoudakis and Tzanopoulos 2019; Knight et al. 2008; Opdam 2018; Opdam et al. 2013; Pinto-Correia and Kristensen 2013),

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a In this thesis, I use two terms interchangeably: The IUCN’s preferred term ‘ecological corridor’ when referring to corridors in general, and ‘connectivity corridor’ when referring to the name of Ecuador’s Sangay-Podocarpus Connectivity Corridor, the topic of this research.
confirming that corridors are far from the only conservation strategy which struggles to move from science into practice.

With theoretical and methodological origins in conservation biology, connectivity conservation builds on a robust biophysical literature (MacArthur and Wilson 1967; Newmark 1987; Venter et al. 2016). Research on genetics, population and landscape ecology, and wildlife biology have justified the need for connectivity and continue to shape processes for designing corridors (Brashares, Arcese, and Sam 2001; Fedorca et al. 2019). However, and much like other subdisciplines in conservation, connectivity conservation struggles with the need to effectively integrate social sciences (Green and Sandbrook 2021; Mascia et al. 2003). Only recently have scholars and conservation professionals made concerted efforts to expand the field of connectivity conservation using theories and methods derived from sociology, economics, political science, and other social sciences (Egerer and Anderson 2020; Ghoddousi et al. 2021; Keeley et al. 2022).

In most cases, connectivity conservation fits within a larger field of practice known as large landscape conservation, wherein water, land, wildlife, and other resources are managed at a regional scale, crossing jurisdictional boundaries, ecosystems, and land uses (Reed, Deakin, and Sunderland 2015; Rudnick et al. 2012; Sayer 2009). Given the complexity of these landscapes and the communities who live on or otherwise depend on the land, questions of power, control, and decision-making—that is, questions of governance—are critical for designing solutions that protect the wellbeing of biodiversity and people (Alaska Conservation Foundation et al. 2022; Lausche et al. 2013; McKinney, Scarlett, and Kemmis 2010; Wyborn 2015). To understand governance in ecological corridors, it is common to look to the different arrangements that have
been applied in protected areas, but corridors present different challenges that need to be further explored (Lausche et al. 2013).

Thus, science and governance are two pillars of connectivity conservation, with both areas fast-evolving in theory and in practice. Bringing these two elements together is a priority for conservationists and may represent the best way of overcoming the implementation gap for ecological corridors. In academic discourse, some scholars have developed ways of exploring the interplay of science and governance, rather than viewing either in isolation (Jasanoff 2004; van Kerkhoff and Lebel 2015; Wyborn 2013; Wyborn et al. 2019). Van Kerkhoff and Lebel (2015) hypothesize that science and governance inform one another: the knowledge we produce informs decision-making, and vice versa. In other words, science and governance are “coproduced.” Furthermore, it is possible to qualitatively evaluate coproduction through measures of ‘coproductive capacity,’ defined as “the combination of scientific resources and governance capability that shapes the extent to which a society, at various levels, can operationalize relationships between scientific and public, private, and civil society institutions and actors to effect scientifically-informed social change” (van Kerkhoff and Lebel 2015:14). Drawing on work by these authors and others, Wyborn (2015) has proposed a simple framework of coproductive capacities, organized around four categories—normative, cognitive, social, and material capacities. Normative capacities describe underlying values and motivations to act; cognitive capacities describe the creation of knowledge; social capacities describe the relationships between actors; and material capacities describe the tangible resources available to actors (Wyborn 2015: 13). Because connectivity conservation often demands cross-scale collaborative governance (i.e., founded on partnership) and robust biodiversity science, Wyborn recognized the approach as a prime example of coproduction and connectivity initiatives as
worthy of capacity assessments. What’s more, as Keeley et al. (2022) argue, identifying gaps in capacity (i.e., coordinating mechanisms, funding, and training) is a top priority for improving social and ecological connectivity.

To advance this effort, my study applies the coproductive capacities framework to an emerging corridor with global ecological significance and local complexity in land uses and livelihoods. The Sangay-Podocarpus Connectivity Corridor (Corredor de Conectividad Sangay-Podocarpus; CCSP) is a 160 km linkage between Sangay National Park and Podocarpus National Park in southeast Ecuador. In July 2020, it was formally designated by Ecuador’s Ministry of Environment, Water, and Ecological Transition (Ministerio del Ambiente, Agua y Transición Ecológica; MAATE) as the country’s first connectivity corridor. The CCSP is the first of 11 proposed corridors in Ecuador and is just one piece of the ambitious Andes-Atlantic Amazon connectivity network, which seeks to connect protected areas from the Andes Mountains to the Atlantic Ocean (Gaia Amazonas n.d.; Sorgato 2018). The CCSP merits particular attention for several reasons. Ecuador is a country with a well-known reputation for conservation. In 2008, it became the first country to grant Nature constitutional rights (Charman 2008). The corridor lies in one of the world’s most biodiverse regions, where the Andes slope eastward into the Amazon basin (CBD, 2020; Olson et al., 2001). However, the corridor is far from uninhabited wilderness. It is complex social-ecological system, home to over 15,000 people, of whom a large portion are of Indigenous heritage (Sorgato 2018). As it moves from the design phase to implementation, the corridor will rely on its new management plan and multi-scalar governance structure to achieve its goal of protecting biodiversity, water, and ecosystem services, while supporting rural livelihoods. These goals are articulated in the management plan, and translated here in English, as “conservation of biodiversity which involves the incorporation
of several compatible and complementary national and local strategies with the socio-economic
dynamics of the territory, through the commitment of local actors and through a focus on sustainable landscape management” (Mancheno-Herrera 2020: 18). The MAATE is collaborating with local governments, non-governmental organizations (NGOs), and universities to implement this mission. Transitioning from design to implementation, both science production and governance are taking form; integrating these capacities is now paramount (Rodas and Mancheno 2020). Thus, at this critical juncture, my study pursued the following research question:

*How do coproductive capacities (normative, cognitive, social, and material) support implementation of the Sangay-Podocarpus Connectivity Corridor?*

Professionals in connectivity conservation sometimes struggle to translate vision into reality (Freile et al. 2022; Keeley et al. 2019). To develop best practices that can be tailored to local contexts, the field needs a robust set of case studies from around the world, especially those that utilize social science to better understand the human aspects of connectivity conservation (Egerer and Anderson 2020; Keeley et al. 2022). In a practical sense, this research is intended to assist local partners in better managing the CCSP long into the future. A deeper understanding of the coproductive capacities in the CCSP may help all parties implement their collective vision of ecological, economic, and social wellbeing. Globally, connectivity conservation is gaining momentum as a strategy for conserving biodiversity and fostering resilience to climate change (CMS 2020; Elliott, Naidoo, and Antelo 2022; Hilty et al. 2020). It is my goal that this research will support evolving efforts to better understanding the ways that science and governance work together to enable effective and equitable connectivity conservation.
Thesis Roadmap

The thesis begins with a literature review, situating this work among prior research in connectivity conservation, environmental governance, and the coproductive capacities framework. Then, I provide an overview of the research site, including biophysical characteristics of the CCSP, the corridor’s socioeconomic characteristics, and historic trajectory. In the next sections, I explain the methods I used to collect and analyze data. Subsequently, I present my results followed by a discussion of emergent themes. Finally, the conclusion includes a summary of this research, implications for the field of connectivity conservation, and recommendations for the CCSP.

Literature Review

Connectivity conservation

Origins and influences

A “Great Debate” has divided conservationists into competing schools of thought for over 150 years (Pearce 2018:1; Sandbrook 2015). At its core, fundamental disagreements about humans’ relationship to the natural world distinguish conservation approaches characterized as “land-sparing” or “land-sharing” (Buscher and Fletcher 2020; Pearce 2018). A strict human-nature dichotomy undergirds land-sparing philosophies and protected area practices. Protectionism has deep historical origins in romanticism and colonialism, as evidenced most strongly in the North American concept of “wilderness” (Cronon 1996; Nash 2014; Stankey 1989). Yellowstone National Park, founded in 1872, is widely recognized as the premier example of human-nature dichotomy enshrined in law (Brockington, Duffy, and Igoe 2008; Spence 1999). The establishment of this first National Park influenced a century of protected
area development, in the U.S. and abroad, characterized by spatially defined boundaries, human exclusion (or limited access), and controlled entry for recreation or tourism (Adams 2004).

Modern protected areas were envisioned as a tool for protecting important landscapes and wildlife habitats but have since expanded to provide a diverse range of benefits (Watson et al. 2014). Advocates for protected areas point to their contributions to national and local economies (e.g., through tourism); role in stabilizing the climate (e.g., through carbon sequestration); and utility in providing ecosystem services (e.g., a clean water supply) (Dudley and Stolton 2010). Nonetheless, the protected area model, sometimes referred to as “fortress conservation,” has been critiqued with reference to the historic relationship of military enforcement in protected areas (Brockington 2002; Dartmouth University 2020). The most notable critiques revolve around the practice of displacement and exclusion of local and Indigenous communities, depriving these peoples of livelihood and cultural and spiritual rights (Brockington and Wilkie 2015; Igoe 2004; Neumann 1998).

Biophysical scientists pen their own critiques of strict protected areas; the most common argument is that these spaces are generally too small and too isolated to accommodate ecological flows and processes at large scale – a reality sharpened by the effects of anthropogenic climate change (Foden and Young 2016; Gross et al. 2017; Tabor 2019). The International Union for the Conservation of Nature (IUCN), the international body that defines protected area categories, recognizes that parks, wilderness areas, and other strict nature reserves are insufficient for adequately protecting global biodiversity (IUCN WCPA 2019). Despite global terrestrial and marine protected area coverage having grown to 15.8% and 8.1%, respectively (UNEP-WCMC 2022), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) states that up to one million species are currently at risk of extinction (IPBES 2019). To
overcome limitations of the “fortress” model, conservation has evolved with numerous approaches embracing an integrated commitment to people and nature (Borrini-Feyerabend and Hill 2015; Buscher and Fletcher 2020: 16–17). Connectivity conservation has emerged in this context.

Rather than advocating for the creation or expansion of protected areas, connectivity conservation prioritizes the spaces in between these areas that maintain, enhance, or restore ecological connectivity (IUCN WCPA CCWG 2022). The scientific origins of connectivity conservation derive from island biogeography (MacArthur and Wilson 1963, 1967; McCullough 1996). Landscape ecologists have adopted the concept to describe protected areas as de-facto islands, whose isolation from one another puts species at risk of genetic segregation and thus extinction (Brashares et al. 2001; Newmark 1987; Wittemyer et al. 2008). Additionally, protected areas sometimes fall short of their biophysical intentions, either because they are not located in optimal places, or because they are ineffectually managed (Jones et al. 2018; Venter et al. 2018). These realizations have fomented a wide-ranging push to study structural connectivity (i.e., connections visible on the landscape) and functional connectivity (i.e., validation that species movements and other ecological flows are occurring). Scientific tools commonly used in connectivity conservation include GPS tracking collars (e.g., Proctor et al. 2015), genetic sampling (e.g., Fedorca et al. 2019), computer modeling, and GIS mapping (e.g., Gurrutxaga, Lozano, and del Barrio 2010). Dominant management themes include reducing human-wildlife conflict on working lands (e.g., Buchholtz et al. 2020) and eliminating human-constructed barriers to movement (such as linear transportation infrastructure – roads, railways, and canals) (Forman et al. 2003).
IUCN Guidelines for Conserving Connectivity

As the scientific basis for connectivity conservation has solidified, so too has its influence on policy, law, and management (CBD 2011; CMS 2020; Crooks and Sanjayan 2006; Hilty et al. 2019; Laur 2021; Lausche et al. 2013). While connectivity science advances in research agendas at universities and government agencies, connectivity has also emerged as a top priority among conservation NGOs, multilateral environmental agreements, and other international entities. In 2016, the World Commission on Protected Areas (WCPA), one of six Commissions of the IUCN, established the Connectivity Conservation Specialist Group (CCSG) to give greater structure to this growing community of practitioners. Since its inception, membership in the Specialist Group has grown to over 1200 individuals spread over 125+ countries. The body defines connectivity conservation as “the action of individuals, communities, institutions, and businesses to maintain, enhance, and restore ecological flows, species movement, and dynamic processes across intact and fragmented environments” (IUCN WCPA 2022; IUCN WCPA CCSG 2022). Note that this definition does not explicitly center objectives for the wellbeing of people who live in and around corridors.

Recognizing a growth in interest but lack of coordination, leaders of the CCSG sought to establish a common vocabulary and streamline efforts across sectors and across continents (Hilty et al. 2020). In 2020, after more than a decade of negotiation and revision, the Specialist Group published “globally-applicable” Guidelines for the field. Guidelines for conserving connectivity through ecological networks and corridors synthesizes a large body of evidence that ecological connectivity is of critical importance for biodiversity conservation, especially as climate change drives species range shifts.
Given the immense complexity of the topic and plurality of approaches for implementing the connectivity vision, the IUCN Guidelines thoroughly represent the current state of the field. Hilty et al. (2020) celebrate complexity while suggesting universal best practices that, they claim, can be applied to any social-ecological system. The appendix of 25 case studies illustrates that connectivity conservation is applicable to terrestrial, marine, and freshwater ecosystems on every continent, and in systems confronted with diverse threats and opportunities (IUCN WCPA CCSG 2020). Nonetheless, the direct utility of the Guidelines may be limited. As the shortcomings of fortress conservation have powerfully illustrated, the primary challenge for effective conservation is to integrate the wellbeing of people and communities with biophysical ecology. In the Guidelines, relatively short sections on social and economic values, governance, and tenure provide broad, sweeping statements regarding the applicability of connectivity conservation, but generally stress its context-dependent nature. This demonstrates that despite this having become an established topic and strategy within conservation, much is still unknown about the transition from planning to implementation and the key factors that can influence whether connectivity conservation achieves its goals.

**Challenges in Implementing Connectivity Conservation**

For many, connectivity conservation has taken hold as a promising model for conservation (Foden & Young, 2016; Gross et al., 2017; Tabor, 2019). However, its practical “on-the-ground” applications have sometimes proven difficult. There are different interpretations of connectivity that may conflate or obscure the clear operationalization of ecological priorities (Bormpoudakis and Tzanopoulos 2019). For example, a recent study by Bormpoudakis and Tzanopoulos (2019) showed that connectivity is conceptualized differently by actors with ecology training than those from land planning backgrounds. Varying interpretations of
connectivity are more than semantic. As Termorshuizen, Opdam, and van den Brink (2007) demonstrated, connectivity assessments performed in the planning context fail to accommodate ecological needs. The flexibility of connectivity can be a double-edged sword. Goldman (2009) argues that the many applications of connectivity make it an attractive conservation strategy; this flexibility, however, can open the door for misunderstanding and disagreement at the scale of local implementation.

Several authors have argued that an implementation gap at the science-practice interface exists for landscape ecology as a whole (Bormpoudakis and Tzanopoulos 2019; Knight et al. 2008; Opdam 2018; Opdam et al. 2013; Pinto-Correia and Kristensen 2013). This gap seems to be exacerbated in conservation strategies that operate at a grand scale, encompassing multiple (sometimes overlapping) jurisdictions and involving numerous individuals and institutions (Beever et al. 2014; Lausche et al. 2013; McKinney et al. 2010; Scarlett and McKinney 2016). Researchers in the field have empirically identified this implementation gap and explored solutions for overcoming it using a case study approach (Keeley et al. 2018) and via comparative metanalysis (Keeley et al. 2019). The latter analyzed 263 terrestrial connectivity conservation plans (CCPs) from around the world and demonstrated an exponential growth in total CCPs in the past thirty years – an expansion led primarily by the United States, Europe, and South Africa. An abundance of activity, however, has not necessarily translated into conservation “success”.

Like many scientific endeavors, connectivity conservation requires robust data, resources, and expertise (Bormpoudakis and Tzanopoulos 2019). But there is increasing acknowledgement that success also depends on how data is produced – that is, the knowledge creation process (Gray et al. 2020; Needham, Beazley, and Papuga 2020). Keeley et al. (2019) reported that the greatest factor that predicts implementation of connectivity plans is the presence of enduring
partnerships among stakeholders. Similarly, Gray et al. (2020) argue that sustained stakeholder engagement (partnerships between land managers, scientists, and local actors) is essential for successful connectivity conservation. Based on their experiences in Northern California, these authors acknowledge that collaboration, communication, and iterative processes incur high transaction costs, but these investments are nonetheless crucial. The literature on collaboration, it should be noted, often cites a definition of the term articulated by Gray (1989): “A process through which parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible” (5). Inclusive, equitable, and collaborative planning is particularly important for connectivity initiatives because the landscapes at issue are usually a mix of private, public, and Indigenous lands (Artelle et al. 2019; Hilty et al. 2020; Keeley et al. 2022; Needham et al. 2020; Wyborn 2015; Zurba et al. 2019). As Needham et al. (2020) point out, “The broader landscape is often highly contested space, with multiple demands and claims over a limited land base” (6). Therefore, these authors note, connectivity conservation is most successful when planning processes include diverse voices in participatory processes, especially from the earliest phases of goal setting.

Connectivity conservation is a rapidly evolving field of inquiry, with new theoretical frameworks emerging to address the social and ecological dimensions of connected landscapes. In one notable example, Egerer and Anderson (2020) devised “social-ecological connectivity” to acknowledge the ways that social processes shape ecological connectivity, especially with regards to ecosystem services in urban contexts. In a similar vein, Keeley et al. (2022) propose that “social connectivity” – especially the flow of information and knowledge – is essential for governing ecological and hydrologic connectivity. Relevant to the application of this emerging
scholarship, others have proposed tools for incorporating social factors into connectivity mapping for locating corridors. For example, researchers have proposed the term “anthropogenic resistance” to describe the human factors that could impede connectivity on a landscape and offered a methodology for incorporating this resistance into connectivity maps (Ghoddousi et al. 2021).

Given the importance of social-cultural dimensions – including those who plan conservation initiatives and those whose lives are directly shaped by them – it is perhaps surprising that connectivity conservation research has only recently expanded beyond the biophysical. To advance this dialogue, governance is an important lens through which to view the issue. The following section provides a brief review on environmental governance before transitioning to the theoretical framework used in this study.

Environmental Governance

Foundational Theories

The philosophy of connectivity conservation is dependent on the framework of social-ecological systems (SESs) (Bergsten, Galafassi, and Bodin 2014; Egerer et al. 2020; Egerer and Anderson 2020; Wyborn 2015). SES scholarship seeks to describe the dynamics of systems composed of biogeophysical elements and their associated social actors and institutions (Berkes, Colding, and Folke 2003; Berkes, Folke, and Colding 2000; McGinnis and Ostrom 2014; Ostrom 2007, 2009). Key to understanding the dynamics of SESs is through analyses of environmental governance, defined by Lemos and Agrawal (2006) as “the set of regulatory processes, mechanisms and organizations through which political actors influence environmental actions and outcomes” (298).
Decentralized governance, and polycentric governance in particular, has demanded the attention of governance scholars since the latter end of the 20th century (Ostrom 1990). Early research on public administration and common pool resources precipitated a reconsideration of the effectiveness of top-down, centralized governance (Ostrom 1990; Ostrom, Tiebout, and Warren 1961). Carlisle and Gruby (2019) describe a polycentric governance system as “a dense and evolving web of decision-making centers—some transitory and others relatively fixed—and supporting actors from diverse sectors and domains” (933). These authors describe three types of normative claims often made about polycentric governance systems: they are better able to adapt to change; they provide “good institutional fit for complex natural resource systems;” and they provide redundancy to minimize risk of failure (Carlisle and Gruby 2019:929). The authors subsequently emphasize that more empirical research is needed to enumerate the factors that turn the potential benefits of polycentricity into real improved performance.

In parallel to the increased scholarship on decentralized governance, Lemos and Agrawal (2006) describe a shift in practice towards decentralized environmental governance occurring since the 1980s. Despite the growth that polycentric governance has achieved in theory and in practice, some scholars stress the limitations of the model. Polycentric governance is not a panacea, and more research is needed to better understand the contexts in which polycentricity is effective (Carlisle and Gruby 2019).

A related thread of governance scholarship pertains to adaptive governance, a model concerned with addressing the inherent (and increasingly dramatic) complexity and uncertainty of SESs. In this context, adaptive governance can be defined as “a range of interactions between actors, networks, organizations, and institutions emerging in pursuit of a desired state for social-ecological systems” (Chaffin, Gosnell, and Cosens 2014:56). Adaptive governance is dependent
on polycentricity—diverse institutions at multiple nested scales are connected by formal and informal social networks of individuals and institutions (Chaffin et al. 2016, 2014; Dietz, Ostrom, and Stern 2003; Huitema et al. 2009)—which is balanced with democratic law and some amount of hierarchy (Cosens et al. 2017; Craig et al. 2017). The adaptive governance model relies on the capacity for adaptability and flexibility (i.e., adaptive capacity) (Folke et al. 2002, 2005; Plummer and Armitage 2010). Another important aim of adaptive governance is to enhance the “fit” between a particular ecosystem and its governance system. Olsson et al. (2007) describe three factors that enhance fit: leadership of individuals, activated social memory, and coordinated actors that cross scales of a multilevel governance system. This third component is often deemed a “bridging organization” (Crona and Parker 2012; Hahn et al. 2006), an actor that is said to “provide an arena for trust building, sense making, learning, vertical and horizontal collaboration, and conflict resolution” (Olsson et al. 2007:34).

**Governance in Ecological Corridors**

At the heart of connectivity conservation is the ecological corridor, described in IUCN Guidelines as “a clearly defined geographical space that is governed and managed over the long term to maintain or restore effective ecological connectivity” (Hilty et al. 2020:4). Corridors are, in short, the places where connectivity science is translated into practice. They are envisioned as flexible spaces that promote connectivity along with other sociocultural and economic benefits (Hilty et al. 2019:112–115). Corridors may be nested within larger ecological networks, enabling connectivity across expansive geographies.

According to the IUCN Guidelines, governance considerations are a core component of planning and implementing ecological corridors. Hilty et al. (2020) contend that corridor governance is analogous to governance of protected areas in that it has three components: “how
and by whom decisions are made, and who should be held accountable” (29). Corridor governance is said to take any form provided it fits the context and helps achieve the corridor’s objectives. Referencing previous literature on protected area governance, Hilty et al. (2020) provide some examples of governance arrangements applicable to corridors: governance by government; shared governance; governance by private individuals, organizations, or companies; and governance by Indigenous peoples and/or local communities—a wide diversity of options which, theoretically, could be tailored to a corridor’s specific context. Furthermore, and based largely on existing IUCN precedent, the authors stipulate that corridor governance requires trust, shared values, and collaboration and should rest on principles of “transparency, accountability, participation and justice in decision-making processes” (Hilty et al. 2020:29–30).

The variation of governance possibilities in ecological corridors is not surprising given the great diversity of connectivity applications. Early IUCN publications on governance for connectivity conservation emphasized this variation: “Governance arrangements for connectivity conservation areas are likely to be dynamic and site-specific, and will evolve over time in response, for example, to changes in the partnerships involved, biophysical conditions (including climate change) and management needs” (Lausche et al. 2013:35). Thus, different corridors present different challenges.

While small corridors may be amenable to traditional governance regimes, larger geographies present greater complexity. Lausche et al. (2013) note that large-scale connectivity governance must grapple with a mix of tenures, a range of stakeholders, a range of land uses, a significant economic dimension, and uncertain government commitment (46–47). These authors conclude that conventional protected area governance through state ownership and control are unlikely. Meanwhile, small parcels of land owned by a single entity are equally unlikely to
achieve large-scale connectivity. Therefore, large landscape initiatives will meld a range of tenure types and uses, and their effectiveness will “depend upon partnerships between civil society, the private sector and national and local governments and other authorities” (Lausche et al. 2013:51). These concerns are echoed by Chaffin et al. (2014): “Centralized governance via top-down directives or command-and-control policies often fails to provide effective solutions for highly contextualized situations, and also often falls short in efforts to coordinate governance across large-scale ecosystems that cross multiple jurisdictional boundaries” (56). As Keeley et al. (2022) argue, governing connectivity across multiple scales requires coordination “across levels, sectors, and geographies” and “financial and technical investment in network governance” (380).

Adaptive governance is theorized as a dynamic system that embraces the complexity and uncertainty of SESs by bridging knowledge and action through multilevel governance structures. Large scale corridors, for the many reasons noted in this section, are prime candidates for adaptive governance arrangements. The majority of adaptive governance scholarship has focused on structures and mechanisms; less is known about individual actors and how their relationships work to operationalize adaptive governance. One way to approach this topic, especially for natural resource governance, is by examining the interplay of science and governance. To do so, we turn to the framework of “coproductive capacity” (van Kerkhoff and Lebel 2015; Wyborn 2015).

Coproductive Capacity

Connectivity conservation is simultaneously the creation and application of scientific knowledge, mediated by a process of adaptive governance (Wyborn 2015). In order to better understand and evaluate connectivity conservation, this study used a theoretical framework of
coproductive capacity: “the combination of scientific resources and governance capability that shapes the extent to which a society, at various levels, can operationalize relationships between scientific and public, private, and civil society institutions and actors to effect scientifically-informed social change” (van Kerkhoff and Lebel 2015:14). This concept was first proposed in 2015 by Lorrae van Kerkhoff and Louis Lebel and is derived from two well-established terms, coproduction and capacity.

The term “coproduction” is used in many ways, but its usage can be grouped into two general categories. On one hand, coproduction can refer to the shared creation of knowledge at the scale of a particular project or program. In this case, experts and users work together to create scientific knowledge, scientists from government agencies working with members of the general public on aspects of a forest plan, for example (Mitchell et al. 2004). Van Kerkhoff and Lebel associate this usage with prescriptive, or normative, commitments to shaping or managing relationships for “improving the scientific basis of decision making” (15). The other, more expansive, formulation of coproduction comes from Jasanoff (2004) who explains, “the ways in which we seek to know the world both reflect and constitute the ways in which we choose to live in it” (1). This “idiom” as Jasanoff calls it, is a descriptive lens through which we can better understand the relationship between science and governance. Jasanoff refutes any notion that scientific knowledge is an exact mirror of reality; rather, science reflects social practices, norms, and conventions. Simultaneously, she writes, scientifically knowledge is deeply embedded in our social life.

While van Kerkhoff and Lebel (2015) acknowledge these distinct interpretations of coproduction, they minimize the importance of the distinction. More recent scholarship (i.e., Harvey, Cochrane, and Van Epp 2019) is emphatic that the difference between “instrumental”
(i.e., facilitated) and “emergent” (i.e., organic) coproduction is fundamental to evaluating their effectiveness. Greater attention has been given to instrumental coproduction, especially with regards to the factors that enable or constrain creation of knowledge considered legitimate, credible, and salient. Many argue that these three factors are key to ensuring that coproduced knowledge is actionable (Beier et al. 2017; Cash et al. 2003, 2006; Glenn 2020). Knowledge coproduction is sometimes critiqued in the literature, especially when it is perceived as a false panacea (Sutherland, Shackelford, and Rose 2017) or, more scathingly, when the process is inauthentic, extractive, or dispossessing (Latulippe and Klenk 2020). More commonly, scholars contend that coproduction is a powerful idea with great potential, but an equally great need for further theoretical refinement (Norström et al. 2020).

Rather than simply observing that coproduction is occurring or has occurred, the coproductive capacities framework seeks to qualitatively assess the factors that enable coproduction. Commonly cited definitions of capacity come from Fukuda-Parr and Lopes (2013): “the ability to perform functions, solve problems, and set and achieve objectives” (8) and Franks (1999): a combination of capabilities required to act and the competence to do so. By applying the concept of capacity to environmental change, van Kerkhoff and Lebel (2015) draw attention to “capacities to create, access, interpret, and apply scientific and research-based knowledge; and capacities to combine science with existing, localized knowledge, practices, and governance to effect change” (15).

This study applies the conceptual framework of coproductive capacities articulated by Wyborn (2015) (Figure 1). The framework draws on the concepts of coproduction, bridging organizations, and adaptive capacity. Wyborn defines coproductive capacities as the “material, cognitive, social, and normative capacities that enable groups of actors to connect knowledge
with action in a cross-scale governance context” (11). These four dimensions emerge from Jasanoff’s (2004) idiom of coproduction. As Wyborn describes it: “this analysis focuses on the coevolutionary relationships between our understanding of reality (the material), our knowledge of that reality (the cognitive), the context of knowledge production (the social), and how we choose to act in the world (the normative)” (12). Below, each capacity is further defined, now in the order in which they are discussed for the remainder of this study:

**Normative Capacities**: “Normative capacities concern the underlying values inspiring actors to work toward a common goal” (Wyborn 2015:13). These values determine whether individual actors are aligned in their perceptions of threats and opportunities and thus motivations to act, all of which are key for developing adaptive capacity (Olsson et al. 2007). Leadership and strong vision are similarly important for fostering normative capacities, as leaders can unite diverse constituencies behind a single purpose, provide strategy, direction, and even inspiration (Hahn et al. 2006; Olsson et al. 2007; Wyborn 2013). Place attachment, an important construct in environmental psychology, is often a driver of normative capacity (Devine-Wright 2013; Williams 2002). Positive relationships between actors and their environment can inspire an emotional connection to the place and a desire to protect it (de Wit 2013).

**Cognitive Capacities**: “Cognitive capacities concern the processes of generating knowledge and turning that knowledge into action” (Wyborn 2015:13). Here, the emphasis lies in the credibility, salience, and legitimacy of scientific knowledge (Cash et al. 2003; Clark et al. 2010). In Wyborn’s framework, credibility is synonymous with scientific quality (especially of technical evidence); salience refers to how useful the knowledge is to decision-makers; and legitimacy is measured via perceptions of fairness, equity, and respect in the knowledge creation
process. Legitimacy is therefore dependent on who is involved in knowledge production and how their perspectives are incorporated into research activities. Achieving outcomes that are accepted as legitimate often depends on facilitated processes that are transparent and inclusive (Cash et al. 2003).

**Social Capacities**: “The social concerns the capacities to produce effective and equitable governance” (Wyborn 2015:13). Collaboration is the essence of social capacities, but this concept can be further broken down into communication (open dialogue); mediation (transparent and legitimate conflict resolution); and translation (shared understanding of terminology) (Cash et al. 2003, 2006; Wyborn 2015). Bridging organizations are essential for creating and maintaining robust and effective social networks and building this capacity (Crona and Parker 2012; Hahn et al. 2006). By creating and supporting cross-scale linkages, bridging organizations span the social gaps that could otherwise hinder collaboration (Chaffin et al. 2014; Dietz et al. 2003). They can boost social capacity in many ways, helping to build trust among actors and resolving conflicts, for example (Crona and Parker 2012; Olsson et al. 2007).

**Material Capacities**: “The material concerns the tangible human resources, financial, and structural capacities to sustain relationships between actors at different scales” (Wyborn 2015:13). Financial resources that are “secure, adequate, and flexible” are required for adaptive governance and linking knowledge to action (Folke et al. 2005; Reid et al. 2016; Wyborn 2015:13). Human resources include the people who have available time to contribute to activities, as well as the structures for sharing knowledge (i.e., networking events, workshops, or digital communication platforms). Furthermore, material capacities can be boosted by institution-sponsored trainings and incentives (Dilling and Lemos 2011; Lejano and Ingram 2009; Olsson et al. 2007).
To ground this theoretical framework, Wyborn (2015) examines two case studies in connectivity conservation, the Yellowstone to Yukon Conservation Initiative (Y2Y) in North America and Habitat 141° in Australia. Wyborn argues that connectivity conservation is a prime example of efforts to operationalize adaptive governance. She uses the lens of coproduction to underline how connectivity conservation blurs the boundaries between science and governance (Wyborn 2013, 2015).

The novelty of a coproductive capacities framework is that it moves beyond the structures and mechanisms of adaptive governance and takes a more relational approach. Wyborn (2015) highlights the importance of interactions and relationships among people to bring into practice the “structures of governance and the rigors of science” (18). The framework is an insightful tool to better understand environmental governance in complex SESs, and as Wyborn has illustrated, is directly applicable to connectivity conservation.
Since its publication, some components of Wyborn’s framework have been reshaped and partially applied (Bennett and Satterfield 2018; Clement, Guerrero Gonzalez, and Wyborn 2020; Marshall, Dolley, and Priya 2018; van der Molen 2018). Van der Molen (2018) reconceptualized the framework in terms of “governance capacities”, concluding that knowledge is essential for facilitating governance—it helps steer decision-making, encourage learning, and connect actors. Bennett and Satterfield (2018) embraced components of the framework to describe “effective environmental governance”, and simplified capacities into skills (leadership, conflict resolution) and resources (financial, infrastructure). One study that explicitly used the four categories above is Marshall et al. (2018) where they examined how knowledge systems fit into transdisciplinary development research: “Material (what is); Cognitive (what we think); Normative (what should be), and Social (what we do)” (10). These authors appreciate the categories for their ability to represent both the individual and the collective. However, it does not appear as if subsequent research has applied the entire framework directly to other case studies.

Other frameworks for coproducive capacities have also been proposed (Pristupa et al. 2019; Robards et al. 2018; Schuttenberg and Guth 2015). In general, these are derived from retrospective investigations of place-based case studies. Examples include Robards et al. (2018), who analyzed cases from the Alaskan Arctic, and Schuttenberg and Guth (2015) who studied coproduction in Hawaii. Robards et al. (2018) identified five enabling conditions for coproduction: evolving communities; iterative processes; boundary organizations; funding; and patience. Schuttenberg and Guth (2015) identified four barriers to coproduction: asymmetrical priorities and capabilities; distinct ontologies; power imbalances; and leadership attrition. These studies are important and contribute to the growing scholarship on science-governance interactions. Still, given the prior application of Wyborn’s (2015) framework to connectivity
conservation, their framework is most ideal for evaluating capacities in a corridor transitioning from design to implementation.

**Research Site**

*Biophysical characteristics*

Ecuador is considered one of Earth’s 17 “megadiverse” countries. Its vast biodiversity hails from the convergence of four distinct biogeographical regions: the Pacific coast, Andes mountains, Amazon rainforest, and Galápagos Islands (CBD 2020). The eastern slope of the Andes, in particular, is recognized as a hyperdiverse region with extreme endemism (Olson et al. 2001). The Sangay-Podocarpus Connectivity Corridor (CCSP) covers a total area of 567,097 hectares and connects 16 distinct ecosystem types (primarily páramo highlands and cloud forest). The elevational gradient ranges from 600 m (1,970 ft) to 4200 m (13,780 ft) above sea level (Sorgato 2018).

The CCSP is home to thousands of plant and animal species. While complete inventories do not exist for the corridor itself, Sangay National Park is known to contain 3,000 plant species (586 are endemic, of which 45% are orchids) (ECOLAP and MAE 2007) and Podocarpus National Park has 1,281 plant species (25 endemic) (Lozano and Aguirre 2004). Furthermore, 344 plant species were identified within Río Negro Sopladora National Park, an area recently established within the CCSP’s borders (Frenkel and Rodas 2017). Initial fauna monitoring efforts in the corridor found 580 bird species, 101 mammals, 162 amphibians, 45 reptiles, and 31 fish. Threatened or endangered species include the Andean “spectacled” bear, jaguar, mountain tapir, and Andean condor (Sorgato 2018).
Figure 2. Sangay-Podocarpus Connectivity Corridor, Ecuador. Urban areas are in purple. National protected areas are in dark green. Provincial and municipal conserved areas in lighter greens. Yellow stars indicate locations of my field visits. Adapted from original © Nature and Culture International
Socioeconomic characteristics

The CCSP includes part of four provinces – Azuay, Loja, Morona Santiago, and Zamora Chinchipe — 18 municipalities, and 57 local districts. The corridor’s “zone of influence” (i.e., direct provisioning of ecosystem services) affects a population of 327,516 and it is estimated that 15,881 people live inside the CCSP (Mancheno Herrera 2020:8). According to the CCSP Management Plan, 7,320 of these individuals belong to an Indigenous group (primarily Shuar and Saraguro) (Mancheno Herrera 2020:8).

The corridor itself is a mosaic. Within its boundaries lay 15 provincial or local “protected forest areas,” 10 municipal conservation areas, and four newly created zones covered by the National System of Protected Areas (Sistema Nacional de Áreas Protegidas; SNAP). In total, 75% of the corridor is under some formal conservation designation (see Figure 2). The CCSP is also home to a complex array of land uses and related environmental pressures. Nineteen percent of the territory is composed of cultivated or grazing lands and about one third of the CCSP’s inhabitants carry out agricultural activities (MAAE & NCI 2018). Significant threats to biodiversity, as identified by the corridor’s main proponents, include mining (20% of the territory is under a commercial mining concession, the state having sold mineral rights to private industry); deforestation and land use change; and road construction (Banks, 2020; MAAE et al., 2020; Sorgato, 2018).

Historical context - CCSP governance and management

While informal corridors have existed in Ecuador since 1992, these antecedents have been non-governmental initiatives promoted by NGOs such as Conservation International and World Wildlife Fund (Freile et al. 2022; Mariscal 2016). As of July 2020, the CCSP became the first corridor officially recognized by Ecuadorian law (Dirección de Comunicación 2020; MAAE
et al. 2020). This development followed shortly after the Ministry of the Environment, Water, and Ecological Transition (Ministerio del Ambiente, Agua y Transición Ecológica; MAATE, formerly MAAE), adopted guidelines and technical criteria for the design, establishment, and management of connectivity corridors [Acuerdo Ministerial MAE-2020-0019 “Lineamientos y criterios técnicos para el diseño, establecimiento y gestión de los corredores de conectividad”]. This was, however, the culmination of a 10-year process involving numerous international and local NGOs, government agencies, funding institutions, and research groups (Gaia Amazonas, 2020; NCI, 2020).

The formal genesis of the CCSP began in 2010. In this year, the Zone 6 regional office of MAATE, with support from Nature and Culture International (Naturaleza y Cultura Internacional; NCI; a US-based NGO with local offices in Ecuador) and financing from the German Agency for International Cooperation (GIZ) first elaborated the need for the CCSP. In 2012, these partners presented the argument that a corridor designation was needed to address the ecological importance of this area, a vast geographic gap between the protected areas of southern Ecuador with numerous ecological threats from human activities (Pesántez 2020). In the years that followed, MAATE and NCI partnered with governments at several jurisdictional levels to establish a patchwork of various conservation lands. These included four areas within the SNAP (including one national park), plus one provincial conservation area and 10 municipal conservation areas. However, there was no legal or governing framework that unified these parcels into a broader conservation initiative (Pesántez 2020).

The legal development of corridors in Ecuador followed a parallel track. The lineage of corridor law in Ecuador can be traced back as far as 2002, when the country adopted its national strategy for biodiversity (Cabrera 2020). 2008 was also an important year in this trajectory, as
Ecuador adopted its new Constitution, which made international headlines for granting legal rights to Nature (Charman 2008; Tanasescu 2013). In 2017, the nation’s supreme Environmental Code (Código Orgánico Ambiental) came into effect, which recognized connectivity corridors as a Special Area for Conservation of Biodiversity, and thus granted the MAATE the authority to adopt formal guidelines and technical criteria for corridors, which it did in 2020 (Pesántez 2020).

In a practical sense, outside of national-level protected areas (over which the MAATE has direct authority) most of the connectivity conservation activities that will occur in a corridor will take legal form at the local level. In Ecuador, authority over land-use planning has largely been devolved to Decentralized Autonomous Governments (Gobiernos Autónomos Descentralizados, GADs), representing each province, municipality, and district. Decisions regarding zoning, rural and urban development, and resource extraction are made when governments update their Land Use and Management Plan (Plan de Uso y Gestión de Suelo, PUGS) and Development and Territorial Organization Plan (Plan de Desarrollo y Ordenamiento Territorial, PDOT).

Therefore, a high priority for the CCSP’s proponents is to integrate the CCSP into each of the PUGS and PDOTs of the corridor’s many jurisdictions, which naturally requires the involvement of dozens of elected officials and bureaucrats.

Beyond its legal justification, the CCSP is governed according to a Management Plan (Modelo de Gestión) (Mancheno Herrera 2020), a document jointly published in September 2020 by MAATE and NCI. As described in an accompanying document published two months later (Arévalo Delgado and Mancheno Herrera 2020), the Management Plan was designed according to a participatory process that engaged several dozen stakeholder groups (i.e., representatives from local government, NGOs, and universities, and interested members of the public) through
47 meetings from 2019-2020. This process was led by MAATE and NCI. Notably, this process yielded the following mission and vision for the CCSP:

**Vision**: By 2030, the Sangay - Podocarpus Connectivity Corridor is consolidated as a national model for the management of productive landscapes and conservation of multilevel ecosystem functionality of natural areas and their ecosystem services, reducing the fragmentation of ecosystems for the benefit of their local populations, through multidisciplinary and participatory management.

**Mission**: The Sangay - Podocarpus Connectivity Corridor is a special area for the conservation of biodiversity, which involves the incorporation of several compatible and complementary national and local strategies with the socio-economic dynamics of the territory, through the commitment of local actors and through a focus on sustainable landscape management (Mancheno Herrera 2020:18; English translation my own).

The Management Plan defines a Management Structure (for all intents and purposes, the governance structure for the corridor) (Figure 3). According to NCI representatives, the structure has a focus from the bottom up, where local actors play a leading role in the initiative’s functioning and make decisions through thematic working groups. These working groups are envisioned as the “operative entities” in the territory, with the “autonomy to make decisions about strategies, planning, and activities” and therefore support the entire management structure (Rodas and Mancheno 2020).

The Management Plan defines seven working groups. These groups roughly correspond to the thematic areas identified as most important to achieving the long-term sustainability of the CCSP. They are titled:

- Governance of the CCSP
- Agriculture
- Biodiversity monitoring
- Protected areas of the CCSP
- Human-wildlife interactions
- Amphibian and reptile research and conservation
- Education, training, and communication
The Management Plan has also identified a list of priority actions under each thematic area. Working groups, while encouraged to develop their own short and long-term work plans, are to primarily consider these high-level priorities. Within the corridor, there is a diverse and complex network of stakeholder groups representing various land uses and interests. Examples include provincial and municipal governments, private landowners, and Indigenous communities. The purpose of the CCSP working groups is to provide a platform for these actors to have a voice in governing this complex social-ecological system (Mancheno Herrera and Ordóñez-Delgado 2020:51). To a large extent, the individuals in the working groups will thus be responsible for moving the CCSP vision forward, from lines on a map to on-the-ground implementation.

The actual status of each working group varies; as of early 2022, four of the working groups are well-established, with membership ranging from five to 15 members each. These are the Amphibian and Reptile Working Group, Biodiversity Monitoring (sometimes “Mammals”) Working Group, Protected Areas Working Group, and Human-Wildlife Interactions Working Group. Two of the original groups have been abandoned, their themes judged as crosscutting and thus not needing a dedicated group. These are the Governance and Education, Training, and Communication Working Groups. The Agriculture Working Group is planned, but not yet established. And a Birds Working Group was established in 2021.
Figure 3. CCSP management structure (Mancheno Herrera 2020). From bottom to top, the headings at each level read “(1) Working Groups - Each thematic area has various working groups; (2) Thematic Areas – From the working groups, three representatives are chosen for each of the five thematic areas; (3) Management Group - Made up of the 15 representatives of each thematic area plus the Ministry of Environment; (4) Secretariat - Made up of three representatives of the management group; (5) General Congress of Actors – All actors with an interest in the management of the corridor; (6) International Cooperation – Lateral support according to the interests and needs of actors in the territory.” The yellow circle on the left reads “It all starts in the roots.”
METHODS

Qualitative methods are considered ideal for engaging with understudied topics (Merriam and Grenier 2019) and for gaining depth of meaning (Anderson and Jack 1991; Rubin and Rubin 2005). To evaluate the coproducutive capacities of the Sangay-Podocarpus Connectivity Corridor and its working groups, I conducted in-depth, semi-structured interviews with relevant people within and connected to the initiative, visited several sites in and around the corridor, and reviewed public documents. This combination of methods was modeled on the case study approach (Yin 2017). I chose to prioritize interviews as my primary data collection method in order to establish more significant researcher-participant relationships, an important consideration for avoiding miscommunications in international, cross-cultural research (Seidman 2006).

Data collection

Interviews

In total, I conducted 27 interviews with 22 individuals (see Table 1). 18 interviews were conducted over Zoom, and nine in person. Interview protocols were approved by the University of Montana IRB (#40-21).

The first phase of six interviews occurred in March and April 2021. Three key informants were identified through published materials on the CCSP website\(^b\) and from online seminars hosted on the CCSP Facebook page.\(^c\) I identified individuals who were common keynote speakers and moderators at these events. This purposive sampling approach ensured that I could hold preliminary conversations with the individuals who publicly represent the CCSP. In the first

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\(^b\) https://www.sangaypodocarpus.org/biblioteca-virtual
\(^c\) https://www.facebook.com/SangayPodocarpus
three interviews, I also pursued snowball sampling to identify three other individuals influential in high-level coordination of the CCSP (Hesse-Biber and Leavy 2010). Participants in this phase included staff at NCI, the MAATE, a provincial government official, and researchers at the Private Technical University of Loja (*Universidad Técnica Particular de Loja*; UTPL). Participants were contacted via email in Spanish, inviting them to be interviewed. In these emails I introduced myself and the project and explained why I believed the recipient’s perspective on the CCSP would benefit my research, but that their participation was completely voluntary. Interviews were conducted over Zoom and ranged from 25 to 60 minutes in length (average length of 41 minutes). Interview questions focused on motivations for the CCSP’s establishment, challenges and successes to date, and suggestions for future directions of the corridor. The interview guide for this phase is presented in Appendix 1.

The second phase of interviews took place between October 2021 and April 2022 and combined both Zoom and in-person interviews conducted in Ecuador. I used rosters provided by NCI to contact the leadership of each CCSP working group. Subsequently, I used snowball sampling to reach other, less active, members of the working groups. Further snowball sampling allowed me to reach other important stakeholders in the CCSP who were not necessarily members of a working group. Details about participants are provided in Table 1. This phase included second interviews with four of the six phase one participants, which allowed them to elaborate on their thoughts or expand on topics of interest. 16 new participants were added to the sample in this phase, two of whom participated in two-part interviews (on Zoom initially, then in person afterwards). In these unique cases, the same overall interview guide was used, but participants expanded on their initial answers using field visits as examples to ground their responses. Interviews ranged from 24 to 71 minutes in length (average of 45 minutes) and
focused on the four categories of the coproductive capacities framework. The interview guide for this phase, presented in Appendix 2, began with questions broadly applicable to the CCSP and then narrowed in focus towards the activities of each working group.

For Zoom interviews, both audio and video were recorded. In person, I recorded only audio. The default language for all interviews was Spanish, and English was only spoken with three participants who explicitly asked to do so.
Table 1. Interview Participants. Those who participated in both phase one and phase two interviews are marked with an asterisk.

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Organization</th>
<th>Profession</th>
<th>CCSP Affiliation</th>
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<td>NGO Staff</td>
<td>Coordinator</td>
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<td>Universidad Técnica Particular de Loja (UTPL)</td>
<td>Researcher</td>
<td>Amphibians and Reptiles WG</td>
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<tr>
<td>3</td>
<td>Universidad San Francisco de Quito</td>
<td>Researcher</td>
<td>Amphibians and Reptiles WG</td>
</tr>
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<td>4</td>
<td>Freelance, Quito</td>
<td>Researcher</td>
<td>Birds WG</td>
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<td>Biodiversity Monitoring (Mammals) WG</td>
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<td>Fondo de Agua Para la Conservación de la Cuenca del Río Paupe (FONAPA)</td>
<td>Water Fund Staff</td>
<td>Amphibians and Reptiles WG</td>
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<td>Protected Areas WG</td>
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<td>Association via Protected Area</td>
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<td>Hydroelectric Staff</td>
<td>Association via Amphibians</td>
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<td>17</td>
<td>Universidad del Azuay</td>
<td>Researcher</td>
<td>Biodiversity Monitoring (Mammals) WG</td>
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<td>18</td>
<td>GAD Municipal San Juan Bosco and Área Ecológica de Conservación Municipal Siete Iglesias</td>
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<td>Association via Protected Area</td>
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<td>Researcher</td>
<td>Human-Wildlife Interactions (Conflicts) WG</td>
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<td>Fundación Futuro Latinoamericano/ Critical Ecosystem Partnership Fund</td>
<td>Foundation Staff</td>
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Field observations and document review

I conducted fieldwork in Ecuador from February 24 to April 4, 2022. After a week in the capital, Quito, I spent the rest of my trip between the cities of Cuenca and Loja, as well as other small towns in the region. In addition to conducting interviews, I visited seven field sites (including four protected areas) around and within the corridor. These visits afforded me the opportunity to make detailed observations about the social and ecological features of these places. Importantly, they gave me first-hand experience in a diversity of places in the CCSP where science and governance interact. Short-term field visits are considered ‘focused ethnography,’ and are best when notetaking is supplemented with robust audiovisual data collection (Knoblauch 2005). As such, my notes were accompanied with still photos and videos. These visits included, chronologically:

- A meeting in the municipality of Chordeleg, between its mayor and environmental technicians, and representatives from FONAPA (the Water Fund for the Paute River, Fondo del Agua para la Conservación de la Cuenca del Río Paute) and NCI, during which the latter two groups submitted and justified a proposal to establish a Conservation and Sustainable Use Area in Chordeleg;
- A tour of Bioparque Amaru (a rescue center, zoo, and educational institution in Cuenca) and its Amphibian Conservation Center. This tour was led by two members of the CCSP Amphibian and Reptile Working Group;
- A hike in Parque Nacional Río Negro Sopladora and two-night stay in its gateway town, Sevilla de Oro. The park ‘technician’ who led the hike is informally part of the CCSP Protected Areas Working Group;
• A tour of Área Protegida Comunitaria Marcos Pérez de Castilla and the community of Oña. This unique protected area was established inside the corridor with support from NCI;

• Three days of herpetology fieldwork (i.e., nighttime surveys) in and around Guarumales, a state-operated hydroelectric plant. I met this group at the end of their 14-day expedition. The team included university researchers who help lead the CCSP Amphibian and Reptiles Working Group as well as the Biodiversity Monitoring Working Group, a university student, and an employee of the hydroelectric plant’s environmental protection unit;

• A hike in Área Ecológica de Conservación Municipal Siete Iglesias and two-night stay in its gateway town, San Juan Bosco. My guide, an employee of the local government, is a part-time manager in the protected area and contributes to both the CCSP Protected Areas and Human-Wildlife Interactions Working Groups;

• Hikes in Parque Nacional Podocarpus, accessed from the cities of Zamora and Loja. I visited this park alone. While technically outside the corridor, Podocarpus anchors the corridor’s southern end and is a well-known attraction for nature tourism. (See Figure 2 for a map of the corridor and the locations of each field visit).

In-person interviews were often timed to coincide with field visits; interviews were most salient when conducted directly before or after observing these conservation initiatives on the ground. Field visits also provided ample opportunity for informal interactions with CCSP members, from meals and social activities to conversations during long truck rides.
Finally, the research process included collection and review of relevant documents to clarify or confirm data produced in interviews, and as general supporting material. Table 2 lists documents consulted for these purposes.

Table 2. Relevant CCSP documents consulted for this study

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors / Editors</th>
<th>Publisher</th>
<th>Year</th>
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<tr>
<td>Management Plan for the Sangay-Podocarpus Connectivity Corridor</td>
<td>Andrea Mancheno Herrera</td>
<td>NCI / MAATE</td>
<td>2020</td>
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<td><em>Modelo de Gestión del Corredor de Conectividad Sangay – Podocarpus</em></td>
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<td><em>Informe del Proceso de Participación Social Para el Establecimiento Oficial del CCSP y la Implementación de la Estructura Interinstitucional de Gestión</em></td>
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<td>Virtual Symposium: Advances in Research, Management, and Conservation in the Sangay-Podocarpus Connectivity Corridor (Proceedings)</td>
<td>Andrea Mancheno Herrera; Leonardo Ordóñez-Delgado</td>
<td>MAATE / NCI / UTPL</td>
<td>2020</td>
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<td><em>Simposio Virtual: Avances en la Investigación, Gestión y Conservación del Corredor de Conectividad Sangay-Podocarpus (Libro de Memorias)</em></td>
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<td>Human-Wildlife interactions in the Sangay-Podocarpus Connectivity Corridor, Andes of Southern Ecuador: A socio-ecological and geographic characterization (Field Practicum Report)</td>
<td>Manuel A. Morales Mite</td>
<td>University of Florida, Center for Latin American Studies</td>
<td>2020</td>
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<tr>
<td>Amphibian and Reptile Conservation and Research in the Sangay-Podocarpus Connectivity Corridor: Report and Projections for the Working Group</td>
<td>Juan C. Sánchez-Nivicela; Fausto Siavichay; Diego Armijos-Ojeda; Verónica L. Urgiles; Diana Székely; Paul Székely; Eduardo Toral-Contreras; Mauricio Ortega-Andrade; Paul Coral; Darwin Núñez; Mario H. Yáñez-Muñoz</td>
<td>Working Group Membership</td>
<td>2021</td>
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<td><em>Grupo de Conservación e Investigación de Anfibios y Reptiles en el Corredor de Conectividad Sangay-Podocarpus: Informe y Proyección del Grupo de Trabajo.</em></td>
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<td>Biodiversity monitoring in the Sangay-Podocarpus Connectivity Corridor: Pilot Phase</td>
<td>Rodrigo Cisneros; Daniel M. Griffith; Carlos Nivelov-Villavicencio</td>
<td>UTPL / Universidad del Azuay / MAATE / NCI</td>
<td>2020</td>
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<td><em>Monitoreo de biodiversidad del Corredor de Conectividad Sangay-Podocarpus: Fase Piloto</em></td>
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Data analysis

With the assistance of Trint.com, I transcribed each interview verbatim, leaving each transcript in its original language. After transcription, I used NVivo software (release 1.6.2, QSR International) to upload transcripts and perform an iterative process of qualitative analysis (Miles, Huberman, and Saldaña 2018). I used selective coding (deductive) and open coding (inductive) to identify themes: initial themes were based on my interview guide questions and the coproductive capacities framework and later themes emerged from the data. Thus, while Wyborn’s (2015) framework lent theoretical structure to my content analysis, I remained open to additional codes and themes as they emerged (Hesse-Biber and Leavy 2010; Miles et al. 2018). Ultimately, second and third rounds of coding were needed to further split large codes into smaller subcodes, or alternatively combine codes.

To strengthen the reliability of my coding scheme, I translated a subsample of two transcripts to English and held an intercoder agreement exercise with colleagues, during which I refined my coding scheme to minimize the extent to which the same passages would be coded differently by different individuals (Creswell 2007). Finally, I translated particularly illuminating quotes to present my findings. In doing so, I have taken some liberties to best preserve the meaning of the quote. Superscript numbers refer to the original Spanish quotes, which can be found in Appendix 3. As is common practice, filler words like “um” or “like” have been removed, and deletions are indicated by ellipses. The number after each quote refers to each unique participant. I also typed up my written field observations and imported these files to NVivo where I used the same coding scheme established for interview transcripts. In this way, I could identify areas where my field observations supported or contradicted sentiments expressed in interviews.
RESULTS: COPRODUCTIVE CAPACITIES IN THE CCSP

Normative capacities

“Normative capacities concern the underlying values inspiring actors to work toward a common goal” (Wyborn 2015:13). These capacities hinge on a common understanding of the challenges for connectivity conservation (perceived threats) as this is what motivates actors to act. Equally important is a shared vision for how to address threats (Olsson et al. 2007). Additionally, place attachment and leadership are important means of building capacity to address threats and take collective action (Devine-Wright 2013; Olsson et al. 2007). I coded these four themes deductively and no significant themes emerged inductively.

Perceived threats

As in social-ecological systems across the globe, the southern Andes are changing rapidly, with both immediate and long-term consequences. The CCSP has emerged in a landscape with many, interrelated drivers of change. Eighty-six percent of participants (n=19) perceived these changes as threats. The most frequent threats mentioned were deforestation for agriculture or settlement (i.e., land-use change) (n=15) and mining (n=15). Additional threats included climate change (n=5), hostile politics (n=4), human-wildlife conflict (n=4), disease (n=3), poaching (n=2), and invasive species (n=1).

Within and around the corridor, small-scale cattle grazing is a main source of livelihood. Beef and dairy products are consumed by families and sold (primarily for the domestic Ecuadorian market). While an essential source of income for residents of the CCSP, the advance of the agricultural frontier is a major concern for many stakeholder groups. “Forest cover is being lost. Converted into agricultural areas, usually to raise cattle,” explained one researcher
“The agricultural frontier continues to advance, [forests] continue to be dismantled. And for us that constitutes a danger,” echoed one protected area staffer and community leader (15).

"What the scientific information shows is that the advance of the agricultural frontier and the destruction of habitats by fragmentation is one of the most serious factors," said the manager of a local water fund (6).

Some linked this threat to an underlying lack of technical expertise in Ecuadorian agriculture, and challenges in rectifying that at a national level:

“The agricultural frontier is advancing a lot because we don’t have the culture, we don’t use technical approaches to agriculture and livestock… For example, here in Ecuador you can find one cow in one hectare, when in a well-managed hectare of pasture, you could have between four or five cows. So that means that you do not need to expand your agricultural frontier to produce better, but rather, you must technify your production.” – Water Fund Manager (6)

“There are many underlying structural problems behind a cow that’s up at 2,500 meters, in a pasture so close to the forest, but they are not easy to change. This requires changing the entire production system, making it more efficient, having more cows per area... It will not stop until you really technify the livestock system.” – University Researcher (19)

The expansion of mining, both legal and illegal, was identified across interviews as an enormous threat to the CCSP. One biologist called mining “very dangerous…very risky” for the corridor (21). Another researcher called it a “real and palpable threat” (3). A representative from Nature and Culture International (Naturaleza y Cultura Internacional; NCI) drew attention to “problems with contamination, problems with illegal mining, and problems that the Ecuadorian state grants [mining] concessions even though these are areas with high biodiversity and sources of water” (1). Among those anxious about mining, the majority cited ecological reasons, such as the potential for mines to disrupt the structural connectivity of the corridor:

“One really painful issue that’s going to affect us a lot, and is unpredictable in the future, not only because of the corridor, is the issue of mining. If we see an updated mining map, the corridor would really be divided into two parts by mining. I mean, it cuts it off completely. I feel like that is a super strong threat.” – NGO Staff (9)
Others spoke out against mining on principle. As one researcher put it, “the problem with mining is that it has not served us well [for human development]” (4). Mining leads to fragmentation, both ecological and social, they argued. According to this researcher, mining divides communities and introduces crime and the kinds of social ills that plague many extractive industries (they cited alcoholism and prostitution as examples).

It seemed that mining was less of a concern in the northern end of the corridor, among participants based in Cuenca, Azuay Province, and more of a concern in the southern part of the corridor. This reflects a long history of legal opposition to mining in Cuenca, and recent victories by activists; though its implications are still unclear, in 2021, a citizen referendum banned mining in the city’s watershed (Ricci 2021). The strongest disdain for mining came from an official from Zamora Chinchipe Province, in the far southern end of the corridor, where around 50% of the territory is under a state mining concession. They lamented the fact that their province—and its biological richness—is as at the mercy of the Ecuadorian government:

“If the State decides to open what is called the mining cadaster, that is, allow more concessions to continue, what we have seen so far is that all of Zamora Chinchipe will end up a concession except national protected areas... In reality, here in Zamora Chinchipe, if it’s not a protected area, it’s nothing. It’s nothing because you have no guarantee. The day after tomorrow the machines come in and forget about it” (5).

The Ministry official (13) only vaguely mentioned “extractive activities” and the need to reconcile those interests with others in the corridor. In a follow-up, they cited the potential for “conflict [due to] mining activities.”

Conservationists view the issue as a nonstarter. Compared to other temporary disturbances like deforestation, mining is seen as a permanent scar on the landscape. “A mining site does not recover,” explained one biologist (21). One researcher took the issue a step further,
issuing a word of warning to their fellow CCSP proponents against the dangers that mining pose, and the need to take it more seriously:

“I do see a very dangerous challenge for the corridor, very risky for the corridor: the mining issue. I really think that it is not being given the importance it deserves… The mining issue can become the stumbling block that cuts the corridor into two parts… We cannot close our eyes. It will not go away.”9 (21)

Researchers, protected area managers, and even hydroelectric staff emphasized that once mining concessions have been granted, the only way to prevent extraction is through the National System of Protected Areas (Sistema Nacional de Áreas Protegidas; SNAP). In the context of the CCSP, where nested protected areas have been designated at both the local and national level, the threat of mining (and subsequent contamination of water) is countered only by setting aside the land under the strictest protections possible.

**Shared vision**

In the CCSP, participants acknowledged that the corridor is a work in process. Though its origins can be traced back over a decade, the initiative’s governance structures are nascent, and projects are just getting off the ground. All 22 participants spoke of their individual visions for the CCSP (not to be confused with the vision and mission statements adopted by the CCSP and published in its Management Plan). Most frequently (n=16), participants envisioned a corridor that protects the landscape, its ecological processes, and its biodiversity. Actors in the CCSP are intimately aware of the biological richness in this zone. For example, an NGO staffer (9) shared, "Thinking about its ecosystem and all the variety of species that exist, it is really a space that needed to be protected."10 This emphasis on protecting flora and fauna was especially evident in observations on field visits to protected areas. While hiking in Parque Nacional Río Negro Sopladora, the park technician exuded pride every time we saw tapir or puma footprints and
highlighted the park’s success in limiting human intervention along its border. Similarly, in Área Ecológica de Conservación Municipal Siete Iglesias, the technician guide enthusiastically identified rare birds like trogon and quetzal, species that are indicators of ecological health.

Scientists seek to catalogue new species in this biodiversity hotspot. This quote reflects the urgency that motivates their work:

“In the particular case of amphibians we have a special situation in that even within protected areas, where you do not have deforestation or pollution… Even in these very well-preserved spaces, amphibians are still disappearing. Reptiles are still disappearing. So that means these things are slipping out of your hands, you know? So for us it's also a race against time. We have to hope that in 10 years we can at least identify what is here. First things first.”

– University Researcher (2)

In Guarumales, herpetologists further emphasized the passion inherent in their mission to find new species, document their existence, and fight to protect their future.

In interviews, others drew attention to the gap in protected areas between Sangay and Podocarpus National Parks, and the need to focus on structural connectivity and land-use planning. For example,

“The idea is to connect these two large national parks, Sangay and Podocarpus. Between these two there was a gap... There was no connectivity, or let's say, there is connectivity, but it's not guaranteed. So, an interesting job that Nature and Culture International has done publicly, along with other institutions, is to identify these ecosystems that may be other islands or may become islands, and instead connect those ecosystems and connect highland areas with lower areas of the Amazon.”

– Water Fund Manager (6)

Coming from the Ministry of the Environment, Water, and Ecological Transition (Ministerio del Ambiente, Agua y Transición Ecológica; MAATE), this same argument appears through a landscape ecology lens, with the CCSP fulfilling both structural and, perhaps more importantly, functional connectivity:

“The interest is common, fundamentally because the topic of conservation for many years was oriented towards islands. And islands are generally spaces that do not maximize conservation, but rather lead to greater fragmentation and greater vulnerability of species
and do not allow the flow of species, or promote a functional ecosystem across these areas.”13 —Ministry Official (13)

Protecting natural resources from human development through the creation of new protected areas was emphasized especially among NCI staff. As one explained, “In 2012, the corridor did not have any [protected] areas within the national system. But now in 2021 there are five areas, and they are the hearts that this corridor has to be able to cover, little by little to achieve that corridor functionality”14 (9). Another described the benefits of protection:

“You can have a corridor without a protected area, but it’s better if you have them under conservation areas and protected areas, because the regulations are different. Territorial planning is different in those areas…The investment of resources is different when it is a protected area or when it is not.”15 — NGO Staffer (10)

One local government official expressed deep concern with the lack of attention on socioeconomics, and too strong a focus on protection. Nonetheless, they concede that the threat of mining may be creating an imperative for protection; in the Ecuadorian context, they remind us, protected areas are the only means of avoiding resource extraction:

“Well, at least as I understand it, a corridor is a management tool for areas outside formal conservation areas, so that people can manage the territory and yet allow movements [of wildlife] while allowing sustainable uses. But it seems like the goals of the corridor are to declare conservation areas and have them recognized by the Ministry of the Environment every, I don't know, two, three months. To declare and declare conservation areas. So where are the people? ... It seems like sometimes we lose sight of that north star. It could be just the way it is here in Ecuador, that if we want to carry out effective conservation we have no other alternative, because [if it’s not protected] they grant a concession to the miners and they exploit it and that's it.”16 (5)

However, protection was not the only vision for the corridor. Equally common (n=16) was the sentiment that the CCSP strives to be innovative, advancing a progressive form of conservation where human wellbeing and socioeconomic opportunity are as seen as fundamentally intertwined with ecological outcomes. This quote captures the sentiment well:

“I believe that success for the corridor would be for the corridor to function as a large area destined for conservation, but also for the survival of the people in those areas. So
those people can have a good quality of life, which is, for example, having access to everything that people in the cities have, right? Health… To have good road connectivity, and have all the benefits of ecosystem services, right? Having good quality water, being able to grow their crops or generate their income without strongly affecting the ecosystem…”17 –University Researcher (3)

The field of conservation must evolve in order to fulfil these ideals:

“It's a challenge because sometimes I think we've historically seen conservation as perhaps a very restrictive issue, an issue where maybe we're conserving the areas and nobody touches these areas. But of course, the vision that the corridor has is not so much that. It is not so much to not allow biodiversity to be used, but perhaps to look for partners so that the activities carried out in the territory are sustainable…”18 –University Researcher (2)

This kind of vision is closely linked with ideals of justice and land sovereignty, especially through helping uphold the rights of Indigenous peoples in the Amazon, such as the Shuar and related tribes. The Shuar today number around 100,000 but have been displaced from much of their traditional lands (Izurieta 2019). As this researcher points out, everyone has the right to a high quality of life, but this does not always entail urban development:

“The thing is, we have to change the discourse around ‘quality of life’. Do I have a better quality of life because I live in this shitty, polluted city of Quito that floods and is a mess? Or do I have a better quality of life if I live in a pristine forest, with clean water, food and everything else? Who has better quality of life? So this is a conceptual discourse on economic development that’s been published in books and all that… I think this is what’s important for the corridor and its people. Even they know that it is important to them. They have defended that land for years. Especially the Shuar groups… I think that the most important thing is that they see themselves reflected in this work, all reflected.”19 –Freelance Researcher (4)

Also underlying these kinds of vision are deep-seated values in local agency and grassroots organizing. A local government official (5) stated that “the people are the owners of the land,” invoking potent ideas of agrarian land tenure. Drawing reference to the ugly history surrounding the expansion of Sangay National Park, which subsumed existing villages, one researcher (11) asserted that the corridor is, above all, to support the needs of the local people. Another researcher (3) framed it as a battle, affirming that “[the CCSP] allows them to fight
against environmental attacks on the area”. These value-laded propositions have implications for the governance of the CCSP. For example, a representative from NCI drew comparison to the failures of early corridor initiatives in Ecuador, and their inability to link international funding to local realities:

“It was an idea that some NGO from some part of the world came up with that came to America or Africa or wherever and said, ‘Ah, here we are going to make a corridor.’ They made the design, but people don’t understand what it’s all about, or don’t participate. And when the financing of that NGO runs out, they leave and there’s no longer a corridor. So, in our case it’s more like we started to build the corridor from the local, from the vision of each actor, from the need of that actor.”

– NGO Manager (1)

Additionally, one university researcher underlined the absolute imperative of local decision-making:

“I’m convinced that we cannot wait until central governments solve people's problems. I’ve almost completely lost hope in such a vertical structure from the top down… I’m convinced that the only revolution is to do local work… Our actions are local and will always be local… So I have a lot of faith in the structure of the corridor.”

– University Researcher (19)

Despite the emphasis on local involvement, one of the largest issues that came up was the absence of a coherent strategy for engaging local campesinos (peasants or smallholders) and making their voices heard:

“For those people who live inside the corridor, what is the corridor for? What is the advantage of having a corridor? So we have producers who we should start to help, to support so that the campesino has better income and puts less pressure on the natural ecosystem. That's a key challenge, isn't it? Ensuring that the campesino can live, but use the resources well, stop deforestation or burning in areas where it is not profitable.”

– NGO Manager (1)

Those who envision a form of conservation that prioritizes socioeconomic opportunity are thinking long term. To avoid failure down the line, these benefits need to be sustained into the future, indefinitely. As explained by a Ministry Official (13), “We need to guarantee these territories for future generations. Far into the future, I mean, for life.”

–
Straddling the line between nature protection and prioritizing people is the concept of ecosystem services (Millennium Ecosystem Assessment 2005). In this Andean context, the guarantee of provisioning services – clean and plentiful water, in particular – is potent inspiration for conserving forests and páramo. Fifteen participants cited water provision and other ecosystem services as a justification for the CCSP. Water is a paramount concern of actors across many sectors. One researcher explained, “I believe that the most effective strategy we have and the one that has allowed the corridor to attain the results that it currently has lies in water. Why? Because it is a mandate for local governments. It is a political obligation. Providing water resources to its people in quantity and quality” (21). A staffer from the hydroelectric plant explained, “Being a hydroelectric company, if we don't have water, we simply don't generate” (16). The water fund manager described water’s importance as "that umbrella that we’ve been searching for, for many years, in different species" (6). Finally, from the standpoint of an international funder, water is what links conservationists with the political interests of local municipalities. Put simply, “If you're a mayor in one of these small towns and you don't have water in your city, you're screwed” (22).

One researcher shared how ecosystem services are generally the best way of engaging local campesinos living in the corridor:

“The concept that we have to sell to people—because that’s the reality—is that the water they drink also comes from this park. That ecosystem services come from this park, such as pollination and others on which they depend. That is to say, their life—the life of the local people is intimately related to the park… That is the most important message to deliver.” (11)

All but one participant cited protection, progressive conservation, or ecosystem services as their primary vision for the corridor. Some participants did mention a desire to collaborate, communicate, and share information with other institutions across the CCSP; expand the corridor
southwards into Peru and solidify a transboundary connectivity network; and generate scientific knowledge for the benefit of all. But when asked to place their individual vision in the context of the group as a whole, most participants felt that their visions were aligned. After several years of planning and coordinating, one university researcher (12) stated how some are eager to move the process along: “The vision I think is great. It's putting it in practice that's the hard part. It's the real challenge.”

**Place attachment**

Place attachment is another factor that can bolster normative capacities (Wyborn 2015). About two-thirds of participants (n=15) shared their personal relationship with the landscapes that encompass the CCSP. Scientists, NGO staff, and public officials recounted growing up in the region and receiving their educations at local universities, primarily in Cuenca or Loja. Now, as many raise families in these cities, the parks and reserves throughout the corridor are important sources of pride, and in some cases an opportunity to pass along an environmental ethic to the next generation.

For some, especially the biologists who have passed up more lucrative careers for the privilege of exploring this wild land, they feel an intimate connection with the physical soil. As one ornithologist (4) said, “I don't have my farm, I don't have my car, the only land that I have is under my fingernails, and you know, my bellybutton. But that's it!” Further, a community leader and protected area staffer (15) stated, “I was born in the countryside, right here, in this exact place, and all my life I have identified with the countryside… So that’s really motivated me to identify with the countryside and identify with its people.”

About half of those who claimed an attachment to place did so on the basis of their professional careers. Biologists recounted places and years in which they discovered new
species, bolstering their professional credibility. One zoologist (17) explained, “We’ve grown up in this corridor.” With its northern edge almost 500 km south of Quito, the CCSP is a distinctly southern initiative. Researchers shared that the majority of scientific attention and funding has been centered on the north of the country, around the capital city and major biological reserves such as Yasuni National Park in the Amazon and the Galápagos Islands. In discussing their connection to place, several participants highlighted their own southern upbringing. And as a herpetologist explained, this region’s lack of previous expeditions means that exciting new discoveries are inevitable:

“Personally, I live here in the south. I’m someone who has lived in the countryside. And something very curious that happened to us is that the south of Ecuador was not well-studied… And as I visited more places in the south of Ecuador, especially high mountain ecosystems, such as páramo, montane forests, I found rare animals and I found animals new to science… And as soon as we entered these areas that had been unexplored within the corridor, we found many, many new species which we’re now working to describe. So that's my strong connection to this place, because I felt like one of those old-fashioned explorers, coming into a place and finding animals that no one had ever seen before…”

University Researcher (3)

The large size of the corridor appears to be a challenge for the CCSP partners. As an NCI cartographer for the initiative stated, “I don’t even know all of the corridor… We’re closer to the northern part, but that southern part is a whole other world” (9). What this suggests is that place attachment in the CCSP is a personal phenomenon where individuals connect to particular sites, yet CCSP partners are also deeply bound to the landscape as a whole.

Leadership

Fourteen of 22 participants identified leadership as a major component of normative capacities. The overwhelming sentiment was that leadership was superb in the years leading up to the corridor’s designation but has been more challenging in the past few years. At the upper levels of CCSP governance, the Cuenca office manager at NCI is the primary leader who
coordinates institutions, hosts meetings, and generally keeps the initiative moving forward. They were identified by name in seven interviews, described as the “head honcho” (2), the “orchestra director” (19), and “a pro” (9). This experienced conservationist is well known in Cuenca, and throughout southern Ecuador. Other leaders mentioned by name include a professor and researcher at the Private Technical University of Loja (Universidad Técnica Particular de Loja; UTPL) (n=5) and the regional representative at the MAATE (n=2). Together, these individuals have brought many disparate threads of science, policy, and practice together under the umbrella of the CCSP. As explained by the NCI manager (1):

“You have to understand that these processes, beyond institutions, depend on people. And there are people who are more committed to the processes and those people make it work. And then others are linked in according to their interest, their motivation for a specific topic.”

Those who lead the CCSP from the top levels have several traits in common. They have a strong grasp of the collective vision and use that to inform strategic decisions. According to one herpetologist (2), “They always tell you which meeting is most opportune for developing some project.” They’ve been involved with the corridor since its earliest days and have built knowledge on a wide range of issues which they can draw on in difficult situations. One NCI staffer (9) described this confidence, as “The way they talk, the way they’re sure of it, and how they fight and fight on…” These leaders are also unifiers. They have a penchant for bringing people together and making them feel part of something bigger than themselves. “We don’t feel alone,” said one protected area manager (16). “They make a huge effort to keep us united,” added another researcher (17).

At the working group level, leadership varies. In some groups, a single leader directs all activities and makes major decisions (e.g., Human-Wildlife Interactions Working Group). On the other hand, the Amphibian and Reptile Working Group divides responsibilities among three
primary leaders. In this structure, one person each takes the reins on research, education, and management. “Each one supports how they can, based on their expertise,” explained one herpetologist (3). In the Biodiversity Monitoring Working Group, leadership is diffuse, with representatives from the Decentralized Autonomous Governments (*Gobiernos Autónomos Descentralizados*, GADs) taking on significant roles across the corridor. In newer groups, like the Birds Working Group, the ranks are not yet filled out, and leadership is less of a priority.

**Cognitive capacities**

“Cognitive capacities concern the processes of generating knowledge and turning that knowledge into action” (Wyborn 2015:13). Wyborn’s framework breaks down the contributing factors as credibility, salience and legitimacy. My inductive coding revealed a difference between *scientific knowledge* (within which I searched for credibility, salience, and legitimacy) and *local knowledge*. Scientific knowledge was identified as a major component of the CCSP by nearly all interviewees (n=21). Slightly fewer participants (n=16) discussed the contributions of local knowledge, sometimes including Indigenous or traditional ways of knowing.

*Scientific knowledge*

Professional researchers are the primary group responsible for generating science in the corridor. Seventy of 113 references coded to this category (62%) came from researchers. To evaluate science production, it’s helpful to analyze the science’s credibility, salience, and legitimacy.
Credibility

Credible science was fundamental for developing the legal basis for the corridor. As the Ministry official (13) explained: “In analyzing the conservation strategies in the territory, along with land use plans, we used a land cover analysis, a connectivity analysis, an analysis of species distribution…”

Observations during a field visit to Guarumales illuminated the endemism of this region’s flora and fauna, and the specialized expertise of researchers to identify species. To survey this region of the corridor for reptile and amphibian abundance, the team conducts annual transects at 14 sites across three locations spanning the elevation gradient. Captured individuals were photographed and identified if possible. When IDs were unclear (most common in the highly diverse frog genus *Pristimantis*), specimens were sacrificed and brought to the laboratory for accurate anatomical measurements and genetic sampling.

In the Biodiversity Monitoring Working Group, scientists have developed a standardized protocol to arrange camera traps for optimal coverage of the corridor. Despite several challenges with engaging local government partners, the project has yielded preliminary “occupation models,” which help to analyze the baseline functional connectivity of the corridor (12).

There are, of course, gaps in the knowledge. Ornithologists are still trying to develop a database of bird presence, range, and abundance. In cases where this kind of information does exist, knowledge about interactions and drivers of change is still lacking:

So, really the first step is to know what is there, right? The second step is to understand what is going on with this population… it may be diseases, it may be an issue of global climate change that is affecting amphibian species. I don't know. This we need to study in depth, and ecologically-speaking on a population level.”

Herpetologist (2)

There are opportunities to expand the CCSP’s capacity for scientific knowledge. One suggestion, proposed by a community leader and protected area manager at Marcos Pérez de Castilla, was
the creation of field stations (15). These stations could host scientists, students, and even interns.

Another suggestion, this time from the hydroelectric staffer (16), was to link biological monitoring with established datasets, for instance on meteorology or hydrology. This blending of information would help quantify the corridor’s ecosystem services, especially water provision.

**Salience**

In general, the science is also highly salient, in that the questions being asked are informed by the needs of the corridor, and conclusions drawn are informing decision-making. For example, the Biodiversity Monitoring Working Group is placing camera traps on the periphery of protected areas, rather than in their core, to better account for human development pressure on animal abundance. Herpetologists are not only discovering new species at an astonishing rate, but also rescuing rare and endangered frogs from mines nearby the corridor. Sensitive amphibians are considered excellent indicators of overall ecosystem health, but herpetologists are also responding to very specific threats, monitoring the presence and severity of amphibian fungal diseases:

“We have several lines of work. One is the pure research part. For example, the taxonomic part of describing this diversity that is largely unknown… And on the other hand, we’re working on monitoring and evaluation of the conservation status of the species in the corridor… While also taking samples to know if these diseases are present within the corridor.”*38* –Herpetologist (3)

In the CCSP, efforts are underway to monitor the critically endangered and “very famous, very emblematic” (3) harlequin frogs from the genus *Atelopus*. Specific species can be powerful in generating conservation support, as described by this ornithologist (20): “Birds are useful because they are charismatic. People know about them… There's even maybe more money for doing conservation with birds than the other groups.”
As framed by another researcher, who focuses primarily on mitigating human-wildlife conflict, systematic knowledge about biodiversity is fundamental for designing appropriate management interventions at the local scale:

“We live in a megadiverse country and the main challenge of a megadiverse country is that we almost never have complete information about a specific site. In the corridor, for example, new species are being described all the time and I’m sure that in terms of biodiversity we do not know the vast majority of the country. We do not know the true dimension of the biological wealth that we have here. So, this baseline information is one of the many things that we need in order to move forward with stakeholder engagement that makes sense.”

—University Researcher (11)

This is certainly true for jaguars, which are essential from an ecological standpoint, as a wide-ranging keystone predator species, but also pose a lethal threat to livestock. The Biodiversity Monitoring Working Group reported jaguars at high elevations never before captured with photo evidence. This documentation has real consequences for the way livestock are managed.

Ultimately, it’s important that the research questions being asked in the CCSP are salient not only to decision makers at the top, but to local communities too. This imperative is laid out by the NCI manager (1): “[Science] is important because it connects directly with citizens and politicians. If we have information that’s understood, that is, collected and then transmitted to society, conservation of the territory will be more valued.”

Nonetheless, there is significant concern that research is occurring in an academic bubble, with questions defined by scientists with little input from locals. This issue emphasizes the challenges of implementing a progressive and participatory form of conservation. Perhaps this would entail focusing research more on ecosystem services and the unifying theme of water, as the Ministry official (13) suggests:

“We could work on comparative models that would allow you to determine with x amount of forest, how much water I have and without this forest, how much it costs me. Quantity and quality of water is one example. Or productive soils, or biodiversity. So having these indicators allows you to say to a community ‘Look, this is what we have
now. Without this, we won’t have that. And how much is that going to cost you?’
Basically, it’s putting value on the resources so that the people can see their
importance.”  

Apart from one researcher studying human-wildlife conflict, the entire science team
interviewed for this study investigates the biophysical realm; however, there is interest in
advancing social science research. Analyzing the beliefs and perceptions of the corridor’s
residents would provide a solid foundation for undertaking ecological research that is most
salient for locals:

“One area in which we’re not working so actively in is social science. I mean, I don’t see
anyone leading it here. For example, ‘How does the campesino in the corridor perceive
the corridor?’ I don’t have any idea. I don’t work in this realm, but I think it’s super
important. I mean, how do they feel? Do they know the corridor exists? Do they know
whether they’re inside the corridor or outside it or on the border? How do they feel about
protected areas? Do they like them? Are they indifferent? I don’t have even the most
remote idea… What would it mean if the corridor means nothing to a campesino that
lives inside the corridor? That would be very bad. Why? Because it would mean the
corridor as a concept is staying at the high level, with the decisionmakers… I don’t know,
does it serve them? Are they in favor or opposed?”—University Researcher (21).

Anecdotally, the human dimensions researcher (11) hypothesizes that the corridor residents are
in favor of conservation, but limited by their economic options:

"It’s like ‘Good, I like the forest, I want to protect the forest, but I’m also hungry, and my
child is sick and I need to buy school supplies for next month…’ So they may need to cut
down a tree and sell it, or poach wild animals, even though it’s illegal.”

These kinds of theories would need significant investigation, especially to generalize across the
total corridor or parse out the differences among some 57 districts and nearly 16,000
inhabitants. But the interest is strong. One NCI staff member (9) went so far as to say “I think the
technical part is already there. I feel like we shouldn’t do anymore there. The work now should
be on the social side.”
Legitimacy

Although the CCSP’s science is highly credible, and for the most part salient, participants expressed concerns with its legitimacy, defined in Wyborn’s (2015) framework as perceptions of fairness, equity, and respect in the knowledge creation process. There are certainly efforts to engage local communities in the scientific process. One highlight is the Human-Wildlife Interactions (Conflicts) Working Group holding workshops to train municipal governments on an innovative ‘first alert’ system for coordinating responses to livestock depredation. Another is the Biodiversity Monitoring group’s inclusion of GAD technicians in camera trapping. The Bird Working Group, too, has plans to build on citizen science efforts like the popular Christmas Day bird count, but that program is in early stages of planning.

A major tension for university scientists is how to balance the requirement of publishing journal articles with the equally important task of sharing findings with local community members. Generally, universities require publications and use journal articles as a metric for evaluating their faculty’s performance. One researcher (2) lamented not being about to publish “at the speed that should be” as a “bottleneck that we hate.” Another researcher (19) was frustrated with the “boom in producing scientific articles, and everyone fighting over data” in a competitive atmosphere. If given the choice, most would rather see their research used to improve management. “Unfortunately, scientific articles stay between scientists. No one, and I mean no one, is going to read a scientific article,”45 said one herpetologist (3). An ornithologist (4) laid out the tension in the starkest terms:

“I mean, that paper is useless. I’d say ‘Look, here’s a paper!’ and the local people would say ‘Yeah, but I still don’t have anything to eat or a job.’ It’s useless, if you get what I mean. I don’t know if its necessarily your obligation as a scientist, but you can help inform development with your research, it can work.”46
These scientists feel they must seek out alternative methods of sharing their knowledge beyond the academy, often turning to social media platforms.

Researchers offered numerous suggestions for improving the legitimacy of their work. One researcher (12) offered formal participatory research: “We need to have participatory research and have some systematic way of talking to the stakeholders in the corridor to determine what are the important questions that we need to address.” Another researcher (17) called for the involvement of more students: “Many of these things that should be implemented here should be done with students, doing surveys, writing their theses, doing research. On the social side too. Because it’s really important. They should be involved.”

Legitimacy could be improved through efforts to train protected area managers and acknowledge their work via authorship, as explained by another researcher (19):

“I’m also excited to train local technicians or rangers. Give them the capacity so that they don’t need us scientists, so that they can measure the efficacy of their own management of the protected area… We have to change this dynamic where we come into the field, use the local people like robots to collect data and then leave.”

Local knowledge

Sixteen individuals expanded the topic of cognitive capacity to include local knowledge as distinct from western scientific knowledge. However, nearly all these references were vague, merely suggesting that campesinos be involved in scientific processes and given the opportunity to contribute other ways of knowing. For example:

“People in the area have local knowledge—not scientific, but local—which is also quite valuable, and has been complemented with scientific knowledge from universities and professionals who work in the corridor. And I think it's all very valuable.”

Hydroelectric staff (16)

A handful of CCSP projects put this knowledge into practice. Prime examples are the first alert system, which functions best if local farmers can identify jaguar prints and predict where the
animal is headed; and the amphibian monitoring effort, which regularly invites local residents to join transects and lead scientists to the richest zones. The Amphibian and Reptile Working Group has even recruited young biologists from the corridor to become members. As a group leader (3) explained, these youth have lived experiences most familiar with “the people who live [in the corridor], the same problems, the same needs…”

Finally, while CCSP promotional materials and formal documents make frequent reference to the Indigenous presence in the corridor, specifically to communities of Shuar and Saraguro, the importance of Traditional Ecological Knowledge (TEK) arose in one single interview. The Ministry official stated:

“Within the corridor we have Shuar communities, which are Quichua. The Saraguros and the Shuar. So, we could look at the experiences that they’ve had in their own development processes, and look at the historical memory that they have in these socio-economic, environmental processes, etc. So I think that could help. In fact, I think that the Universidad Técnica Particular de Loja offers these kinds of cultural degrees and they could really be an important link in supporting this. Also Universidad Amazónica”(13).

**Impacts of the COVID-19 Pandemic**

The pandemic’s negative impacts on cognitive capacities were numerous. From 2020 to early 2022, projects were slowed down or cut off entirely. For researchers, fieldwork came to a standstill. “Ecuador was practically closed for a year… It was more difficult to access scientific collections at museums or universities, or work in the lab. Everything was restricted and that set us back”(3). “All kinds of work were paralyzed,” claimed one herpetologist (2). Field surveys at night—when herps are most active—were nearly impossible due to a national curfew which remained in force for many months.
Social capacities

At the heart of coproductive capacities are social dynamics. “The social concerns the capacities to produce effective and equitable governance” (Wyborn 2015:13). Translating science into effective and equitable governance requires a constellation of relationships fit to address the challenges of any given context. To code this section, I used deductive and inductive methods. I combined themes of communication, mediation, and translation (Wyborn 2015) into a collaboration code (referring to collaboration among CCSP partners, within and across working groups), and then found that bridging organizations and public engagement were the most appropriate additional codes.

Collaboration

Nearly all interview participants (n=21) raised the topic of collaboration, which undergirds the CCSP’s governance structure. The CCSP is promoted in public documents as a model of bottom-up collaborative governance (Mancheno Herrera 2020). This study probed what each participant viewed as enabling or constraining collaboration. Some actors see institutional collaboration as a major accomplishment, with one researcher (21) boasting of “the fact that so many institutions are unified with a common north star even if their individual role in the territory is small,”52 and the Ministry official (13) proudly describing “a wide participation of different actors at different levels, in an empowering process.”53 For others, the collaborative model has been a challenge. A provincial government official (5) described management as “very macro” and “very complicated to handle due to the huge diversity of actors in the territory.”

The CCSP Management Plan (Mancheno Herrera 2020) has been designed to facilitate collaboration within and across thematic working groups. NCI staff, who are largely responsible
for designing and establishing these groups, describe them as “the motors” that power the CCSP “machine” (1), or ideally the “platforms” on which rest collaboration (10). Note that working group membership is a voluntary commitment. The voluntary nature of the groups seems to have simultaneously narrowed down the individuals who care most about the CCSP, while at times limiting the extent of their own involvement.

The most accurate indicator of successful collaboration is the presence of clear and open communication channels. Interviews and field visits revealed that communication is strongest within individual working groups, but severely lacking across groups. Time and time again, participants commended their colleagues within their working group, but criticized the dearth of cross-group communication.

Each working group collaborates differently. The Amphibian and Reptile group is a well-oiled machine, with core leaders and associated members who assist on various projects where they can. The Protected Areas group meets infrequently but convenes when needed. Meanwhile, the Human-Wildlife Interactions group is in transition, having recently enlisted a new organization, Fundación Condor Andino, to take a coordination role. The Biodiversity Monitoring group is looking into doing something similar to alleviate the coordinating responsibilities that currently fall on university researchers. Finally, the Bird group is new, having only gathered three times and is still recruiting members. Within each working group, members appear to communicate effectively: “We share within the group and quite openly. We've shared data, we've shared information… I think it's pretty open, pretty transparent,” said one researcher (2), referring to the Amphibian and Reptile Working Group. Digital forms of communication have been essential for maintaining open communication: “People in our group have taken advantage of the technology that we now have. Zoom, WhatsApp, and email have
been incredibly important and helpful to keep us going,” said a member of the Human-Wildlife Interactions Working Group (11). “[Within the group], we talk all the time through WhatsApp. We’ve even shared data there,” added a member of the Biodiversity Monitoring Working Group (5).

However, there is essentially zero communication between working groups. “I think the groups are working pretty well, but closed completely. There is no communication between groups. There's none,” said one researcher (2). Another researcher (8) didn’t know the bird group existed: “So you’re telling me there’s a bird group. But I had no idea that there’s a bird group. I didn't know that. Sometimes we get so engrossed in herpetology, just reptiles and amphibians.” A third researcher stated plainly, "There’s no exchange between what each group is doing. At least not that I’ve been involved in… There’s no cohesion or interaction between the groups" (17). This is generally seen as a problem. On one occasion, however, a researcher (12) suggested that it’s okay for each group to work in silos, as long as they come together at some point down the road:

“I don't know what the other working groups are doing. It seems like we're just all kind of working in our own little teepees and at some point we need to get together again and say, ‘OK, what have you done? What have you done? And now, what can we do?’ But right now, I think that's an important stage. We need this time to actually produce something. Not just always be talking about ideas and visions.”

When asked about avenues for sharing insights across working groups, several participants pointed to a virtual symposium held in 2020 which attracted more than 1000 viewers (Mancheno Herrera and Ordóñez-Delgado 2020). But this was a public event, primarily a scientific conference to share findings from research undertaken in the corridor. While impressive in many ways, the symposium is best viewed as a long series of presentations. Along with hundreds of curious members of the public, CCSP working group members were clued into
just how much research was occurring in the corridor, which could spur opportunities for future collaborations. But the symposium was not a focused meeting or workshop calibrated to address management issues in the corridor. The management structure calls for a general congress (junta) of all CCSP actors to be convened from time to time, but this has yet to occur. It’s possible, again, that the pandemic is responsible for this delay.

At the top level of CCSP coordination, communication is spotty. The most frequent form of communication at this level is one large WhatsApp group with over 150 members. This is a fluid group that includes coordinators from NCI, formal CCSP working group members, representatives from local governments, and some other corridor residents. The chat serves many purposes. Most recently, it’s provided a space for anyone to post photos or videos of flora and fauna and ask for identifications. The chat is also a go-to arena to post professional development opportunities, such as webinars. One protected area manager (18) beamed with excitement for its potential: “My colleague visited the Piemonte Waterfall and found a fungus that released a vapor. It was really cool! But we didn’t know what it was. We don’t study that kind of biology. But maybe someone else who specializes in fungi [would know].”\(^ {60} \)

In contrast, one researcher (8) was frustrated with its lack of purpose:

“Look, someone says that there is going to be an Ecuadorian zoology congress, a National Congress. Yes very nice. And then here, someone wrote ‘Listen to this sound.’ So since I study amphibians, I knew what kind of frog it was. And so I said 'Ah, look, it's this frog.' So nothing to do with the corridor management plan. Which was the original point. That’s how it is, end of story. So I think it’s faded a little. You can’t even tell who’s the leader anymore.”\(^ {61} \)

There was one particularly surprising breakdown in communication: when interviewed in April 2021, the provincial official, supposedly a highly involved individual in the CCSP, was not even aware that the Management Plan had been released (it has been online since November 2020). They reported, “I haven’t seen it. I was part of its construction, I participated in a few
phases. I sent in some contributions and then I don’t know what happened. I’ve had an information void since that moment… I knew that there was a ministerial decree [in July 2020] but since then I really haven’t known anything.”5. These are the kinds of issues that threaten to alienate important contributors and limit social capacity in the corridor.

Transparent and legitimate conflict resolution (mediation) is considered an important element of healthy collaboration. In the CCSP, however, there have been few opportunities to test conflict-resolution processes. At this stage, admittedly early in its formation, the initiative appears to be relatively free of overt conflicts. When asked to recount any conflicts within their working groups or the CCSP as a whole, very little rose to the surface. In fact, many pivoted to discuss ‘conflict’ as the threats to the corridor: deforestation, mining, and livestock depredation. Others reiterated their deep concerns about local community involvement in research and land management. One stakeholder, the hydroelectric representative (16), hypothesized that conflicts have been rare because the CCSP is loosely organized at this point, and suggested that conflicts would be a welcome development, perhaps requiring actors to work together in search of a solution.

One institutional conflict was the perennial tension between central and decentralized government control. The Ministry official shared that the Ecuadorian state wants to devolve control to lower levels of government because “at the end of the day, they’re the ones who are going to resolve their issues in their territory”63 (13). The provincial official (5) certainly doesn’t see that happening, as they state, “In the end, although we may want to believe otherwise, it continues to be the central government that dictates the norms and the rules… As I see it, the state is never going to allow us to manage our territory how we want.”64 This tension, deep-
seated in historical and contemporary Ecuadorian politics, has the potential to harm the CCSP’s prospects in the future.

Within the CCSP and its working groups, translation—defined here as a shared understanding of terminology—is a strong enabling condition for collaboration. Though each discipline has its own vernacular, this does not seem to create barriers. Nearly everyone I spoke to, in academia, NGO, government, or resource management, has received education in the natural sciences. As a result, they share a common form of scientific literacy.

Personal relationships strongly enable collaboration. Throughout interviews, many participants pointed out that their professional relationships were founded on friendship and the conservation community in southern Ecuador is close-knit. “If we’ve linked up, its mostly because of personal relationships,” recounted an NCI staff member (10). Further, a zoologist (17) shared, “I truly love them, because they were my professors… And thanks to them I love biology.” There’s also a sentiment shared by CCSP actors that they are stronger than the sum of their parts. Unity trumps individualism here. “We’re no longer individuals, but rather part of a collective,” said one herpetologist (3).

**Bridging organizations**

Foundational to adaptive governance approaches, the bridging organization (sometimes known as boundary organization) is a vital element of social capacity to make connections between actors, often across scales. In the case of the CCSP, where direct collaboration across working groups is lacking, the role of a bridging organization is all the more important, discussed by 17 participants. Two major bridging organizations NCI (Nature and Culture International), and MAATE (Ministry of Environment) emerged in this research.
In the case of NCI, there’s no denying how important the organization and its staff have been to this corridor’s network. They were described as “the glue that keeps the group united” (11), “the link or the hub” (20), “coordinating all the different levels” (12), “channeling people” (3), “supporting, helping, facilitating” (15), “acquiring funding” (8), “motivating” (17), and “pushing us along like a diesel engine, slowly, but pushing” (19). A herpetologist (3) described in detail how NCI leverages connections to advance the corridor:

“They [NCI] ask us if we need anything. They might provide vehicles, or NCI might talk to people in the communities that we're going to enter. So there’s this reciprocity. NCI does not abandon us, we directly talk to NCI, and NCI also does things like talk to the Ministry or talk to a local government about some political or bureaucratic issue. NCI frees us of that weight. So it's mutually beneficial and works really well. And the outreach stuff, NCI also takes care of a lot of that. So we give them the results or the findings we have and they take care of it using their social media platforms and all that, sharing it with as many people as possible. And at the same time, they’re holding meetings with our future donors.”

The corridor’s vision and implementation rest largely on NCI’s shoulders. The MAATE, though also a bridging organization, functions this way out of statutory requirements. When issues like protected areas, corridors, and land use planning transcend municipal or provincial boundaries, the MAATE is the legal authority, and their approval is required for many processes. Despite playing a vital role in lending formal legitimacy to the CCSP, the MAATE is severely lacking in material capacities, such as human resources and funding. One researcher explained how the Ministry would never take an active management role in the field: “It won’t happen. It simply won’t happen. You’ll be a grandpa and you still won’t see it” (19). The Ministry official described how the MAATE can make a positive impact with the few resources they have:

“We’ve participated as proponents of some of these projects, or as part of multidisciplinary, inter-institutional teams. At other times our role has been to advise or guide the processes that are implemented in the territory… Another important point is that initially the process [CCSP formation] was generated and led by the Ministry with the participation of other actors. Now, as laid out in the plans, it’s all about local actors
who generate these initiatives with the support of the central government institutions” (13).

Together, NCI and MAATE keep the CCSP moving forward. The NCI manager called the two organizations the “pilots,” who need to know “when to accelerate, when to turn, how to get where we want to go” (1). Though interview participants were reticent to directly criticize NCI or MAATE (beyond calling out the government’s inherent weakness), these groups carry the greatest responsibility for addressing future changes and needs for the CCSP.

Public engagement

The CCSP involves internal and external relations. Collaboration, described in the previous section, pertains to working relationships among self-identified CCSP coordinators and working group members. In this section, public engagement describes the relationships that CCSP members have with non-working group members. In total, 18 participants discussed public engagement. Seven participants specified engagement via education, and six discussed engagement via tourism.

Like most aspects of the CCSP, educational activities vary by working group. The Amphibian and Reptile Working Group stands out for their robust educational program where they’ve developed children’s coloring books and posters; hosted a photography exhibit at a Cuenca university; led a scientific illustration workshop; and partake in a Loja radio show called ‘Lunes Verde’ (Green Monday). Two factors seem to drive this working group’s focus on education. One is the central involvement of Bioparque Amaru, a leading environmental education organization in Cuenca. The other is a cultural bias against snakes where an uninformed public tends to kill the animals without cause. A herpetologist (3) explained their approach for changing this: "At certain times of year, snakes come out and the people get scared,
because they think they’re venomous. So we made a plan to go out there and hold workshops so that people could recognize the snakes and realize that most are not venomous.”

The Biodiversity Monitoring Working Group also has a significant educational reach. Camera trap images from their project are an amazing tool to get young people excited about the biodiversity in their own backyard. As the provincial official (5) said: “We end up with these beautiful photos and videos, which get the people really excited.” The official further shared that “people get jazzed” when they see photos of peccaries or tigrillos. “Around here, what people want to know is whether there’s a tapir or not. Whether there’s a bear or not. And if there is, then they’re happy!” they (5) added. At AECM Siete Iglesias, a park manager (18) recounted an experience they had with elementary school students in San Juan Bosco:

“They’re surprised to see a bear and say ‘Woah, I’ve never seen a bear before!’ This video we recorded, we’re using it to raise awareness, to say ok ‘If you kill a bear, believe me that bear is a huge seed disperser’. We have bear scat that looks like this and this little seed is like this, like this, like this [stuck in the scat]. The kids are impressed and now they’re conscious. It’s impressive, especially with the youngest kids.”

At this time, the other established working groups have no formal education programs for the general public. At the higher levels of the CCSP initiative, public engagement is bolstered by a strong web presence. Sangaypodocarpus.org is visually attractive and highly informative, as is the initiative’s facebook page. Photographs are a powerful tool for attracting interest, as are short and engaging blog posts.

In many conservation initiatives, especially among protected areas, tourism represents a potential point of engagement for the public. Discounting Sangay and Podocarpus National Parks (adjacent to, but not within the corridor), tourism in the CCSP is very minimal. What does exist is limited to the confines of protected areas. The newly established park Río Negro Sopladora receives a handful of hikers on the weekend, with one major boost each year for a religious
pilgrimage that traverses the park’s single trail. Similarly, AECM Siete Iglesias receives a handful of visitors each week, primarily from surrounding cities like Cuenca and Loja.

Protected areas in the corridor have ambitions to expand tourism. Río Negro Sopladora is planning to build interpretive signage and expand rustic lodging in the park. Siete Iglesias intends to finish constructing its visitor center. And the Marcos Pérez de Castilla Community Protected Area aspires to welcome (regulated) ecotourism. The true potential to attract visitors to this remote area is disputed. While local Ecuadorians may be able to come enjoy these wild lands, their economic impact is limited, at least compared to relatively wealthy foreigners. And foreigners would require infrastructures like hotels, restaurants, and efficient transportation. As one ornithologist (4) explained:

“We could start making birdwatching routes. That would be in the future when the roads improve, we can train people to provide services, create routes so that everyone has an income. Tourists could visit one forest, stay the night, and then move onto another site. Everyone would share the income, right? People could work in hospitality, sell their local food, run lodges or hotels, you know. But this is something that takes a long time, a very long time.”

Another participant stressed the need to produce high-quality and accessible science before tourism can succeed. They compared Ecuador’s knowledge base with that of Costa Rica, a popular eco-tourism destination:

“We’re one of the planet’s most mega-diverse countries, but we don’t have sufficient detailed information. So how do we sell that product to tourists? … We can't compete with Costa Rica. For example, Costa Rica has all its biodiversity in guidebooks. Where you should go to see it all. You have guides, informed people, and people who know that seeing a monkey can provide income. And here in Ecuador, in some communities you see a monkey and it’s hunted for food, or sometimes hunted out of ignorance, or for sport… So when we find out that having a monkey can provide us money for tourism, we can improve. But we do that by gathering information.” – Water Fund Manager (6)
Impacts of the COVID-19 Pandemic

In professional circles around the world, strict pandemic lockdowns and other social distancing measures changed the way that coworkers, partners, and other collaborators work. In the CCSP, changes were dramatic. Ecuadorians were accustomed to in-person meetings and large gatherings. Traditionally, one researcher (11) reported, “we needed to be seated at a desk across from each other in order to fill out forms and sign them and everything else.” Working from home made this impossible, and everyone had to adapt. Seventeen participants (77%) identified changes to their workflow. In general, collaboration suffered: “The pandemic, as you know, hit in March [2020] and it's like we just never got the ball rolling,” said one researcher (12). It “put the brakes” on meetings and communication, said another researcher (17), and prevented working groups from “getting organized” to do the work they had planned (18), added a protected area manager.

The symposium offered a silver lining as it was originally planned for 150 participants in Loja, but actually attracted 1000 viewers via Zoom and Facebook Live. Virtual communication provided the tools to keep work moving, albeit haltingly, as explained by one researcher (11): “One good thing that we (people like you and me) can take away from this terrible pandemic tragedy, is that it’s possible to advance things digitally that we wouldn’t have even thought of before.” Switching to virtual communication presented an opportunity for some. Whereas before, “those without resources to travel would miss out” on meetings, the pandemic helped expand access, according to one NCI staffer (10).

Nonetheless, there was a general consensus that virtual channels cannot serve as the only form of communication. Whereas many people saw virtual meetings as a “miracle,” one NCI staffer (10) pointed out that workshops require more engagement from all parties: “It’s a whole
‘nother story when you can be there, shaking hands, giving hugs, having side conversations.”79 However, pivoting entirely to Zoom calls led some to feel burned out: “It happened to everyone, sitting alone on the computer, at meetings, meetings, meetings. It was way too much. Fortunately, it’s not quite like that anymore,”80 recounted the water fund manager (6). One researcher (8) described this feeling as “isolating.”

Several individuals pointed out that the pandemic made it more challenging to work with rural communities. While this has been a major shortcoming of the CCSP since its inception, the pandemic appears to have exacerbated the challenges. One researcher (10) reflected on how they were unable to share research findings with communities. Another (2) complained that they “[Weren’t able] to work with communities, with park rangers for example… Anything that was with people was completely interrupted.”81 One herpetologist (3) recalled that until vaccinations were widely available, researchers held off on visiting rural villages, afraid to infect or be infected. Beyond the practical implications, social distancing hindered trust building and collaboration so critical to the CCSP’s success. There is hope that when the pandemic subsides, work with communities can quickly accelerate.

The pandemic also impacted public engagement, leading to a precipitous drop in tourism: “The effects on us were so visible,” recounted a guide in Río Negro Sopladora (14). “Roads were basically closed, no one moved, there were no tourists… Incomes dried up for people in the food industry, or hotels. Just like you saw last night!”82 They pointed out that hotels remained practically empty, and that recovery would be slow.

Material capacities

“The material concerns the tangible human resources, financial, and structural capacities to sustain relationships between actors at different scales” (Wyborn 2015:13). In the CCSP, as
elsewhere, financial concerns are paramount. All 22 interview participants discussed aspects of funding, a deductive code. Furthermore, 21 participants examined the closely related topic of human resources, another deductive code. Although not explicitly defined as a material capacity in Wyborn’s 2015 framework, law and policy was raised by 14 participants as a clearly defined, material factor that enables the CCSP’s success.

**Funding**

Every interview emphasized the importance of funding to the CCSP, its institutions, and individuals. Among participants, there was a broad consensus that funding is absolutely essential. Many reluctantly accepted the importance of capital, with one researcher (11) saying, “everything depends on it, unfortunately.”83 “The corridor can’t function on just good intentions from a group of friends,”84 said a herpetologist (8). Further, the water fund manager (6) explained, “One needs to be able to make a living.”85 According to the provincial government official (5), “Money is what moves us, whether we like it or not, it turns the gears.”86 Funding must be well managed, as I was reminded several times by the NCI manager (1). As they and others recounted, previous corridor initiatives in Ecuador secured million-dollar budgets yet failed to produce results.

For now, funding is an ad-hoc, opportunistic endeavor. Over the years, small private grants have been secured to complement paltry public investments. Protected areas receive a small annual budget from MAATE. Each local municipality also has a small budget for environmental work, though usually destined for producers, rather than biodiversity projects. Key institutions like NCI and UTPL facilitate grant writing with working group leaders to support projects. Successful proposals have attracted funds from individual private donors, foundations, and multilateral funding agencies. For example, funding from GIZ (the German
Corporation for International Cooperation) supported the first landcover and connectivity analyses used to define the corridor. According to CCSP documents, the Critical Ecosystem Partnership Fund was another early seed funder for NCI and UTPL to organize research projects, such as early amphibian and reptile surveys. Domestically, a key funder is the Electrical Corporation of Ecuador (*Corporación Eléctrica del Ecuador*; CELEC), which contributes to water-related research projects through FONAPA (the Water Fund for the Paute River, *Fondo del Agua para la Conservación de la Cuenca del Río Paute*).

Funding is quite flexible, in that CCSP partners can be creative in linking or embedding CCSP work into broader projects based at their home institutions. One example is the Amphibian Conservation Center at Bioparque Amaru, which serves as a breeding center for endangered frogs in the corridor as part of their larger mission to breed threatened species from all around the country. Or the Biodiversity Monitoring group, which makes use of camera traps that local governments already have in their possession. Funders can promote flexibility too. The one funder (22) interviewed in this study highlighted the potential for their funding to support not just biodiversity, but also livelihoods based on nontimber forest products.

In this large, complex landscape, participants shared the critical need for more funding, and the sentiment that there will never be enough. “There will always be a lack of resources,” said one NCI staffer (10). “We’ll always want more because these are big ideas. But we need to make do with what we get,” said a guide at Río Negro Sopladora (14). Yet, several acute challenges hinder the CCSP’s ability to secure adequate funds. First, there is currently no mechanism for the CCSP as a legal entity to receive and distribute funds. In other words, partner institutions must fundraise on the behalf of the initiative. Multilateral lenders present other challenges: “It’s super impossible to obtain [international funding] because the requirements are
complicated…and the issue with the language barrier,” explained the provincial government official (5). The official (5) then provided a broader critique of international funding:

“I’ve seen international funds that are a lot more efficient. You ask them for a bridge, for example. The Japanese Embassy asks you to fill out a paper or two, you tick the boxes and there you go, you send in the paper and you have a bridge. Why does funding for biodiversity and climate change have to be so complicated? It needs to be simplified. If not, we’re not going to be able to do anything.”

Despite these challenges, the CCSP is collectively more attractive to funders than its individual constituent parts. As expressed by eight participants, a proposal submitted on CCSP letterhead carries more weight and appears more legitimate. The NCI coordinator (1) described this as the “seal” or the “crest.” One zoologist (19) called it a “stamp.” The symbolic importance of the CCSP is that it attracts attention and appears a worthy investment.

One consequence of insufficient funds is a scarcity of reliable transportation and other built infrastructure. Trucks and gasoline are critical for fieldwork, especially in a large, remote landscape. Interviewees emphasized that budget cuts imposed on MAATE are responsible for fewer functional vehicles. According to some long-time conservationists, this was turning into a “crisis” (8), even affecting the most beloved Galápagos National Park (19). For example, in Río Negro Sopladora, the Park’s only truck was damaged and there were no backups available, limiting field visits. Similarly, in Marcos Pérez de Castilla, the area’s single ranger only had access to a motorcycle, rather than a full-size truck. There are cases of highly functional infrastructure in the CCSP. For example, climate-controlled laboratories at the Amphibian Conservation Center keep warm-adapted (lowland) and cool-adapted (páramo) frog species healthy. During a site visit to AECEM Siete Iglesias, technicians equipped with professional DSLR
cameras and zoom lenses captured stunning photos of birds and other wildlife, returned to a well-equipped office, and uploaded their best shots to social media.

**Human resources**

Human resources are closely, yet not entirely, dependent on funding. Nearly all interviewees (n=21) emphasized how formal and informal human resources are critical to success. Protected areas face chronic staff shortages, exacerbated recently by the pandemic. Layoffs and budget cuts have hit the MAATE, affecting the number of technicians available to support protected areas as well as capacity of individual areas. For example, Río Negro Sopladora only has six employees (one administrator, two technicians, and three rangers) to cover over 75,000 acres, and Marcos Pérez de Castilla has only one full-time staff member.

CCSP working group members, as voluntary affiliates, contribute as they see fit and as they find the requisite time and energy. Given this inevitably diffuse and sporadic participation, there are few hard requirements to be a working group member. At last count, the Birds Working Group had 13 members (according to their WhatsApp chat), but the majority are inactive. All groups are seeking to grow. Growing in numbers represents an opportunity to infuse each group with fresh perspectives, as well as more diverse representation. “Without a doubt, we become stronger not just with the presence of more people, but through representation at the ground level,”89 said an NCI staffer on the Protected Areas Working Group (10). A herpetologist (3) further explained, “What we want is more people….more people and new people with new ideas and fresh minds.”90 Working group leaders are quite understanding that new members may have limited capacity: “It would be ideal if everyone wanted to support us by working hard and putting in a ton of effort, but that tends to be very complicated,”91 explained a researcher in the Protected Areas Working Group (21).
Fifty percent (n=11) of interviewees identified time availability as a limitation. When most working group members and other partners are supported by another paying job, CCSP commitments rarely take priority. “With more funding, I think we could all commit more time,” said one ornithologist (4). “It’s not that we lack desire or motivation, it’s that we don’t have enough time,” added an NCI staffer (10). Some pointed out that the kinds of conservation processes underway in the CCSP are inherently slow, regardless of how much work one puts in. But others were more upset, primarily with their own inability to meet personal standards. “I’m frustrated with my own pace,” bemoaned one ecologist (12). More adequate funding could translate into more time availability, and greatly enhance the material capacity of the working groups and the CCSP as a whole.

Another major barrier to consistent human resources—expressed by eight interviewees—is political turnover. Every two to five years, depending on the type of jurisdiction, elections bring in new leadership, who in turn hire new technical staff. In local governments throughout the country, these transitions can derail long-term projects or undermine training efforts:

“The current government may want to do something totally different from what the previous government did and then the next government changes what the previous government did, and so on. So that makes it very difficult, because not only in our country, but in many other countries, even here in the United States, long-term initiatives that fulfill objectives for the whole country are very difficult to identify and, above all, to maintain.” —Researcher (11)

Confronting this challenge can go one of two ways: either design plans and projects that carry weight (i.e., mandated by law), regardless of what authority comes to power; or create systems that are resilient to change. One excellent example of the CCSP building resilience into their human resources is in the Biodiversity Monitoring Working Group and the Human-Wildlife Interactions Working Group. In both groups, training local GAD technicians is at the core of their mission. Both have adapted their approach to use recorded trainings available online, on
demand. This ensures that whenever new technicians are onboarded, they can access training content and quickly become familiar with the monitoring methodologies and the conflict first alert system.

With the CCSP’s far ranging social network, opportunities to harness informal human resources are abundant. During herpetology surveys in Guarumales, for example, a personal friend of the lead researcher accompanied the group, lending their time and energy to the project. In Cuenca and Loja, interested high schoolers have formed “ecoclubs,” volunteer groups that assist with simple environmental projects—river clean ups, for example. Ecoclubs have backed up a handful of Amphibian and Reptile Working Group projects. The Biodiversity Monitoring Working Group, by designing a simple camera trap methodology, has made it easier to enlist nonexperts (GAD technicians with agronomy backgrounds, for example) to contribute data to the group’s surveys, strengthening the corridor’s social network in the process.

**Law & Policy**

I decided to code law and policy under material capacities, since it was usually raised in a material sense (the literal, written text of the relevant laws and policies). Interview participants view law and policy as important foundations for the work they carry out in the corridor. The CCSP’s legal designation was a popular topic among all three NCI staff, both government officials, and a funder (n=7), but not among researchers or protected area staff. These seven participants explained that legal status enables robust, reliable conservation. “We needed the Ministry to recognize it officially,” explained the NCI manager (1). In the early years, they further emphasized, “there was no specific law to establish corridors” in Ecuador. “We supported the Ministry of the Environment to create the Law for Corridors that was passed in 2019… This is the first corridor recognized by the Ecuadorian State under the law”95 (1). Other NCI staff (9)
concur that having such a law is essential and increases the legitimacy of the corridor:

“Everything is there in the ministerial agreement. A corridor is made up of three elements: core areas, remnants, and the matrix.” According to the NCI manager (1), when the corridor law was passed, “then the corridor was established and recognized… So now we can say that the corridor exists on paper. It exists. This is a huge accomplishment because it’s recognized by local and national actors.”

Formalized laws enable connectivity conservation to be incorporated into local land-use planning, according to one NCI staffer (9). It also creates a policy avenue to align local, provincial, and national priorities for “reforestation, conservation, and climate change,” stated the provincial government official (5). Legal designation is one of the things that sets this corridor apart from previous corridor efforts:

“It’s the first corridor officially recognized by the State. Why is this relevant? Due to the fact that in Ecuador there have been previous initiatives in which they have invested a lot of resources, a lot of money, many thousands of dollars to create corridors and none of them have worked… So getting this corridor recognized by the State is the greatest achievement for me.” –University Researcher (21)

This law is even seen as a point of national pride:

“In most other countries, corridors don’t have legal recognition. Here we got them legal recognition by the State. So that’s a major accomplishment. I can say categorically. It was an achievement for the corridor, because it was so much work, so much insistence from us to get the territory recognized by law… We managed to get it baptized.” –NCI Staffer (10).

Given the close relationship between protected areas and corridors (corridors are defined as a complementary figure for conservation), its unsurprising that protected area designation is also seen as a valuable element of material capacity. Decentralized government has allowed for two parallel systems to form, the National System of Protected Areas (Sistema Nacional de Áreas Protegidas; SNAP) and a system of local or municipal areas. In general, protected areas
with legal designations provide assurances that conservation efforts are long-lasting. At the
municipal level, the law can prevent rotating authorities from changing course:

“Being declared a protected area by a local government, and having an ordinance
document that backs it up, this means that the next mayor or the next authority can’t
come in and say ’I no longer want the area.’ It’s there. It’s already in the ordinance. It
exists.”
—University Researcher (21)

As discussed earlier, designating protected areas at the national level is seen as a robust counter
to mining concessions and other extraction. As the NCI manager (1) explained, “Once it’s in the
National System, they can’t do mining, forestry, petroleum extraction, etc. Because it’s all
prohibited.”

Finally, other legal designations can amplify the security of protected and conserved
areas in the corridor. The southern end of the corridor forms part of the vast UNESCO Biosphere
Reserve ‘Podocarpus el Cóndor’. Meanwhile, there are efforts to designate sites under the
Ramsar Convention on Wetlands of International Importance.

**Impacts of the COVID-19 Pandemic**

The pandemic also had profound consequences for material capacities, particularly
funding. As one ornithologist (4) put it, “This thing [the pandemic] hits badly! It has been a
mess! Economically it has been crazy.” As described earlier, the public sector entered a state of
emergency, which put the entire economy into crisis. Apart from the slowdown in public
financing, there were important implications for land use. The lockdowns seem to have provoked
two competing forces to take hold in Ecuador. As the economy slowed, relatively poor families
searched for extra income. “On one hand, [campesinos] took interest in expanding their
production…expanding their agricultural land along the border with protected areas,”
explained the Ministry official (13). On the other hand, they (13) explained, “people in the city
saw the need to conserve these areas, protect them for better quantity and quality of water, resources, etc.” Ironically, an enhanced appreciation for nature among urban populations may have backfired. For example, the water fund manager (6) posited, “Many people returned to the countryside and put pressure on those ecosystems… I’m not sure how much, but I'm sure there was deforestation.” They (6) further expanded, “We went back and resuscitated our old farms, planted crops, opened up new roads…putting pressure on the forest.” In material terms, the pandemic made work more difficult for the CCSP. While funding was cut drastically, the forests they sought to conserve faced increasing pressure.
### Table 3. Summary of results

<table>
<thead>
<tr>
<th>Governance level</th>
<th>CCSP Overall</th>
<th>Working Groups</th>
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| **Normative capacities** | - Common vision is very strong, especially around protecting water  
- Place attachment complements vision  
- Leadership is strong but may wane without material resources | - Clear vision for each group  
- Leadership varies widely, due to scope and age of the WG |
| **Cognitive capacities** | - Technical and robust science is very credible  
- Science is mostly salient to a wide variety of actors  
- Legitimacy of science is a concern due to lack of inclusivity | - Strong technical science in most WGs  
- Little to no TEK or local participation in research agendas |
| **Social capacities** | - Most collaboration occurs within WGs  
- Collaboration between WGs is very weak  
- Collaboration between WGs and coordinators is inconsistent  
- Bridging organizations are an essential asset  
- Public engagement varies, with opportunities to expand | - Communication within WGs is very strong  
- Some WGs conduct strong educational activities for the public  
- Eco-tourism has potential for some WGs but specific plans for implementing a tourism program are unclear |
| **Material capacities** | - Funding for operations and coordination is a constant concern, but there are opportunities to engage new funders  
- Human resources are difficult to maintain due to voluntary nature of the initiative, so creativity abounds  
- Law & policy lend the CCSP legitimacy | - Project funding is dependent on the capacity of each WG to acquire sufficient, dedicated funds  
- Transportation to project sites is often unreliable  
- Other equipment for projects is sufficient  
- Formal human resources are variable, but some groups access informal social networks to carry out project needs |
DISCUSSION

Utility of the coproductive capacities framework

Evaluating large landscape and connectivity conservation initiatives is inherently complex. These initiatives often span ecosystems, focal species, land uses, and political jurisdictions (Keeley et al. 2022). They tend to bridge sectors, including government, academia, non-profits, industry, and others. Any useful analysis of these initiatives must accommodate, rather than oversimplify, this complexity. Wyborn (2015) introduces a novel theoretical framework for measuring capacities across two well-established connectivity conservation initiatives, the Yellowstone to Yukon Conservation Initiative (Y2Y) in North America and Habitat 141° in Australia. The framework divides the ambiguous term ‘capacity’ into four broad categories: normative capacities, cognitive capacities, social capacities, and material capacities. Although not always a clean division, it is a useful heuristic. To paraphrase Marshall et al. (2018), coproductive capacities account for what should be, what we think, what we do, and what is – four dimensions of the interplay between science and governance. In Wyborn (2015), the author elegantly applies the framework to Y2Y and Habitat 141° and found that both initiatives were driven by strong normative capacities and varying degrees of cognitive and social capacities. Material capacities were lacking, which inhibited the initiatives from mobilizing other capacities. That study was completed over a decade after the formation of Y2Y and Habitat 141°. Wyborn concludes that these initiatives lack the capacities to most effectively “connect knowledge with action,” a cause for concern (18).

In contrast to studying connectivity conservation initiatives after a decade of their existence, this study approached the CCSP during its first two years. This Ecuadorian initiative is in a different phase than its North American or Australian counterparts but is in a similar stage as
many emerging connectivity conservation initiatives around the world. Transitioning from planning to implementation, systems of science and governance are largely developing through exploration and experimentation. Despite these different contexts, Wyborn’s (2015) framework proved remarkably useful for studying the CCSP; it is broad enough to apply to a new context, yet flexible enough to allow a deeper analysis of elements within each coproductive capacity. As the CCSP transitions into its implementation phase, the CCSP can lean into its strengths while bolstering its weaknesses to increase the overall success of the initiative. The following sections provide greater detail on the coproductive capacities of the CCSP.

**Normative capacities**

In the literature, normative capacities depend largely on aligned values and motivation. Wyborn’s (2015) framework defines this category as “the underlying values inspiring actors to work toward a common goal” (13). A common sense of purpose is, in turn, believed to contribute to adaptive capacity (Olsson et al. 2007). Other enabling conditions for normative capacity are, in theory, leadership (Olsson et al. 2007) and place attachment (Devine-Wright 2013; Williams 2002). In the CCSP, normative capacities largely reflect their definition in the literature. Interview participants rarely discussed values explicitly, but their values shined through in discussions about their perceived threats to the corridor and visions for addressing them. As in the framework, place attachment and leadership were important drivers of normative capacity in this study.

Normative capacities are, in general, very strong, both within and among CCSP working groups. Diverse actors in the CCSP initiative have aligned visions that correspond to a shared perception of their threats and reflect common values. Essentially, there is a strong belief that the CCSP has provided a platform to accommodate differences of opinion (e.g., where and when to
designate protected areas) but still with a distinct focus of maintaining intact landscapes to support thriving biodiversity and healthy communities. This vision closely matches the written vision, formally adopted in the CCSP Management Plan, which calls for “ecosystem functionality of natural areas and their environmental services, reducing the fragmentation of ecosystems for the benefit of their local populations, through multidisciplinary and participatory management” (Mancheno Herrera 2020:18).

Place attachment is best described as an emotional bond between individuals and their environment, most often a positive relationship (Altman and Low 2012). In the CCSP, place attachment, though taking on different kinds of significance depending on the individual, binds CCSP actors to the landscape, inspiring their work and serving as a source of strength to overcome challenges. Environmental psychologists have long sought to understand the emotional ties that lead individuals to care for their environment (Devine-Wright 2013; Masterson et al. 2017). As with human-human relationships, human-place relationships are known to inspire sacrifice and protectiveness (de Wit 2013). Stakeholders in the CCSP demonstrate this powerfully, often referencing their personal relationships with the landscape as inspiration for their commitment to conservation. One unique aspect of place attachment in the CCSP is its association with regionalism in Ecuador. Even in this relatively small country, there are distinct regional differences. Among scientists in the South, there is a strong feeling of pride in having developed their research agendas far from Quito. The southern region has more recently developed strong scientific institutions, compared to the capital region. Therefore, many of the CCSP’s contributors are proud that the initiative is driven by scientists and conservationists born, raised, and educated in the South, and who have committed their careers to local issues.
Leadership in the corridor is generally strong, but threatens to wane, unless bolstered by material capacities. Managers at NCI and MAATE are strong formal leaders at the upper levels of governance. Strong leaders are considered particularly important for providing inspiration and for linking organizations across multiple levels (Olsson et al. 2007). These are two areas where the CCSP’s most prominent leaders excel. These individuals were recognized across a cross section of interviewees as providing both strategy and unity. On the other hand, leadership in each working group is more informal; each group has one or more highly active members, but their responsibilities and approaches to delegating tasks vary widely. Recent literature notes that while skilled, charismatic leaders may be effective in more formal, hierarchical governance systems, informal network governance may require distinct kinds of leadership (Chaffin, Floyd, and Albro 2019). Similarly, effective network governance often requires shared leadership (Imperial et al. 2016; Scarlett and McKinney 2016). The CCSP working groups are best viewed as relatively informal networks of individuals, where leaders are emergent, rather than predefined. Their status as leaders emerges from their relationships with others in the network, rather than formal title or position.

Hence, there is a hybrid form of leadership in the CCSP: at the top of the hierarchy, strong, charismatic leaders lend the entire initiative direction. Among each working group, emergent leaders play a larger role in their looser, sometimes shifting networks. Taken as a whole, this hybrid leadership model fits well with what the literature has recommended for effective environmental leadership (Chaffin et al. 2019; Imperial et al. 2016; Olsson et al. 2007). It also maps well with the contention that emergent adaptive governance needs to strike a balance between polycentricity and hierarchy (Cosens et al. 2017). Leadership is an area where interdependence between the coproductive capacities is clear. Leaders at all levels of the CCSP
identified a lack of time and money to effectively reach their goals. Without sustained material inputs, such as funding and human resources, leadership has started to decline. What’s more, leadership crosses over into social capacities in numerous ways. For example, leadership relies on open and clear channels of communication. These are just a few reasons why coproducutive capacities should not be viewed in total isolation, but rather in concert with one another.

In this study, one of the strongest drivers of normative capacity is a shared commitment to water. Stakeholders discussed many different reasons for valuing water: Herpetologists value the streams and rivers for the habitat they provide rare amphibians; farmers need water to irrigate crops; local politicians crave water “of quantity and quality” to attract reelection votes; the hydroelectric dams need water to generate electricity (and income); and overall access to clean and healthy water systems is essential for human health. The way in which water enables unity was evident in a meeting between conservationists and the mayor of Chordeleg, a small town in the northwest corner of the CCSP. Staff from NCI and FONAPA presented a proposal to create a municipal ‘Conservation and Sustainable Use Area.’ The meeting began haltingly and rather tense as the two groups debated complex sticking points. Suddenly the mayor stood and declared that the fundamental goal was to protect the water source. This was a reminder to all gathered that they had the same ultimate goal and alleviated tension among the stakeholders. Conserving water is paramount for the future success of the corridor.

Given the universal importance of water, there are countless other examples from around the world where water has brought people together. In the United States, watershed collaboratives have emerged as a preferred strategy for local decision-making on complex water issues, especially amidst increasing competition for scarce water resources (Sabatier et al. 2005). In Peru, a collaborative process successfully protected the headwaters of a high-Andean
watershed. In this example, a river basin council served as a forum to bridge knowledge and belief systems between key stakeholders, primarily urban government officials and rural campesinos (Ostovar 2019). These success stories are noteworthy because water also has the potential to be divisive. Especially in places experiencing extreme drought, conflicts over water have turned neighbors against one another (Gleick 1993). Water conflicts are also playing out in real time, with major crises exacerbated by climate change erupting from Oregon (Kirkpatrick et al. 2021) to Chile (Bartlett 2022).

Though Ecuador is not threatened by drought, protecting water sources from degradation is a paramount concern. In fact, the country has a rich history of water policy (Cisneros 2019). In the 1990s, the state relinquished most direct water governance, in line with overall neoliberal trends in the region. Corporate economic interests dominated water governance but were tempered by Indigenous and campesino movements. A variety of multi-stakeholder watershed governance models proliferated, especially after 2008 legislation related to the new national constitution further encouraged stakeholder participation. Finally, legislation passed in 2014 and 2015 [“Ley Orgánica de Recursos Hídricos, Uso y Aprovechamiento del Agua” and implementation legislation] codified and regulated stakeholder participation in watershed governance, effectively “homogenizing” what was then a diverse set of contextual arrangements (Cisneros 2019: 29). By law, NGOs and individuals were barred from river basin councils, while governments at all levels, organized water users, and universities were welcome. A 2019 study found that these regulations had adverse impacts to existing partnerships, actually forcing some stakeholders (especially NGOs) to negotiate watershed governance outside of formal river basin councils (Cisneros 2019). It seems that the CCSP is one example of these alternate mechanisms for water governance and has in fact drawn people together. Rather than sowing conflict, water
has been used as a platform for motivating collaborative conservation, refocusing energy away from the legal sphere and into the informal governance of water through collaboration.

While water is a unifying issue, mining is a complex and controversial issue in Ecuador. The nation is experiencing a severe economic downturn (Dennehy 2020; Osborn 2022) and the expansion of extractive industries represents one way for the central government to overcome mounting debt. As economic conditions deteriorate, this challenge is expected to increase. Although mining, in general, is a commonly perceived threat in the CCSP, the urgency of the issue is debated. To some in the corridor, mining is an obvious, immediate, and direct threat. But to others, it is more ambiguous, perhaps a concern for the future. This is one of the most significant divisions among CCSP leaders. It may determine strategic decisions for the corridor. For example, will the CCSP engage with activism, and if so, how? And more generally, will the CCSP be proactive or reactive when confronting mineral exploration and extraction?

To date, the preferred means of protecting water and preventing mining has been through the creation of new protected areas within the corridor. To some in the connectivity conservation field, this may sound counterintuitive. The literature has theorized corridors as something distinct from protected areas. For many, including the authors of the IUCN Guidelines, connectivity conservation represents a way to expand a conservation ethos beyond the traditional approach of strict protections (Hilty et al. 2020). In many parts of the world, this may be feasible. In Southeastern Ecuador, however, the threat of destructive mining seems so great that legal protections are preferred by conservationists; for them, the CCSP is a means of coordinating these protections above all else.

The CCSP’s mission statement calls for “a special area for the conservation of biodiversity, which involves the incorporation of several compatible and complementary national
and local strategies” (Mancheno Herrera 2020:18). To account for the reality that protected areas and corridors can be woven together across large landscapes, the IUCN Guidelines introduced the term ‘ecological network,’ landscapes conserved via protected areas connected by corridors. It would seem the CCSP fits this definition far better than ‘ecological corridor.’ Evidently, the term ‘corridor’ remains poorly defined, being used in different ways around the world. In fact, a primary goal of the IUCN Guidelines was to standardize terminology, but this remains a work in progress. Recent publications have intentionally embraced this diversity, expanding the corridor concept to be more inclusive of different interpretations (Green and Sandbrook 2021).

Terminology aside, the literature has emphasized for decades that corridors across the world share some common traits, but are context-dependent, especially where governance is concerned (Lausche et al. 2013). Ecological corridors, at their most basic, are spatially defined areas specifically intended to facilitate ecological processes and flows (most often wildlife movements). Some corridors are designed for specific species, for example, giant pandas in China (Wan 2020) or brown bears in Romania (Fedorca 2020). Others are more general in their ambitions (Fitzgerald 2020). Some corridors are very small (Lewis 2022) while others span continents (Zeller 2020). In urban areas, built infrastructure such as wildlife crossing structures may be needed to facilitate connectivity (Jongman 2020). In agriculture-dominated landscapes, a dual approach can be used to protect forest fragments and encourage environmentally friendly farming practices (Cullen 2020). In large, highly complex landscapes, where vast expanses of intact habitat remain, but land use change threatens connectivity between these areas, conservationists tend to use all tools at their disposal. The Y2Y initiative embodies this case well; over the past two decades, they have advocated for protected areas at national, provincial, and local levels, in addition to securing trusts, easements, and other private land assurances for
critical linkages (e.g., providing pathways for grizzly bears to expand their range) (Hilty 2020). Corridor examples make clear that the IUCN Guidelines are purely aspirational in their quest to standardize a heterogeneous field and should in fact be tailored to the local context in order to be most useful.

The CCSP is a classic example of the flexible nature of corridors. It shares elements with many of the aforementioned examples, but does not fit neatly into a single definition. In the CCSP, connectivity conservation has been tailored to fit the particular threats and opportunities of the landscape and its inhabitants. The initiative aims for multi-species connectivity but with particular emphasis on sensitive or endangered species such as *Atelopus* frogs; the corridor seeks to engage with agricultural producers but opposes drastic land use change; and above all, the CCSP readily incorporates protected areas whenever possible, primarily to confront mining and protect water.

**Cognitive capacities**

Cognitive capacities are presented in Wyborn’s framework as the ability to generate knowledge and turn that knowledge into action (Wyborn 2015:13). Most often this includes scientific knowledge, which should be credible (adequate, technically-sound, and evidence-based), salient (useful to decision-makers), and legitimate (knowledge creation processes perceived as fair, equitable, and respectful) (Cash et al. 2003; Clark et al. 2010). Though not explicitly included in Wyborn’s framework, there is abundant and growing literature on the importance of considering and even prioritizing local knowledge, especially from Indigenous stewards of the land (Artelle et al. 2019; Needham et al. 2020). In this study, cognitive capacities hewed closely to the framework, with interviewees primarily focused on scientific knowledge, yet little mention of local or traditional knowledge. Cognitive capacities proved to be moderately
strong in the CCSP: though science is highly credible and mostly salient, there are concerns about its legitimacy.

The corridor is a vast outdoor laboratory where knowledge about the landscape and its inhabitants is produced daily by professional researchers, some local communities, and a host of partners under a variety of conditions. Driven by a robust research agenda, scientific knowledge is technically-sound and always growing, though at a faster rate in more established working groups. The Amphibian and Reptile Working Group, for example, has a highly productive research team conducting both field and laboratory studies, uncovering new species, and writing up findings in formal publications. The Biodiversity Monitoring Working Group, too, is producing credible scientific knowledge through their extensive camera trapping network. Both science-focused working groups consist of researchers from regional universities who have explored parts of the corridor’s intact and modified landscapes for over a decade, well before the CCSP was a formal entity. Many years of research contribute to the science’s credibility.

The CCSP’s commitment to producing scientific knowledge is clear in the composition of its working groups: professional researchers make up the majority of formal membership, and other affiliated members (e.g., protected area managers or staff at the hydroelectric plants) have advanced scientific degrees. The importance of producing science is also evident in the CCSP’s outreach materials (i.e., website and social media) where new scientific discoveries dominate the feed, and in the massive commitment to the research symposium in 2020. Compared to other corridor initiatives, the CCSP’s emphasis on science production stands out. There are few other corridor case studies where science and research are such a high priority. In most global examples, connectivity conservation depends on scientific knowledge to define corridors, but it is
less common to see data collection continue to feature so prominently in ongoing activities once a corridor has been designated (IUCN WCPA CCSG 2020).

For the most part, researchers are addressing salient questions and pursuing knowledge useful for advancing collective scientific knowledge and for making practical land management decisions. Certainly, biological monitoring and inventory yields new discoveries (i.e., description of new species). But much of the research has practical applications as well: Amphibians are being studied as indicators of overall ecosystem health and water quality; camera traps are placed along the peripheries of protected areas to monitor the effects of encroaching agriculture; and jaguars are a focal species not just because they are ecological keystones, but because of their implications for human-wildlife conflict. Driven by strong normative commitments to the landscape, and motivated to make the greatest impact possible with limited material resources, the CCSP’s researchers are producing science that is not just technically credible, but also salient to a wide range of stakeholders. When monitoring efforts discover that jaguars are prowling higher elevations than ever before, this information serves many interests. Nearby protected areas can parlay the images to boost nature tourism; government officials can make better decisions about permitting logging and other resource use; and local producers can better protect their livestock from depredation.

Still, major concerns exist surrounding the minimal involvement of local people. Even though most interviewees contend that a major goal of the CCSP is to involve local people in science production, they have not yet achieved this ideal. The CCSP is far from alone in confronting this challenge. Robust data, resources, and expertise are critical for connectivity conservation (Bormpoudakis and Tzanopoulos 2019). But the literature is increasingly clear that success often depends on legitimate knowledge creation processes – that is, how the data is
produced (Gray et al. 2020; Needham et al. 2020). For the CCSP, science legitimacy could be improved in many ways, as suggested by interviewees: a sustained commitment to participatory research, involvement of more students, and greater acknowledgement of protected area managers’ expertise. As of now, most science, though credible and salient, is produced in an academic bubble. Perhaps most concerning, consideration and inclusion of Indigenous and Traditional Ecological Knowledge (TEK) is largely lacking in the corridor’s research endeavors. Western-style science dominates in the CCSP. In such a complex landscape, the over-reliance on one system of knowledge may be an important limitation which precludes learning from the Indigenous wisdom and practices that have supported social-ecological interdependence for millennia (Castleden et al. 2017; Gregory et al. 2006; Tsosie and Claw 2019). As the corridor aims to serve a diverse mix of stakeholders, decisions should be informed by an equally diverse set of knowledge products.

Despite these present shortcomings, there are major opportunities for the CCSP to strengthen cognitive capacities. For one, there is room to expand the variety of sciences (ways of knowing) it takes into consideration. The corridor’s relatively large Indigenous population likely holds a wealth of TEK. When approached via equitable partnerships—founded on truth and reconciliation—these communities may be able to contribute expertise that yields creative solutions for conservation in a way that western-style scientific knowledge cannot (Finegan 2018; Shackeroff and Campbell 2007). Participatory mapping has been identified as one tangible way for local people to share knowledge about wildlife populations and movements that benefit conservation planning (Brown and Kyttä 2014; Joa, Winkel, and Primmer 2018). In one example, this method was used to engage locals in designing a connectivity corridor in Nova Scotia and New Brunswick, Canada. (Needham et al. 2020). A recent study conducted in
Ecuador’s northern cloud forests found synergies between TEK and scientific approaches to restoration (Mariscal et al. 2022). The tree species identified as culturally important to local Indigenous peoples coincided with the species found to be successful in regeneration surveys. The authors concluded that interviews with local communities on the socio-ecological importance of particular tree species could help build connectivity corridors via restoration. The resultant forests would thus benefit wildlife, ecological processes, and the people who have lived in the area for generations.

Still, there are several challenges in integrating ways of knowing (Gray 2016). These include the often-erroneous assumption of ‘sameness’ among members of one community; the struggle to consider which forms of knowledge should be privileged over others; and issues of trust and respect (Raymond et al. 2010). Some are critical of this pursuit altogether, arguing that integration minimizes or even denigrates the unique epistemologies inherent in TEK, infringes on Indigenous data sovereignty, or perpetuates unjust knowledge extraction (Matsui 2015; Nadasdy 1999). These challenges may be exacerbated at the landscape scale, where many different communities, histories, and cultures interact or even overlap. Nonetheless, these efforts continue. Some governments and NGOs have explicitly recognized the long-term benefits of local and Indigenous leadership, and its critical role in shaping policy for transboundary, large landscape conservation (Beazley et al. 2021).

Another major opportunity to strengthen cognitive capacities while improving relations with corridor residents is through a refined focus on agriculture and livelihoods. As discussed earlier, many in the CCSP envision a progressive form of conservation that embraces rural livelihoods rather than fearing their ‘impacts’. There are plans to create a dedicated Agriculture Working Group, but that has yet to materialize. Once a network of producers is better developed
in the CCSP, some think they can lead the way. Several interview participants suggested that this working group would be the most concrete way for campesinos to have a formal voice in CCSP matters. Under this scenario, agriculture could be a unifying theme (much like water currently is). For example, cacao farmers who want to reap economic benefits from certification schemes like Smithsonian’s Bird Friendly could take charge in protecting biodiversity on their own lands. Bird habitat would benefit along with the farmers’ income. Finally, the CCSP and each of its working groups could recruit social scientists to expand their research agendas. Both quantitative and qualitative methods—surveys, interviews, focus groups, and more—could greatly benefit the CCSP. At this stage, there is too little understanding about how local corridor residents perceive conservation, what their priorities are, and what their needs are. Many interview participants acknowledged that this gap in understanding threatens to undermine the corridor’s success and should be a high priority in the coming years.

**Social capacities**

In Wyborn’s (2015) framework, social capacities are the most directly aligned with governance. Social capacities include collaboration, often facilitated by bridging organizations and enabled by communication (open dialogue), mediation (transparent and legitimate conflict resolution), and translation (shared understanding of terminology) (Cash et al. 2003; Wyborn 2015:13). Social capacities also include engagement with many stakeholders in transparent and legitimate consultation processes (Wyborn 2015:13). In this study, evaluation of social capacities aligned with the framework closely: collaboration and bridging organizations were the central themes within the CCSP’s internal social network and public engagement (via education and tourism, rather than consultation) was the central theme externally.
Social capacities in the CCSP vary widely, depending on scale. Within individual working groups—especially the larger and more established groups—collaboration is exceptional, driven largely by open channels of communication and strong personal relationships. Between working groups, however, formal collaboration is very weak. Collaboration is also relatively weak between the top coordination levels and the bottom levels (i.e., working group members). The stark differences between intra-group, inter-group, and vertical collaboration may not be surprising, considering the structure laid out by the CCSP Management Plan (Figure 3). As illustrated by the tree diagram, each working group has purview over a thematic area. These “operative entities” are granted the “authority to make decisions about strategies, planning, and activities” (Rodas and Mancheno 2020). Whereas strong working groups may function well for advancing certain priorities (i.e., rigorous scientific research), it may also create silos. There is no formal linkage between working groups, and informal communication is scant. Similarly, vertical communication between coordinators at NCI and MAATE and other CCSP actors involved at the working group level is hindered by the lack of formal structure. Though the Management Plan envisions a mid-level “management group” with representatives of each working group, this body has not yet been formed. Most interview participants acknowledged that social structures in the CCSP are a work in progress. At this stage, siloed working groups ensure that colleagues can work closely to create momentum around discreet projects. Once a critical mass is reached at each working group (in funding, stakeholder participation, scientific knowledge, etc.) more concerted effort can be dedicated to cross-group collaboration. A key feature of adaptive governance is its capacity to be flexible and change (Folke et al. 2002; Plummer and Armitage 2010). In the coming years, it will be
important to observe if and how collaboration expands beyond the confines of each working group and adjust the management structure accordingly.

Bridging organizations are a critical means of building cross-scale linkages in a polycentric or multilevel governance system (Chaffin et al. 2014; Dietz et al. 2003). Bridging organizations play many roles, helping build trust, make sense, encourage learning, improve collaboration, and resolve conflicts (Crona and Parker 2012; Olsson et al. 2007). In the CCSP, the two apparent bridging organizations are NCI and MAATE. These two organizations, one an NGO and the other a government ministry, seek to maintain connections amongst institutions and individuals, to varying success. Their role is a difficult one, as they must strike a balance between providing strategy and leadership while sharing power and influence with others. If they are too passive, the CCSP may lack direction. But if they are too assertive the CCSP may lose legitimacy as a participatory, inclusive initiative. Bridging organizations often face this dilemma, though overcoming them pays dividends for successful conservation outcomes (Berdej and Armitage 2016; Kowalski and Jenkins 2015). There is no consensus on how exactly bridging organizations should navigate this tension (Berdej and Armitage 2016; Steenbergen and Warren 2018).

Some cases indicate that erring on the side of strong leadership can lead to better outcomes. Such was the case for one international network of marine scientists and managers (Kowalski and Jenkins 2015). Wyborn (2015) noted that Y2Y’s success as a bridging organization stemmed in large part from their ability to channel funds to partners through a regranting program. In the CCSP, NCI and MAATE carry an outsized responsibility in linking this corridor to national-level priorities – such as achieving the United Nations’ Sustainable Development Goals. Doing so will help garner support for current and future corridor initiatives.
But the fact that NCI and MAATE see themselves steering the ship, so to speak, may be cause for concern. It begs the question, where do local people get to make their voice heard? On the other hand, clearly identifiable bridging organizations may allow for greater accountability. Striking this balance will be a major indicator of the CCSP’s future success.

Social capacities extend beyond the internal networks that form the CCSP. Public engagement via education and tourism are growing, with potential to expand significantly. Both areas present clear, attainable opportunities to strengthen social capacities while also improving relations with local corridor communities. Currently, most education activities are opportunistic, but all have been successful. In both the Amphibian and Reptile and the Biodiversity Monitoring Working Groups, educational activities are essential means of disseminating scientific research beyond academic publications. These outreach initiatives have yielded a more educated public that’s also more sympathetic towards conservation projects. There is undoubtedly room to expand these educational activities.

Tourism could benefit from more focused strategic planning that takes into account regional, national, and international dynamics. Ecotourism has become an important element of conservation projects worldwide (Stronza, Hunt, and Fitzgerald 2019). The opportunity to view charismatic and endangered mammals (e.g., jaguars) can bring in revenue to support habitat protections in large landscapes like the Brazilian Pantanal (Greve 2014; Tortato and Izzo 2017). Conversely, connectivity conservation can facilitate tourism prospects. In the Kostroma region of central Russia, a large ecological network was established in 2008. Large-scale land planning and regulation of timber harvesting, hunting, and fishing has benefited game populations and opened up opportunities for increased tourism and recreation (especially for hunting) (Khoroshev 2020). In another example, the Mura, Drava, and Danube Rivers and their floodplains form what
is known as the “Amazon of Europe” across parts of five countries. The riverine corridors and ecological network they anchor provide habitat for some of the most threatened wildlife species on the continent. Meanwhile, river restoration in some sections has led to construction of bike trails and other recreational amenities for residents and tourists to experience this landscape up close (Mohl, Varga, and Györfi 2020).

In Ecuador, tourism is a growing industry. According to 2018 figures from the Ecuador Central Bank, tourism accounted for 5.4% of GDP. The tourism sector is the fourth largest source of foreign income, after crude petroleum, bananas, and shrimp (Ministerio de Turismo del Ecuador, 2020). Even in this small country, it is a multi-billion-dollar industry. However, the pandemic emphatically disrupted this growth; international air arrivals dropped from 1.1 million in 2019 to just 350,000 in 2020 and is now slowly recovering (Ministerio de Turismo del Ecuador 2022). In interviews, it was clear that the pandemic has made some skeptical of tourism. During the past two years, Ecuadorians who relied on international tourism for their income suffered. Ecotourism may be one alternative livelihood in the corridor, but an overdependence on any form of tourism can reduce resilience to changes (Mudzengi et al. 2021) and can undermine other conservation and development objectives (Belsky 1999).

Nature tourism in Ecuador is formally monitored in protected areas. Data from the National System of Protected Areas (SNAP) shows that the Galápagos Islands are Ecuador’s most visited park, with 271,000 visitors (two-thirds foreigners) in 2019, the last reliable data before the pandemic (Ministerio de Turismo del Ecuador 2022). In contrast, there were 1.8 million visits to all other SNAP areas, of which 80% were Ecuadorians. In Sangay National Park, 1,441 foreigners visited, compared to 15,191 nationals. This trend holds for all mainland protected areas except for Yasuní National Park, the emblematic site deep in the Amazon
Rainforest. Apart from two outliers, domestic Ecuadorian travelers have outnumbered international tourism in protected areas. This might suggest that the CCSP should focus resources on developing a sustainable ecotourism model for Ecuadorians, rather than investing in the infrastructure to draw international tourists. This domestic model may prove more resilient to global shocks like the pandemic. Furthermore, it may promote the CCSP as a point of national pride in Ecuador (and regional pride in the country’s South) while strengthening place attachment among the corridor’s proponents and inspiring further stewardship of the land.

**Material capacities**

In Wyborn’s (2015) framework, material capacities are comprised of funding that is secure, adequate, and flexible; tangible human resources; and other structures to sustain relationships between actors (i.e., networking) (Folke et al. 2005; Reid et al. 2016; Wyborn 2015:13). Institutionalized training and incentives also contribute to material capacities (Dilling and Lemos 2011; Lejano and Ingram 2009). In this study, material capacities hinged on funding and human resources (including time availability) with little mention of training or incentives. Law and policy were brought up in interviews in many ways, but most often in a material sense, and were thus included in this category.

Material capacities are the CCSP’s weakest link in the initiative as a whole and especially in individual working groups. Though usually secure and flexible, funding is inadequate, which severely hinders the CCSP’s ability to advance and complete projects. Human resources are tied closely to funding availability: in a volunteer model, working group members are unable to dedicate as much time as they would like. Even at the upper levels, coordinators from NCI and MAATE can only dedicate a fraction of their time to the CCSP, as part of their broader work portfolio. Funding also affects material infrastructure like the availability of transportation for
fieldwork. Interview participants could recount few, if any, trainings or incentives they received as a direct result of their involvement with the CCSP. Though usually limited, human resources vary according to working group or project. More established groups, such as the Amphibian and Reptile Working Group, have been able to recruit researchers from many institutions to collaborate on field surveys, each individual contributing to the greater goal of the group. Some members are more skilled in field collecting, others in genetics and taxonomy, and yet others in education and outreach. This group has also made use of informal networks, enlisting interested friends to assist on expeditions or high school students to volunteer at public educational events.

Inadequate funding is a pervasive problem in conservation, especially in the developing world’s tropical ecosystems (Balmford et al. 2003; Bottrill et al. 2009; James, Gaston, and Balmford 1999). What’s more, a recent survey conducted with members of the IUCN WCPA Connectivity Conservation and Transboundary Conservation Specialist Groups found that financial support was the main factor that influenced large landscape conservation success (Mirza et al. 2020). Therefore, it is not surprising that funding emerged as a major constraint to the CCSP’s material capacities – and overall success for that matter. Funding is an area where the CCSP’s leadership and bridging organizations, especially NCI, are working most actively. At the time of publication, NCI, MAATE, and FONAPA were soliciting major funding from a European government. Much of this work is now under the pretense of expanding beyond the CCSP initiative to designate a transnational corridor with Peru. Meanwhile, ornithologists in the Birds Working Group are waiting on a U.S. funder’s decision regarding a large grant proposal.

Throughout interviews and informal conversations, the ideal funding model for the CCSP emerged as one point of disagreement. NCI and MAATE representatives insisted that a decentralized, ad-hoc approach was preferable as it fostered ownership and agency among many
stakeholders and generally reinforced polycentric governance (Dietz et al. 2003). On the other hand, many working group members, stressed by their voluntary workload and the added responsibility of raising money, suggested a more centralized funding model with dedicated, paid staff. In this scenario, a professional grant writer and other fundraising personnel could collaborate with working group leaders to deliver proposals to a diverse suite of funders. A central trust could be established to formally bank the CCSP’s funding, and a budget process developed to strategically and fairly distribute resources to working groups. Y2Y dealt with this issue when founding partners formally incorporated Y2Y as an NGO, enabling more centralized financial administration. This structure has attracted significant support from philanthropies and enabled an effective re-grant program for partners around the landscape (Wyborn 2015). Habitat 141°, on the other hand, operated as an alliance of many organizations and had to rely on in-kind contributions and small grants, which were ultimately insufficient (Wyborn 2015). Another Australian connectivity initiative, known as the Great Eastern Ranges (GER), was established with guaranteed funding from the Government of New South Wales. The state’s environmental trust continues to support the initiative, which is now a non-profit legal entity. (GER 2020; Pulsford and Howling 2020). These examples indicate, and the survey conducted by Mirza et al. (2020) confirms, that large landscape conservation initiatives are funded by a diversity of sources (public, private or a mixture of both). The success of Y2Y and GER suggest that centralized administration of those funds may work best, especially for these very large and complex landscapes.

Law and policy, especially the Ecuadorian corridor legislation, were shown to be potent enablers of material capacity. Ecuador’s attention to connectivity in policy mirrors a broader trend around the world, where decision-makers are swiftly embracing connectivity as an
imperative. Law and policy which mandates connectivity conservation is emerging at all levels of governance, from the United Nations and associated international treaties, to regional transportation and wildlife agencies (Breuer et al. 2022; Laur 2021). When Ecuador’s corridor law was passed, a new level of legitimacy was bestowed on a loose collection of partners, creating the CCSP in its present form. Now, there are opportunities to leverage the CCSP’s legitimacy to help secure more funding. Rather than operating as distinct working groups and writing proposals on a per-project basis, the CCSP has the opportunity to work collectively. The CCSP is the first corridor established by Ecuadorian legislation, a major accomplishment for securing political buy-in. It helps conserve one of – if not the most – biodiverse places on the planet. There is a powerful symbolic value in presenting that initiative as one coherent entity. The CCSP’s founders believe that law and policy have thus far been essential for developing the corridor’s legitimacy. Moving forward, interviewees contend that the corridor’s legal standing can help secure greater funding to fully implement the vision.

**Connectivity conservation amidst a pandemic**

For over two years, the COVID-19 pandemic has influenced nearly all aspects of life. The CCSP initiative has not been spared these impacts. While researching in the midst of the pandemic, it came as no surprise to me that disruptions caused by the virus and public health responses were emphasized in interviews and day-to-day interactions during field visits. The pandemic induced a variety of changes, both positive and negative. As noted above, there were significant changes to workflow and communication. At first, research and other work was completely halted or significantly slowed. Then, a wholesale shift to virtual formats increased efficiency and inclusivity, but hindered development of strong personal relationships, especially with rural communities. Similar challenges were noted by researchers in the US National Park
Service during the first year of the pandemic (Miller-Rushing et al. 2021). These authors identified a host of impediments to research, management, and public engagement due to COVID-19, but also opportunities to increase flexibility and inclusivity in their work. Researchers in the UK also identified mixed impacts of the pandemic on conservation (Thurstan et al. 2021). They documented case studies from Guinea-Bissau, Seychelles, Sri Lanka, Borneo, and the UK which demonstrated the pandemic’s role in reducing local capacity, funding streams, data collection, and partnerships. Nonetheless, the crisis was so disruptive that those same conservation initiatives have been spurred to increase innovation and cross-sectoral engagement.

For example, efforts to prevent cross-species coronavirus transmission in Cantanhez National Park in Guinea Bissau involved public health agencies, park officials, tour guides, and other local people. In other cases, the absence of international researchers created opportunities for locals to receive training and education to take on larger roles in international research projects (Thurstan et al. 2021).

There were also economic changes in Ecuador, some of which manifest in land use and tourism. A general slowdown of the economy crushed government budgets with severe consequences for protected areas. The recession also curtailed tourism, forced some rural producers to increase pressure on surrounding forests, and even led urban populations to return to the countryside—a phenomenon that has been observed from Sweden (Åberg et al. 2021) to India (Rajan, Sivakumar, and Srinivasan 2020). Around the world, protected and conserved areas suffered a range of unprecedented challenges brought on by the pandemic (e.g., reduced tourism revenue, increased illegal activities like logging and poaching, and decreased educational outreach) (Waithaka et al. 2021). But overall, this emerging research suggests that many protected and conserved areas fared better than originally thought; even with little prior
experience or guidance on how to weather a pandemic, they found creative solutions to remain an asset to society (e.g., virtual meetings and online public engagement) (Waithaka et al. 2021).

Despite all the upheaval, the pandemic did not seem to sway CCSP actors from their vision or perceptions of threats. At no point during the pandemic did the CCSP deviate from its ultimate conservation goals. However, the pandemic inhibited cognitive, social, and material capacities to address the corridor’s threats and operationalize the CCSP vision. As we transition out of the pandemic’s acute phase, CCSP partners can be inspired that their vision and mission did not budge, but should learn from the pandemic’s other impacts – interrupted funding, research, and collaboration – and strive to build resilience into connectivity conservation. There is no simple narrative to describe the overall impact of COVID-19 on conservation, especially in domains beyond terrestrial protected and conserved areas. For example, a review of the pandemic’s impacts on marine areas identified counteracting influences difficult to measure (i.e., decreased tourism versus increased subsistence resource use) (Phua et al. 2021). Equally mixed impacts were identified for natural resource governance by Indigenous peoples and local communities (Walters et al. 2021). It is unclear if the pandemic has influenced corridors and connectivity conservation in any generalized way. Of note, however, our increased consciousness of zoonotic disease has sparked an intense need to better understand how land use change and fragmentation drive zoonosis and spillover, an arena where ecological connectivity figures prominently (Plowright et al. 2021). The pandemic has emphasized that the CCSP’s vision of social-ecological health is as relevant as ever.
CONCLUSIONS

Connectivity conservation is a rapidly growing field, with ecological corridors taking various forms across terrestrial, marine, and freshwater ecosystems around the world (Hilty et al. 2020). Biophysical science—including population ecology, wildlife biology, and genetics—is fundamental to these efforts, but social science is critical to the success of connectivity conservation (Keeley et al. 2022). Understanding the elements of governance that lead to effective implementation of corridors is essential. Many connectivity initiatives encompass large and complex landscapes, with multiple political jurisdictions, land uses, and thus communities of stakeholders (Lausche et al. 2013). Collaboration among these diverse constituencies has been heralded as the most worthwhile approach to corridor implementation (Gray et al. 2020; Keeley et al. 2019). This study sought to evaluate an ongoing effort in Ecuador to implement the Sangay-Podocarpus Connectivity Corridor, which links two national parks across a region of extraordinary biodiversity. Engaging the CCSP in its early years offered an opportunity observe and describe a critical transition from planning to implementation. There are many frameworks for measuring conservation effectiveness, and those which consider capacity are in need of further testing and refinement (Clement et al. 2020). Through a theoretical framework of ‘coproductive capacities,’ this project explored the interplay of science and governance. Interviews with 22 individuals, along with field visits and document review, informed an analysis of the normative, cognitive, social and material capacities of the CCSP and its thematic working groups.

The CCSP initiative has maintained strong normative capacities, driven by a common vision to protect biodiversity, water, and other ecosystem services, while supporting rural livelihoods. Most actors believe these priorities are compatible, and even interdependent.
Scientists, protected area managers, NGO and government representatives are working actively to advance this vision, effectively leveraging strong cognitive and social capacities. Nonetheless, implementing projects and activities that balance the needs of people and nature in the corridor is sometimes hindered by an overdependence on academic, mostly biophysical science and lack of real partnership with Indigenous peoples and local communities, both in science production and governance writ large. Internally, collaboration within the CCSP initiative is sometimes hampered by missing or weak communication channels. All of the above is influenced by material capacities which are inconsistent and insufficient (especially funding). Additionally, this study was conducted during the height of the COVID-19 pandemic, which has delayed and disrupted the CCSP's progress towards corridor implementation.

This case demonstrates that successfully establishing a large-scale connectivity initiative takes years of work and several forms of capacity. The CCSP’s desire to expand into Peru is a reminder that transboundary conservation presents an additional set of challenges and opportunities. For the CCSP’s proponents, the appeal of a multi-national connectivity network is twofold. From an ecological standpoint, the North-South and East-West connectivity that currently spans the Ecuador-Peru border is part of the valuable migration and dispersal pathways that numerous threatened wildlife species need. Furthermore, protected areas in Peru face the threat of geographic isolation that Sangay and Podocarpus National Parks did prior to the CCSP’s establishment. Extension of the corridor into Peru would further advance goals of an Andes-Amazon Ecological Network, eventually bolstering connectivity across the continent to the Atlantic Ocean (Gaia Amazonas n.d.; Sorgato 2018). From an administrative standpoint, a transboundary corridor could help mobilize new resources, specifically funding. As mentioned before, the CCSP is currently soliciting major funding from a European government.
Other global examples suggest that ambitious projects that span countries can motivate interest from funders and garner other kinds of support from the international community (e.g., IUCN recognition) (Metcalfe 2003; Vasilijević et al. 2015). In the northern Andes, various transboundary corridor initiatives were supported in the 1990s and 2000s by international NGOs such as Conservation International. A review of these experiences found that some were quite successful in mobilizing financial, technical, and institutional resources (Freile et al. 2022). In a notable marine conservation example, the Coral Triangle Initiative, through a legal agreement between six Southeast Asian countries, successfully increased capacities for leadership and planning (Ellett 2021). Nonetheless, these initiatives can prove more complicated at the ground level and many have struggled, at least initially, to link governance across scales and elicit meaningful participation from local communities (Christie et al. 2016; Freile et al. 2022; White et al. 2014). Given the CCSP’s current struggle to engage local communities, any expansion at this time should probably be done with caution, paying close attention to the local social-political dynamics on both sides of the border.

From a theoretical standpoint, this study is likely the first to directly apply Wyborn’s (2015) coproductive capacities framework to a new social-ecological system. As Wyborn noted in their 2015 study, connectivity conservation is, at its core, a venture in science-governance coproduction. Scientific products are used to inform land management decisions, and in turn, the arrangement of social actors across the landscape dictates the way science is produced. The CCSP’s transition from design to implementation provides an illuminating case study in science-governance coproduction. During this transition period, much is in flux. With numerous moving pieces, scientific and governing processes adapt to changing conditions. The CCSP demonstrates many hallmarks of adaptive governance. An emphasis on decision-making through thematic
working groups helps establish polycentricity (Chaffin et al. 2014; Dietz et al. 2003). The flexible, decentralized nature of these groups, led by emergent, shifting leadership is balanced by strong, dedicated leadership from the CCSP’s top-level coordinators, who lend the initiative some hierarchical rigidity (Craig et al. 2017). Thus, there is a balance of top-down and bottom-up governance. In the CCSP, bridging organizations proved to be especially crucial for maintaining this balance by building trust, enabling collaboration, and remaining available should any conflicts arise (Crona and Parker 2012). Currently, adaptive capacity in the CCSP is constrained primarily by lack of financial and human resources (Folke et al. 2005; Reid et al. 2016). For these reasons, the CCSP exhibits characteristics of emergent adaptive governance and further supports Wyborn’s (2015) assertion that ecological corridors can be evaluated based on their adaptive capacity.

Useful as it is, the coproductive capacities framework has room for refinement. As Wyborn (2015) alluded to, the strict four-part categorization is imperfect, and can detract from viewing important interactions between the capacities. Perhaps most importantly, normative capacities have wide-ranging consequences. What we believe in affects how we create knowledge, how we interact with others, and how we seek resources. It’s equally impossible to view cognitive capacities in isolation (i.e., the information we have affects the priorities we set and who we partner with). Social capacities are widely consequential too (i.e., our social networks can influence what we believe, the information we have access to, and resources we can attain). Finally, and perhaps unsurprising for the perpetually underfunded conservation field, material capacities can dictate how the other capacities are mobilized. As illustrated by Figure 4, coproductive capacities should be viewed in concert; all four categories can affect any other. Yet,
as the figure emphasizes, this research found that normative and material capacities are particularly influential.

![Diagram of coproductive capacities]

Figure 4. The coproductive capacities should not be viewed in isolation, but rather in concert. Each of the four categories can influence the others. Normative and material capacities tend to exert the greatest influences (indicated by slightly larger arrow caps).

With regards to the coproductive capacities framework, a transboundary expansion would likely create greater complexity for researchers, depending on the level of similarity between countries involved. I would venture that normative capacities could take many more forms, as underlying values and their manifestations (e.g., ways of expressing place attachment) would vary according to one’s cultural background. Cognitive and social capacities could also become more difficult to assess across national borders, as institutional structures (i.e., governmental bodies and scientific enterprises) can look very different from one country to the next. Transboundary initiatives would present interesting ways of viewing material capacities, especially if international funding mechanisms and legal agreements are present.

This study can lend some important insights for connectivity conservation. As the recent publication of IUCN Guidelines demonstrates, connectivity conservation is a nascent field with tremendous potential (Hilty et al. 2020). Biophysical research has steadily progressed for
decades (e.g., Fedorca et al. 2019; Proctor et al. 2015). However, it is equally important to understand the human actors (individuals and institutions) who implement conservation—and are simultaneously part of the social-ecological landscape—and the social factors that stand in the way of implementation (Keeley et al. 2019). Leaders in connectivity conservation believe in the global need to reconnect fragmented landscapes. In the next decade and beyond, perhaps the greatest challenge for the field will be implementing this vision in diverse contexts. While collaborative governance is widely held to be critical, the CCSP case illustrates that collaboration relies on more than just social capacity. In addition to diverse stakeholder participation and clear communication, these initiatives need actors with aligned visions and ideals (normative), robust science and other forms of knowledge (cognitive), and well-managed funding (material). The CCSP has not yet achieved strong capacities in each of these areas, but looks well-positioned to do so in the future. The ambiguity of what a corridor is or does elicits a common critique: their vast potential can also lead to confusion or even conflict in their implementation (Goldman 2009; Green and Sandbrook 2021). Progressive models of conservation rely on a certain degree of experimentation and studying these case studies in diverse contexts, at all phases of their development, will contribute to a theoretical understanding and practical implementation of connectivity conservation.

**Recommendations**

The CCSP has a strong foundation and is continuously evolving with opportunities to improve its short and long-term success. Based on my analysis of the initiative, I offer the following recommendations to strengthen each of the coproducive capacities:
Normative

- Ensure that expansion of the CCSP into a transnational corridor with Peru does not detract from solidifying the CCSP’s existing form, science production, or governance processes. This likely entails bolstering the CCSP’s unique identity and referring to it as one contributing element of a separate, but larger transboundary corridor.

- Convene a workshop dedicated to analyzing the potential impacts of legal and illegal mining in the corridor. Identify scenarios that are acceptable or unacceptable to the CCSP, and the threshold at which political engagement would be necessary.

Cognitive

- Invest in social science research to identify the needs and perspectives of people who live in the corridor, especially Indigenous peoples and agricultural producers.

- Incorporate Traditional Ecological Knowledge into current and future research projects using participatory methods.

- Establish stronger partnerships with local universities to encourage more undergraduate and graduate students to conduct research in the corridor, especially social science.

- Acknowledge the local expertise of protected area managers and encourage them to contribute as central members of research teams.
**Social**

- Establish the Agriculture Working Group and ensure its membership includes representatives from rural Decentralized Autonomous Governments (*Gobiernos Autónomos Descentralizados*; GADs) and producers of various sizes.
- Strive to boost membership in all working groups, especially with representatives from the GADs.
- Convene the CCSP general congress (*junta*) at least once per year, in person. Rotate host cities between Cuenca, Loja, and Zamora.
- Convene one pilot workshop on a cross-cutting theme to share expertise and capacities across working groups. Human-wildlife conflict (i.e., killing of snakes) could be a potential first theme.
- Develop and publish a comprehensive strategy for educational programs in the CCSP and a strategy for developing ecotourism at the appropriate scale.

**Material**

- Create a dedicated executive secretariat, consisting of at least two salaried, full-time staff.
- Open a trust fund for the CCSP and transparent rules for allocating funds to working groups, whether on an annual or per-project basis. (This important decision to be made by the congress or *junta*).
- Request that partner institutions (including the MAATE) pledge annual monetary contributions to the CCSP, in addition to in-kind contributions.
Limitations and Future Research

There are three significant limitations to this study. First, the data only represents a subset of voices in the CCSP; interviews with 22 participants captures the perspectives of many relevant individuals and institutions, but not all. Biologists, ecologists, and other biophysical researchers made up half of my sample (partially due to the makeup of CCSP actors and partially due to my sampling design). Designing a study that could be executed remotely meant that I focused on interviewing individuals who had easy access to Zoom. This mostly entailed professionals, and few rural producers who actually live inside the corridor’s boundaries. While this sample worked well in answering my research questions regarding initiative implementation, in particular the role of science in governance, it failed to capture the perspectives of an important constituency in the region.

Second, the study was conducted over the course of one year, providing a snapshot in time that may not accurately reflect the past or future of the CCSP. Again, this poses little problem for analyzing the CCSP’s transition period, but a longer-term project would help situate these findings in a broader historic context. What’s more, this year was largely dominated by the COVID-19 pandemic which had significant impacts on the initiative’s ability to make progress towards its goals. The pandemic offered an opportunity to evaluate the CCSP’s capacity to overcome challenges. However, these findings may be limited in their applicability to future cases, when the pandemic is, presumably, a nonfactor.

Third, and perhaps most importantly, there are inherent limitations to any qualitative study, which can never be wholly objective. Interviews and field visits certainly allowed for more genuine relationships with participants, and qualitative analysis allowed for deep engagement with the data. But there are cultural considerations to take into account. As a white
student from the United States, my positionality played an important role in data collection. Prior familiarity from living in Ecuador and conducting interviews in Spanish assisted in this international, cross-cultural research. Participants spoke at their own pace, but sometimes my language limitations made it difficult to understand the nuances of what participants were saying. By transcribing and then analyzing the data, I later had the chance to re-read passages to elucidate meanings that I had previously overlooked.

Future research would benefit both the CCSP and connectivity conservation as a whole. Revisiting the corridor in two to three years could yield insights into the pace at which corridor implementation can occur. At this point, similar interviews and use of the coproducive capacities framework would allow a longitudinal comparison. A survey instrument could help expand the sample, both in size and in representation. A social network analysis (SNA) could leverage quantitative measures to better characterize relationships among individuals and institutions who make up the CCSP. Once all working groups are well-established in membership and direction, future studies could interrogate differences between working groups, potentially yielding more specific recommendations to support the next phase of the corridor’s implementation. As noted earlier, the CCSP is in need of greater social science research that engages with Indigenous peoples, local communities, and especially agricultural producers in the corridor. Such research should most likely be undertaken by students at universities in the region. Finally, the coproducive capacities framework is a powerful lens through which researchers can view science, governance, and their interactions. This framework should be utilized and adapted, if necessary, to evaluate other connectivity conservation initiatives at different stages of their development, from small corridors to large ecological networks.
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APPENDIX 1. INTERVIEW GUIDE (PHASE 1)

English version:

[Introductions, purpose of the project, consent]

**Personal background.** Let’s start with your personal work in conservation.
- 1. How long have you worked at [Organization]?
- 2. What are your primary responsibilities at [Organization]?

**Motivations for the corridor.** Thanks for sharing. Now I’d like to shift to the corridor itself.
- 3. What is your role with working on the corridor project in particular? How long have you been working with the corridor?
- 4. What motivated or catalyzed the formation of the corridor?
  - Probe: Any other important events that led to the idea for the corridor?

**On the designation process.** I read that the corridor has been in development for 10 years; it looks like it was quite a comprehensive process…
- 5. Who was involved in the process? What kinds of individuals and institutions?
  - Probe: How did those groups work together?

**On governance.** In the management plan, you present the multi-level governance structure for the corridor, all the way from the working groups up to the general council.
- 6. How does that governance structure work?
- 7. How important are the working groups to its functioning?
  - Probe: Who can join a working group?

**Successes and challenges.** I’d like to discuss more fully some of the challenges and successes the initiative has faced so far…
- 8. When you think about this initiative, what has gone well?
- 9. Have there been any major challenges along the way?
  - Probe: Please elaborate on [challenge x,y,z]? Why were those challenges significant?

**Future directions.** Looking forward now, what are the next steps?
- 10. What are the critical needs and priorities moving forward?
- 11. When you think about the future of the corridor, what are you most excited about?

**Conclusions.** Those are all of the questions I planned on asking today. As I mentioned earlier, I would like to continue conversations in the future as I develop my research project. Is there anything that you would like to add today that we didn’t get a chance to cover?
Do you have any questions for me?

Thank you again for taking the time to talk today! I would love to stay in contact via email, and if you think of questions or concerns, please feel free to write me.
Versión en español:

[Introducciones, objetivos del proyecto, consentimiento]

**Experiencia personal.** Comencemos con su trabajo personal en la conservación.
1. ¿Por cuánto tiempo ha trabajado en [Organización]?
2. ¿Cuáles son sus responsabilidades principales en [Organización]?

**Motivaciones para el corredor.** Gracias por compartir. Ahora me gustaría enfocarnos en el corredor en sí.
3. ¿Cuál es su rol al trabajar en el proyecto en particular del corredor? ¿Cuánto tiempo lleva trabajando con el corredor?
4. ¿Qué motivó o catalizó la formación del corredor?
   Probe: ¿Algún otro evento importante que llevó a la idea del corredor?

**Sobre el proceso de designación.** Leí que el corredor ha estado en desarrollo durante 10 años; parece que fue un proceso bastante completo...
5. ¿Quién participó en el proceso? ¿Qué tipo de personas e instituciones?
   Probe: ¿Cómo trabajaron juntos esos grupos?

**Sobre gobernanza.** En el plan de gestión, presenta la estructura de gobernanza multinivel para el corredor, desde los grupos de trabajo hasta la junta general de actores.
6. ¿Cómo funciona esa estructura de gobierno?
7. ¿Qué importancia tienen los grupos de trabajo para su funcionamiento?
   Probe: ¿Quién puede unirse a un grupo de trabajo?

**Éxitos y desafíos.** Me gustaría discutir más algunos de los éxitos y desafíos que la iniciativa ha enfrentado hasta ahora ...
8. Cuando piensa en esta iniciativa, ¿qué ha salido bien?
9. ¿Ha habido desafíos importantes en el camino?
   Probe: Por favor, explique [desafío x, y, z]? ¿Por qué fueron importantes esos desafíos?

**Direcciones futuras.** Mirando hacia el futuro, ¿cuáles son los próximos pasos?
10. ¿Cuáles son las necesidades y prioridades críticas en el futuro?
11. Cuando piensa en el futuro del Corredor, ¿qué es lo que más le emociona?

**Conclusiones.** Esas son todas las preguntas que planeaba hacer hoy. Como mencioné anteriormente, me gustaría continuar las conversaciones en el futuro mientras desarrollo mi proyecto de investigación. ¿Hay algo que le gustaría agregar hoy que no tuvimos la oportunidad de cubrir?

¿Tiene alguna pregunta para mí?

¡Gracias nuevamente por tomarse el tiempo para hablar hoy! Me encantaría mantenerte en contacto por email, y si tiene alguna pregunta o inquietud, no dude en escribirme.
APPENDIX 2. INTERVIEW GUIDE (PHASE 2)

English version:

[Hi, good morning/ good afternoon]. Thank you so much for speaking with me today. As I wrote in my email, my name is Gabriel and I am a graduate student at the University of Montana. I am studying International Conservation and Development. In particular, I am interested in how connectivity conservation plans get implemented on the ground.

ALT: [It’s great to see you again, and I hope you’ve been well since we spoke earlier this year. If you remember, I was at the beginning of my research project about the Sangay-Podocarpus Connectivity Corridor and now I’d love to talk in more detail about your experiences with this initiative].

For my master’s thesis, I’m looking at how the CCSP’s collaborative governance structure is working. I’m trying to get a sense of the capacities of each working group to implement the management plan. I’m especially interested in the role of science in your groups. While my thesis paper will be in English, I’ll also be providing the CCSP with a short report in Spanish which I hope will be helpful to all moving forward.

Before we start, I want to let you know that your name will remain confidential. If it is OK with you, I would like to record the interview. This will ensure that your comments are accurately recorded and allows me to focus on what you are saying rather than taking extensive notes. Is that OK with you?

**Introductions and Background**

Could you tell me about yourself and about your role in the CCSP?

- Which working groups are you a part of?

How did you get involved in the CCSP?

**Part I – Questions About the CCSP in General**

I’d like to know what this landscape means to you. Describe your personal connection with the region.

Why do you think the CCSP is important?

- Do you think others see the importance of the CCSP in the same way?

In 10 years, what would success for the CCSP look like? In 50 years?

What kind of knowledge or information is important in the CCSP?

How is knowledge or information shared among people involved in the CCSP?

- [Do you know who has different kinds of information? How easy is it to find that information?]
Have there been conflicts within the CCSP? How were they dealt with?
- [Are these relationship conflicts; task conflicts (content and goals of work); or process conflicts (how work is done)?]

How does funding influence the CCSP achieving its goals?

**Part II – Questions About Working Groups Specifically**

What would you say is the mission of the [working group]?

Can you tell me a little bit about leadership in your working group?
- Has it been effective?
- How does it scale up to the CCSP as a whole?

How does [working group] use knowledge or scientific information?

How do you think others perceive and use the science that comes out of [working group]?
- Is it seen as high quality?
- Is it valued?

How effective is communication among working group members?

How does your working group communicate with other levels of CCSP governance?

Have there ever been conflicts within the [working group]? How were they dealt with?

Does the [working group] have access to funding? If so…
- How are decisions on funding made?
- Are you concerned with funding availability in the future?

Can you tell me about any training or other support you have received as a part of the [working group]?

**Wrap-up**

How has the pandemic affected the CCSP and the [working group]?

Is there anything else I should know about the CCSP or the [working group]?

Is there anyone else I should talk with to learn more?

Those are all of the questions I planned on asking today. Do you have any questions for me?

Thank you again for taking the time to talk today! I would love to stay in contact via email, and if you think of questions or concerns, please feel free to write me.
Versión en español:

[Hola, buenos días / buenas tardes]. Muchas gracias por hablar conmigo hoy. Como escribí en mi email, mi nombre es Gabriel y soy un estudiante de posgrado en la Universidad de Montana. Estoy estudiando Conservación y Desarrollo Internacional. En particular, me interesa cómo se implementan los planes de conservación de la conectividad en la realidad. Lo siento en avance si mi español no este claro.

ALT: [Un gusto verte. ¿Como estas? Es un placer volver a verte y espero que te hayas sentido bien desde que hablamos a principios de este año. Si recuerda, estaba al comienzo de mi proyecto de investigación sobre el Corredor de Conectividad Sangay-Podocarpus y ahora me encantaría hablar con más detalle sobre tus experiencias con esta iniciativa].

Para mi tesis de maestría, estoy analizando cómo está funcionando la estructura de gobernanza colaborativa del CCSP y medir las capacidades de cada grupo de trabajo para implementar el plan de gestión. Estoy especialmente interesado en el papel de la ciencia en sus grupos. Si bien mi trabajo de tesis estará en inglés, también daré al CCSP un breve informe en español que espero sea útil para todos en el futuro.

[Para incluir perspectivas de cada grupo de trabajo, estoy hablando con un líder de cada grupo y unos miembros.]

Antes de comenzar, quiero decir que tu nombre será confidencial. Si te parece bien, me gustaría grabar la entrevista. Esto garantizará que tus comentarios se registren con precisión y me permitirá concentrarme en lo que está diciendo en lugar de tomar apuntes extensos. ¿Está bien contigo?

**Introductions and Background**

¿Podrías hablarme de ti y sobre tu papel en el CCSP?
- ¿De qué grupos de trabajo formas parte?

¿Cómo te involucraste en el CCSP?

**Part I – Questions About the CCSP in General**

¿Me gustaría saber que significa para ti este paisaje? ¿Cuál es tu conexión personal con la región? ¿Personalmente que sientes?

¿Por qué crees que el CCSP es importante? [¿es importante?]
- ¿Crees que otros ven la importancia del CCSP de la misma manera?

En 10 años, ¿cómo sería el éxito del CCSP? ¿En 50 años?

Cuales son las amenazas más peligrosas para el éxito del corredor? Amenazas para el grupo de trabajo?
• Yo entiendo que la minería es un asunto importante. ¿La ves cómo una amenaza?
• También me han dicho que la necesidad de proveer la cantidad y calidad del agua está relacionada con eso. ¿Que piensas?
• ¿Entonces qué hace el grupo de trabajo para abordarla?

¿Qué tipo de conocimiento o información es necesario en el CCSP?
• ¿Sabes quién tiene diferentes tipos de información? ¿Es fácil o difícil buscar esa información?

¿Cómo se comparte el conocimiento o la información entre las personas involucradas en el CCSP?

¿Ha habido conflictos dentro del CCSP? ¿Cómo fueron tratados?
• ¿Son conflictos de relaciones; conflictos de trabajo (metas y contenido del trabajo); o conflictos de proceso (cómo el trabajo está hecho)?

¿Cómo influye el financiamiento en el CCSP para lograr sus objetivos?

Part II – Questions About Working Groups Specifically

¿Cuál dirías que es la misión del [grupo de trabajo]?

¿Han logrado crear un plan de trabajo de corto plazo (como 2 años)?

¿Puedes contarme un poco sobre el liderazgo en tu grupo de trabajo?
• ¿Ha sido efectivo?

¿Cómo utiliza [el grupo de trabajo] el conocimiento o la información científica?
• Cómo se traduce la información científica en cambio o acción?

¿Cómo crees que los demás perciben y usan los conocimientos científicos que vienen del [grupo de trabajo]?
• ¿Se considera de alta calidad?
• ¿Se valora?

¿Qué tan efectiva es la comunicación entre los miembros del grupo de trabajo?

¿Cómo se comunica tu grupo de trabajo con otros niveles de la gobernanza de CCSP?

¿Ha habido conflictos dentro del [grupo de trabajo]? ¿Cómo fueron tratados?

¿Tiene el [grupo de trabajo] acceso a financiamiento? Si es así…
• ¿Cómo se toman las decisiones sobre el financiamiento?
• ¿Te preocupa la disponibilidad de fondos en el futuro?
¿Puedes contarme sobre alguna capacitación u otro apoyo que hayas recibido como parte del [grupo de trabajo]?

**Wrap-up**

¿Cómo ha afectado el CCSP y el [grupo de trabajo] la pandemia?

¿Hay algo más que yo debería saber sobre el CCSP o [grupo de trabajo]?

¿Hay alguien más con quien yo debería hablar para conocer más?

Esas son todas las preguntas que planeaba hacer hoy. ¿Tiene alguna pregunta para mí? ¡Gracias nuevamente por tomarte el tiempo para hablar hoy! Me encantaría mantenerme en contacto por email, y si tiene alguna pregunta o inquietud, no dude en escribirme.
APPENDIX 3. ORIGINAL SPANISH QUOTATIONS

Notes: Some short quotes of few words are not included here. The number in parenthesis after each quote refers to the unique interview participants.

1 “Se pierde la cobertura de bosque. Para convertirlo en áreas agrícolas, generalmente para tener ganado” (3).

2 “Se sigue avanzando con la frontera agrícola, se siguen desmontando. Y para nosotros eso constituye un peligro” (15).

3 “Lo que muestra la información científica es que el avance de la frontera agrícola y la destrucción de los hábitats por la fragmentación es uno de los factores más graves” (6).

4 “Avanza mucho la frontera agrícola porque no tenemos una cultura, no hacemos un seguimiento más técnico a la agricultura y la ganadería… Por ejemplo, aquí en Ecuador tu puedes encontrar una vaca en una hectárea, cuando en una hectárea bien manejada de pasto podrías tener entre 4 o 5 vacas. Entonces eso quiere decir que no necesitas ampliar tu frontera agrícola para producir mejor, sino más bien, debes tecnificar tu producción” (6).

5 “Entonces hay muchos problemas estructurales de fondo que es que diarios hace una vaca 2500 metros de altura en un potrero tan cerca del bosque, pero eso no es fácil de cambiar. Eso requiere cambiar todo el sistema productivo, hacerlos más eficiente, tener más vacas por superficie… No va a parar hasta que tecnifiques de verdad el sistema ganadero” (19).

6 “Un tema que sí es doloroso y va a afectar muchísimo y es impredecible en futuro, no solamente por el corredor, es el tema de la minería. Si nosotros vemos un mapa actualizado de la minería, realmente el corredor se dividiera en dos partes por el tema de la minería. O sea, te corta. Eso siento que es una amenaza súper fuerte” (9).

7 “En general el problema con la minería es que no ha servido para el desarrollo” (4).

8 “Si el Estado decide abrir lo que se llama el catastro minero, es decir, que se pueda seguir concesionando más. Entonces, lo que hemos visto y la tendencia es que Zamora-Chinchipe termine concesionado todo lo que no es área protegida del Estado… Aquí realmente, Zamora-Chinchipe, si no es un área protegida no es nada. No hay nada porque no tienes garantía. Mañana pasado entran las máquinas y olvidate” (5).

9 “Yo sí veo un reto muy peligroso para el corredor, muy riesgoso para el corredor: el tema minero. Realmente yo pienso de que no se le está dando la importancia que tiene… El tema minero se puede convertir en la piedra de tope que corte el corredor en dos partes… No podemos cerrar los ojos. No va a desaparecer” (21).
“Pensando en su ecosistema y toda la variedad de especies que hay, es realmente un espacio que necesitaba ser protegido” (9).

“En el caso particular de los anfibios tenemos una situación especial y es que incluso dentro de las áreas protegidas, donde no tienes deforestación, no tienes contaminación. Incluso en estos espacios muy bien conservados, los anfibios igual están desapareciendo. Los reptiles igual están desapareciendo. Entonces eso quiere decir que hay cosas que salen de tus manos. Entonces para nosotros es también una carrera contra el tiempo. Entonces tenemos que esperamos que en 10 años al menos podemos identificar que hay. Primera cosa” (2).

“La idea es conectar estos dos parques nacionales grandes como Sangay y Podocarpus. Pero dentro de estos dos había un hueco de... No había conectividad, o digamos, existe la conectividad, pero no está garantizada. Entonces, un interesante trabajo que he hecho Naturaleza y Cultura Internacional público, o también ha sido parte con otras instituciones, es ir identificando estos ecosistemas que puedan ser otras islas y a la larga ya no sean islas, sino que vayan conectando ecosistemas y que vayan conectando zonas de altura con zonas más bajas de la Amazonía” (6).

“El interés es común, fundamentalmente porque el tema de conservación en muchos años estuvo orientado a islas y las islas generalmente son espacios que no maximizan la conservación, sino más bien aportan aquella mayor fragmentación y mayor vulnerabilidad de las especies y no permite el flujo de las especies, ni tampoco consolidar un concepto ecosistémico de la funcionalidad de estas áreas” (13).

“El corredor no tenía en el 2012 ningún área dentro del sistema nacional. Pero ahorita en 2021 ya son cinco áreas, entonces son los corazones que tiene este corredor para poder cubrir, digamos poco a poco y lograr esa funcionalidad de corredor” (9).

“Tú puedes tener un corredor sin un área protegida, pero es mejor si las tienes bajo áreas de conservación y áreas protegidas, porque las regulaciones son diferentes. El ordenamiento territorial es diferente en esas áreas... La inversión de recursos es diferente cuando es un área protegida o cuando no lo es” (10).

“Bueno, al menos como yo entiendo, un corredor es esa gestión que haces de las áreas fuera del tema de conservación para que las personas manejen o para manejar el territorio y que digamos permita la movilidad, de la gente haga, no sé, un aprovechamiento sostenible y demás. Pero no que muchas veces o las metas del corredor están siendo de esa forma declarar áreas de conservación y reconocerlas por el Ministerio del ambiente cada, no sé, 2, 3 meses, como te decía, declarar y declarar áreas de conservación. Entonces, dónde queda la gente? … A veces ese norte se nos pierde. Puede ser que a lo mejor por como funciona nuestro territorio aquí en el Ecuador, si nosotros queremos hacer conservación efectiva no tenemos otra alternativa, porque el resto de la otra es que te concesion en los mineros y te exploten y se acabó” (5).
17 “Yo creo que el éxito del corredor sería que el corredor funcione como una gran área destinada para la conservación, pero también para la supervivencia de la gente de esas zonas. Entonces esas personas pueden tener una buena calidad y una buena calidad, que es, por ejemplo, tener acceso a todo lo que se tiene gente de las ciudades, no? Salud; para tener buena comunicación vial y tener todos los beneficios de los servicios ecosistémicos, no? Tener agua de buena calidad, poder cultivar sus productos o generar sus ingresos sin afectar fuertemente al ecosistema…” (3).

18 “Es un desafío porque a veces creo que históricamente hemos visto la conservación como un tema tal vez muy prohibitivo, un tema en el que quizás estamos conservando las áreas y nadie toca estas áreas. Pero claro la visión que tiene el corredor no es tanto eso. No es tanto no permitir que se usa la biodiversidad, sino tal vez buscar socios para que las actividades que se desarrollan en el territorio sea sostenible” (2).

19 “Es que tenemos que cambiar el discurso de 'calidad de vida'. Yo tengo mejor calidad de vida porque vivo en esta ciudad de mierda contaminada Quito y que se inunda y es un relajo. O tengo mejor calidad de vida si vivo en un bosque rarísimo, con agua limpia, comida y todo lo demás. ¿Quién tiene mejor calidad de vida? Entonces este es un discurso conceptual de desarrollo económico que se lo publicó en libros y todo eso… Por ahí yo creo que es la importancia del corredor para la gente. Inclusive ellos saben que es importante para ellos. Esa tierra la han defendido por años. Sobre todo de los grupos Shuar… Yo creo que lo más importante es que ellos vean reflejado, reflejado todo eso” (4).

20 “Fue una idea que se le ocurrió alguna ONG de alguna parte del mundo que vino a América o África o donde sea y dijo, ‘Ah, aquí vamos a hacer un corredor’, hicieron el diseño, pero la gente no entiende para qué sirven o no participa de eso. Y cuándo se acaba el financiamiento de esa ONG se van y no quedó corredor. Entonces, en el caso nuestro es más bien comenzamos a construir el corredor desde lo local, desde la visión de cada actor, desde la necesidad de ese actor” (1).

21 “Yo soy un convencido de que no podemos esperar hasta que los gobiernos centrales solucionen los problemas de la gente. He perdido casi completamente la esperanza en esa estructura tan vertical desde muy arriba… Entonces soy un convencido de que la única revolución es hacer el trabajo local… Nuestras acciones son locales y siempre serán locales… Entonces tengo mucha fe en la estructura del corredor” (19).

22 “A esas personas que viven dentro del corredor ¿para qué les sirve el corredor? ¿Cuál es la ventaja de tener un corredor? Entonces ahí tenemos productivos que deberíamos empezar a mejorar, a apoyar para que el campesino tenga mejores ingresos y haga menos presión sobre el ecosistema natural. Eso es un reto clave, ¿no? El hecho de que el campesino pueda vivir, pero usar bien los recursos. No seguir deforestando, quemando en zonas donde no es ventable” (1).

23 “Entonces necesitamos garantizar estos territorios para las futuras generaciones. A futuro, o sea, de por vida” (13).
“Yo creo que la estrategia más efectiva y en la actualidad y la que le ha permitido al corredor tener en los resultados que tiene en la actualidad radican en el agua. ¿Por qué? Porque es un mandato para los gobiernos locales. Es una obligación política. Que el proveer de recurso agua a su gente en cantidad y en calidad” (21).

“Al ser una empresa hidroeléctrica, digamos, si no tenemos agua, simplemente no generamos” (16).

“Para mí el agua es como ese paraguas que se ha buscado por muchos años en las especies” (6).

“El concepto que tenemos que venderle a la gente — porque es una realidad — es que de este parque también viene el agua que ellos toman. Que en este parque vienen los servicios ecosistémicos, como la polinización y otros en los que ellos dependen. Es decir, su vida — la vida de la gente local está íntimamente relacionada con el parque… Ese es el mensaje más importante de entregar” (11).

“Yo nací en el campo, acá mismo, en este mismo lugar y toda la vida me he identificado con el campo… Entonces eso ha motivado mucho de que uno se identifica con el campo y se identifica con la gente” (15).

“Personalmente yo también soy un habitante de acá del sur. Soy alguien que ha vivido en el campo. Y algo muy curioso que nos pasó en el sur del Ecuador fue poco estudiado… Visitaba más sitios dentro del sur del Ecuador, sobre todo ecosistemas de alta montaña, como los páramos, los bosques montanos, encontraba animales raros y encontraba animales nuevos que con el pasar de los años se han visto la luz… Y como te digo, el momento que entramos a zonas que habían sido nada exploradas dentro del corredor encontramos muchas, muchas especies nuevas con las cuales estamos trabajando ahora y serán descritas a lo largo de este tiempo. Entonces, esa es mi fuerte conexión con eso, porque me sentía como esos descubridores de antaño de llegar a un sitio y encontrar animales que nunca nadie había visto antes…” (3).

“Hay que entender que estos procesos, más allá de las instituciones, dependen de personas. Y hay personas que son más comprometidas con los procesos y esas personas hacen que funcione y las demás, pues se vinculan de acuerdo a su interés, a su motivación para una temática específica” (1).

“Siempre te dicen con cuál junta es ahora mismo más oportuno también desarrollar alguna iniciativa” (2).

“La forma de hablar, la forma de estar seguro de eso y cómo él lucha, lucha…” (9).

“No sentirnos solos” (16).
“Hace un esfuerzo grande en mantenernos unidos” (17).

“Cada quien aporta desde sus experticias” (3).

“Fue un poco ya analizando el tema de las figuras de las estrategias de conservación en el territorio, los planes de ordenamiento territorial, ya se hizo un análisis de cobertura, un análisis de conectividad, se hizo el análisis de la distribución de las especies” (13).

“Entonces, realmente el primer paso es saber que hay, no? El segundo paso es entender qué es lo que está pasando con esta población… pueden ser enfermedades, pueden ser un tema incluso de cambio global que está afectando a las especies de anfibios. No lo sé. Esto necesitamos estudiar a profundidad mucho sobre e incluso sobre la ecología, sobre un tema ya más poblacional” (2).

“Tenemos varias, varias líneas. Una es directamente la parte de investigación pura, por ejemplo, la parte taxonómica de describir esta diversidad que es en gran parte desconocida… Y por otro lado, también estamos trabajando con el tema de iniciar con monitoreo y evaluación del estado de conservación de las especies en el corredor... mientras también se toma muestras de eso para saber si existe, si es que existen estas enfermedades dentro de todo el área del corredor” (3).

“Nosotros vivimos en un país megadiverso y el reto principal de un país megadiverso es que disponemos— casi nunca tenemos información completa sobre un sitio específico. En el corredor, por ejemplo, se están describiendo especies nuevas todo el tiempo y yo estoy seguro que sólo en términos de biodiversidad no conocemos como la gran mayoría del país, no conocemos la verdadera dimensión de la riqueza biológica que tenemos ahí. Entonces, esta información de base es una de las tantas cosas que requiere seguir marchando para que el stakeholder engagement tenga sentido” (11).

“Es importante porque esto se conecta directamente con los ciudadanos y con los políticos. Entonces si tenemos esa información comprendida, digamos, primero, recopilada y luego transmitida a la sociedad, el valor de la conservación del territorio va a ser mayor” (1).

“Se podría trabajar en modelos comparativos que te permitan determinar con esta cantidad de bosque cuánto de agua yo tengo y sin ese bosque cuánto me cuesta. Cantidad y calidad de agua es un ejemplo. Suelos productivos, la biodiversidad. Entonces tener algunos indicadores que te permitan decirle a la comunidad ‘Mira, esto es lo que tenemos ahora. Sin esto no vamos a tener esto. Y cuánto te va a costar esto? O sea, un poco también es poner en valor los recursos que se tienen para que la gente pueda ver la importancia” (13).

“Un tema de que no se trabaja tan fuerte es el tema de la investigación social. O sea, yo no veo a nadie que esté liderando eso acá. Por ejemplo, ¿cómo percibe el campesino común dentro del corredor al corredor? Yo no tengo ni idea. No trabajo yo en esa línea, pero yo creo que es súper importante hacerlo. O sea, ¿Cómo se siente? ¿Saben que existe el corredor. Saben que están dentro del corredor o están fuera o están en el borde? ¿Cómo ven a las áreas protegidas? ¿Las
ven bien? ¿Les son indiferentes? No tengo ni la más remota idea… ¿Qué tal que para el campesino común que está dentro del corredor no le signifique nada el corredor? Eso estaría muy mal. ¿Por qué? Porque entonces el corredor y el concepto de corredor se está quedando en la parte de arriba, en los tomadores de decisiones… No lo sé… ¿Les sirve, no les sirve? ¿Está a favor, está en contra?” (21).

43 “Lo que quiere decir ‘está bien, a mí me gusta el bosque, yo quiero preservar el bosque, pero también tengo hambre y también mi hijo está enfermo y también tengo que comprar los útiles escolares para el próximo mes.’ Entonces que para ello tengo que tumbar un árbol y vender el árbol, los tengo que cazar animales silvestres, aunque sea ilegal” (11).

44 “O sea, pienso que la parte técnica ya está. Siento que no debemos hacer nada más ahí. El trabajo ahorita sería ya en la parte social” (9).

45 “Lamentablemente los artículos científicos se quedan entre los científicos. Nadie, nadie va a leer un artículo científico” (3).

46 “O sea, el paper no nos sirve ni a vos ni a mí, o sea. O sea, yo cogí el hilo, 'mira que es un paper!' Y la gente local dice 'ya, pero yo sigo sin comer y no tengo en qué trabajar.' No sirve, se me entiendes? No sé si que como científico no es tu obligación, pero si puedes ayudar con esa información, a veces el desarrollo, yo creo que funcionaría” (4).

47 “O sea, muchas de las cosas que se pueden implementar aquí deberían ser estudiantes tomando... Haciendo encuestas, haciendo sus tesis, sus investigaciones. En la parte social también. Porque es muy importante. Deberían estar involucrados” (17).

48 “Por eso esa también me entusiasma mucho entrenar al técnico local. Al guardaparque. Darle capacidades para que no necesite del científico, sino que ellos solos puedan medir su eficiencia de su gestión, de su área protegida…Tenemos que cambiar esa realidad que llegamos al campo, usamos a la gente local como robots para coger datos y luego nos vamos” (19).

49 “Gente de la zona que tenían ya su conocimiento local— no científico, pero sí local— que también es bastante valioso, y se ha complementado con el conocimiento científico de universidades, de profesionales que trabajan en el corredor. Y creo que es muy valioso” (16).

50 “Dentro del corredor tenemos comunidades Shuar, que son Quichua. Los Saraguros y los Shuar. Entonces con ellos se podía trabajar en varios...a ver experiencias que ellos han tenido dentro de su propio proceso de desarrollo, y podríamos trabajar también en la memoria histórica que se tiene en estos procesos socio-económicos, ambientales, etc. Entonces yo creo que podría eso aportar. De hecho, creo que la Universidad Técnica Particular de Loja tiene algunas carreras que se sintonizan con el tema cultural y podría ser un vínculo realmente para apoyar a esto. También la Universidad Amazónica” (13).
147 “Ecuador pasó prácticamente cerrado, casi un año… era más complicado el asunto de revisar colecciones, acceso a museos, universidades, tener laboratorios, cosas así. Todo eso fue muy restringido y eso nos ha demorado” (3).

“El hecho de que estén sumadas tantas instituciones como un norte claro y de que su trabajo en su territorio así sea pequeño, le aporta una iniciativa mayor” (21).

“Una amplia participación de actores locales…[en] un proceso de empoderamiento…” (13).

“Entonces lo que hacemos, es compartirlo dentro del grupo y de forma bastante abierta, no? Hemos compartido datos, hemos compartido información… En general yo creo que es bastante abierto, bastante transparente” (2).

“La gente de los grupos ha sabido sacar muy buena ventaja de las ayudas tecnológicas que ahora tenemos, como esta que tú y yo estamos usando ahora. El Zoom, el WhatsApp, el correo electrónico han sido ayudas importantísimas para mantener” (11).

“Sí, con ellos conversamos bastante en el grupo de WhatsApp. Igualmente nos hemos compartido datos” (5).

“Creo que los grupos estamos funcionando bastante bien, pero cerrados completamente. No hay una comunicación entre grupos. No hay” (2).

“Mira que tú me dices, 'hay un grupo de aves' pero yo no he conocido que hay un grupo de aves. Entonces yo no sabía eso. Es que a veces uno se mete solo en herpetofauna y solo en reptiles, anfibios…” (8).

“No hay como un intercambio de todo lo que se está haciendo entre los tres grupos. Al menos yo no he estado involucrado en eso. … No hay una cohesión ahí, una interacción entre los grupos” (17).

“Entonces dado caso la compañera visitó las Cascadas Piemonte y se encontraba un hongo que botaba un vapor. Así, impresionante, así. Entonces nosotros no sabíamos. No somos esa provisión de biología, quizás alguien especializado en hongos” (18).

“Mira, alguien pone que va a haber un congreso ecuatoriano de zoología ahí el Congreso Nacional. Sí lindo. Y yo respondí una vez que alguien me dijo 'oye este sonido.' Entonces como yo estudio los anfibios, yo sabía que rana es. Y entonces yo le dije 'ah, mira, es esta rana.' Entonces nada de plan de manejo del corredor. Que fue el original de esto. Y así está. Mira, uno habla de cosas así, no? En fin. Entonces yo creo que un poco se apagó, un poco se apagó y ahí también es porque ya no se sabe ni quién es el líder” (8).
“No lo vi. Y estuve en la construcción, participé de algunas etapas. Envía algunos aportes y luego no sé que sucedió...Tengo un vacío de información desde ese momento... Supe que ya había el acuerdo ministerial, pero de ahí yo no he sabido realmente nada” (5).

“A la final son ellos quienes van a resolver los temas en territorio” (13).

“Al final de cuentas, aunque nos quisiéramos engañar, sigue siendo el estado central el que dicta las normas y las reglas... Veo que el estado nunca va a dejar que gestionemos como queremos nuestro territorio” (5).

“Si nosostros hemos vinculado, es más bien por temas de relaciones personales” (10).

“Realmente yo los quiero mucho porque fueron mis profesores... Y gracias a ello yo amo la biología” (17).

“Ya no como un individuo, sino como parte de un colectivo” (3).

“Ellos nos piden si es que necesitamos más cosas que NCI pueda gestionar. Entonces digamos NCI podría gestionar vehículos, o NCI podría gestionar hablar con la gente de las comunidades a donde vamos a entrar. Entonces siempre como esa reciprocidad NCI no nos abandona, nosotros directamente hablamos con NCI, y NCI también si tiene que ir a otras instancias, por ejemplo, hablar con el ministerio o hablar con una prefectura o el tema político o burocrático, NCI también nos libra de ese peso y nos ayuda con eso. Entonces siempre es ganancia de un lado y del otro, porque funciona muy bien. Y la parte de divulgación también NCI se encarga mucho de eso. Entonces mostramos resultados o los avances que tenemos y ellos se encargan desde sus plataformas de redes sociales y todo eso, divulgar, divulgar a cuanta gente se pueda llevar. Al mismo tiempo, ellos tienen reuniones con gente que probablemente sean nuestros financistas en el future” (3).

“No va a pasar. No va a pasar. Serás abuelito tú y eso no lo verás” (19).

“Nuestra participación ha sido como proponentes de algunos de estos proyectos, como parte de los equipos multidisciplinarios, interinstitucionales y en otros aspectos ha sido el poder asesorar, orientar y guiar los procesos que se implementan en el territorio... Un tema quizás importante que nos deja una lección bastante también grande, es que inicialmente el proceso fue generado y liderado por Ministerio con la participación de otros actores. En este momento en la normativa lo que se trata es más bien de que los actores locales sean los que generen estas iniciativas con el apoyo de las instituciones del Gobierno central” (13).

“Porque ese piloto tiene que, pues, saber cuándo acelerar, cuando girar, cuando... para llegar al punto que queremos” (1).

“En cierta época del año hay serpientes y ellos tienen miedo a las serpientes porque siempre las han considerado venenosas. Entonces con esta gente se planificó ir al territorio y hacer
talleres para que ellos conozcan a estas serpientes y se den cuenta de que la mayoría de ellas no son venenosas” (3).

73 “Acá la gente lo que quieren saber es si hay o no hay la danta. Hay o no hay el tapir, hay o no hay el oso y si hay comienzo están felices” (5).

74 “Entonces ellos se sorprenden, ver un oso dice 'Oh, yo nunca he visto un oso.' Entonces el video que grabamos, llegamos a ellos para hacer conciencia, para decir ok 'si tú matas un oso, creeme que el oso es un dispersador de semillas inmenso'. Tenemos excremento del oso así y la semillita es así así así. Entonces todo eso es impresionante y la conciencia que ellos realizan entonces es impresionante. Especialmente los niños” (18).

75 “Podemos empezar a hacer rutas de aviturismo. Eso sería futuro cuando mejoren las carreteras, podemos entrenar a la gente para que den servicios, crear rutas para que todo el mundo tenga un ingreso, sus bosques en que sé yo, los turistas se queden en un sitio, después en otro y todos compartan el ingreso, enten en todo sentido, no? La gente que puede trabajar en servicio, la gente que puede trabajar vendiendo su comida local, que siembra al lodge o al hotel, ya sabes. Pero es algo que toma mucho tiempo. Es algo que toma mucho tiempo” (4).

76 “Somos de los países megadiversos a nivel planeta, pero no tenemos la información suficiente y a detalle. Entonces como vendemos ese producto al turista... No podemos competir con Costa Rica. Por ejemplo, Costa Rica tiene levantado toda su biodiversidad en guías, libros. A dónde vas? Tienes guías, gente preparada y conoces gente que sabe que al ver un mono le da plata. Y aquí en el Ecuador, en algunas comunidades ves un mono y es cazado para alimentarse, pero también a veces es cazado por desconocimiento, por un deporte o, no sé, por ignorancia. Entonces cuando nosotros descubramos que tener un mono ahí nos da plata para el turismo, podemos mejorar. Pero eso lo hacemos levantando información” (6).

77 “Nosotros necesitamos estar sentados en el escritorio y vernos y llenar el formulario y firmar y no sé que” (11).

78 “El Zoom, el WhatsApp, el correo electrónico han sido ayudas importantísimas para mantener…Y la cosa buena que digamos hemos podido sacar, estoy seguro, mucha gente como tú y yo, de esta terrible tragedia pandémica, es que es posible adelantar cosas a través de los medios digitales que antes no se nos hubiera ocurrido” (11).

79 “Otra cosa es llegar a dar la mano, un abrazo, conversar inclusive sobre otras cosas” (10).

80 “A cual más ido ha pasado solo en la computadora, reuniones, reuniones, reuniones. Eso digamos que fue demasiada. Afortunadamente ya no estamos así” (6).

81 “Nos limitó a no poder trabajar con comunidades, a no poder trabajar más, por ejemplo con los guardaparques… cualquier cosa que era con la gente. Esto sí se interrumpió por completo” (2).
“Fue tan visible cómo nos afectó. Cómo nos afecta a nosotros? Prácticamente se estaba cerrando las vías de acceso porque no hubo personas que estaban transitando, no hubo turistas… Careces de recursos de las personas que se dedican a la alimentación como los restaurantes, las personas que se dedican, como tú estuviste en un hotel, no es cierto?” (14).

“Las cosas dependen sin duda del financiamiento… por desgracia…” (11).

“El biocorredor no puede funcionar solo con las buenas intenciones de los amigos” (8).

“O sea sin esos recursos, no es posible… No es posible avanzar porque, puedes tener voluntad o puedes tener ganas de escribir o de trabajar en grupo, pero necesitas vivir” (6).

“[Dinero es] lo que nos mueve, independientemente que no nos guste, es lo que nos mueve” (5).

“Nunca sería suficiente. Toda la vida siempre queremos más porque las ideas son muy grandes, es cierto, pero tenemos que acoplarnos del presupuesto que recibimos” (14).

“He visto fondos de cooperación que son mucho más eficientes. Te piden, o sea, para hacer un puente, por ejemplo, la embajada japonesa te pide una hoja de aprecio o dos hojas, llenas con un tic tan, tan, tan, tan, tan. Esto es, se fue el papel y tienes un puente. ¿Porque para cooperación para el tema de biodiversidad y para cambio climático tiene que ser tan complicado? Debería simplificarse. Si no, no vamos a hacer, nada” (5).

“Sin lugar a dudas fortalecerle no solamente con presencia de más gente, más representantes a nivel territorial” (10).

“Lo que deseo también es que haya más gente… más gente y gente nueva con nuevas ideas y gente con la cabeza fresca” (3).

“Sería ideal que todos quisieran aportar y trabajar fuerte y ponerle ganas, pero suele ser muy complicado” (21).

“Yo creo que podríamos ponerle más tiempo. Podríamos enfocarnos en ya ejecutar actividades” (4).

“Como te digo, al ser un tema voluntario—no es que hace falta ganas sino que nos hace falta tiempo” (10).

“El gobierno de turno quiera hacer algo totalmente diferente a lo que hizo el gobierno anterior y el futuro gobierno cambia lo que hizo el gobierno anterior y así sucesivamente. Entonces eso hace muy difícil, porque no solo en nuestro país, sino en muchos otros países, incluso aquí en los Estados Unidos que las iniciativas a largo plazo que sean objetivos de país, sean muy difíciles de identificar y sobre todo de mantener” (11).
“No había la ley específica para establecer corredores, es decir la normativa del Ministerio ambiente no había. Entonces, para que se reconozca oficialmente tuvimos que hacer la normativa, entonces se fue el otro proceso que construimos la norma de corredores del Ecuador, que ahora permitiría que se establezcan corredores en cualquier parte del país… Apoyamos al Ministro del Ambiente para crear la Ley para Corredores que ya se aprobó en el año 2019” (1).

“Todo es en el acuerdo ministerial. El corredor está constituido por tres elementos. Areas nucleo, los remanentes y la matriz” (9).

“Con esa ley ya el corredor se estableció, se reconoció …Entonces, ahora podemos decir que el corredor ya en papel, está. Existe. Entonces ya tenemos un gran avance porque está reconocido con los actores locales y nacionales” (1).

“Es un corredor, el primer corredor oficialmente reconocido por el Estado. ¿Por qué es relevante esto? Por el hecho de que en el Ecuador sí han habido iniciativas previas en las cuales han invertido muchísimos recursos, mucha plata, muchos miles de dólares en crear corredores y ninguno ha funcionado. … Pero entonces el lograr de que este corredor sea reconocido por el Estado es el logro para mí más grande” (21).

“En la mayoría [de otros países] no tienen reconocimiento jurídico. Aquí logramos que tengan el reconocimiento jurídico por parte del Estado. Entonces eso es otro logro del corredor. Puedo decir categóricamente. Fue un logro del corredor, porque fue tanto trabajo, tanta insistencia desde nosotros para que lo que estaba en la ley se pueda reconocer ya al territorio… Nosotros logramos que nos bautizen” (10).

“Al ser declarada un área protegida dentro de un gobierno local, y como tiene una ordenanza que es el documento que la respalda, eso permite que no llegue el próximo alcalde o la próxima autoridad y diga ‘ya no quiero el área.’ No puede hacer eso. Ya está en la ordenanza. Está” (21).

“Una vez que este incluido en el Sistema Nacional, entonces ya no se puede hacer minería, extracción forestal o petróleo, etcétera, porque ya queda prohibido” (1).

“La gente tiene por un lado el interés de poder ampliar sus sistemas productivos… hizo que la gente amplíe la frontera agrícola-pecuaria, sistemas productivos a zonas de protección. Mientras que la gente que está afuera, que vive en las ciudades y en las comunidades, tiene más necesidad de que se conserve esas áreas, porque ahí están protegidas. En mayor cantidad y calidad de agua, sus recursos, etcétera.” (13).

“La pandemia sí provocó que mucha gente vuelva al campo y al volver al campo le puso presión a ciertos ecosistemas y empezó a trabajar más allá. Entonces. Yo no estoy seguro cuál sea la magnitud de eso, pero sí estoy seguro de que hubo deforestación, aumento de caminos en algunas áreas. No sé cuál es el porcentaje o el número de hectáreas de esto, pero sí sé que hubo... Volvamos a activar nuestras fincas, volvamos a sembrar o hacernos una casa y abrieron caminos. Entonces empezaron a ponerle otra vez presión al campo. Pero no sé... Desconozco cuál fue el impacto, o sea, qué tan grande fue” (6).