The contributions of transboundary networks to environmental governance: The legacy of the MAP initiative

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A R T I C L E   I N F O

A B S T R A C T

Because many environmental threats span national boundaries, transboundary networks have emerged as a form of multi-stakeholder platform to support environmental governance (EG). There are transboundary networks in various ecologically important regions of the world such as the Amazon. However, there remains a need for systematic analyses to adequately evaluate the contributions of transboundary networks to EG. This paper takes up the case of the "MAP Initiative", a transboundary network in the tri-national frontier of the southwestern Amazon that sought to support EG. We examine three key questions: 1) how do transboundary networks motivate participants to engage in collaboration across boundaries for EG, 2) how do transboundary networks evolve structurally as well as strategically to increase their impact on EG, and 3) can transboundary networks generate outcomes beyond information sharing for EG? The analysis draws on historical documents, participant observation, and key informant interviews about the MAP Initiative. The findings confirm that transboundary networks motivate cross-border exchanges in multiple ways, they evolve structurally in multiple ways that increase their capacity, and that evolution supports multiple forms of activities and outcomes that support EG. We conclude with a discussion of the contributions and challenges of transboundary networks regarding EG.

1. Introduction

Environmental governance (EG) refers to coordinated action among multiple stakeholders who pursue deliberative processes to arrive at decisions about environmental management (e.g., Bridge and Perrault 2009; Evans 2012; Lemos and Agrawal 2006). EG is thus a broad term that encompasses decision processes relevant to natural resource use, pollution control, responses to climate change, and various other environmental threats. EG may transpire among governmental agencies, non-governmental organizations, private sector firms, community associations and other stakeholders, who operate on different scales or across scales, from the local up to the global levels.

Many environmental issues span national boundaries, which pose challenges to EG. Different legal frameworks, administrative systems, and national cultures can all serve to impede coordination across boundaries for EG (Perz 2016). There is thus a need for transboundary approaches to bridge the divides (e.g., Klinke 2012; Mitchell, et al. 2020; Nurhidayah, et al. 2014; van Oosten 2004).

A key organizational strategy for transboundary EG involves networks (e.g., Leibenath et al., 2010; Manring 2007; Milman, et al. 2020; Song, et al. 2019). Transboundary networks can increase the reach of EG efforts by spanning national and other jurisdictional boundaries (e.g., Klinke 2012; Scott and Carrington 2011). Similarly, transboundary networks can encompass ties that span policy sectors which may divide governmental agencies (e.g., Alexander, et al. 2016; Berkes 2017; Perz 2016). Further, transboundary networks offer a flexible organizational

platform that can change over time as key issues for EG change (e.g., Angst and Hirschi 2017; Berardo 2014; Bodin 2017).

However, there remain questions about how transboundary networks operate and evolve over time to generate outcomes that advance EG. While we know that transboundary networks can usefully span jurisdictional divides for EG, it is less clear how cross-border ties motivate network members to pursue joint collaborative action. While we know that networks constitute a flexible organizational form, and while there is substantial attention to adaptive governance with regard to EG, network studies tend to focus on structural rather than strategic change, whereas adaptive governance has conversely paid relatively little attention to structural change in networks for EG. Long-term studies of transboundary networks should focus on the joint evolution of their structural and strategic dynamics and how that joint evolution might increase network contributions to EG over time. Finally, while stakeholders in transboundary networks can benefit each other by exchanging information, there is less evidence of whether such networks can go beyond knowledge dissemination to more concrete actions like adoption of policies or implementation of management plans. If we can answer one or more of these questions in the affirmative, it would show how transboundary networks can contribute in diverse ways to transboundary EG.

We therefore adopt an historical, qualitative approach to follow the career of a transboundary network as it sought to contribute to EG. We take up the case of the "MAP Initiative", a transboundary network in the southwestern Amazon. MAP was named for the three states that make up a tri-national frontier, where **M**adre de Dios (Peru), **A**cre (Brazil) and **P**ando (Bolivia) meet. The MAP Initiative emerged around 2000 to hold tri-national public forums to discuss issues of shared concern and then pursue collectively identified priorities to advance transboundary EG. Its long history, spanning two decades, permits an evaluation of its evolution over time and its contributions to EG. We can thus address gaps and limitations in previous work about the contributions of transboundary networks to EG.

We begin by briefly reviewing theoretical discussions and empirical work on networks and EG. We first focus on transboundary networks and their purported assets and difficulties with regard to EG, noting gaps and limitations in previous work. We then focus on the dynamics of networks, noting the strong formal and structural emphasis in network analysis. From those two discussions, we identify our three research foci about transboundary networks and EG: 1) how transboundary networks support EG by motivating participant collaboration across boundaries, 2) how the joint evolution of structure and strategy in networks can increase their impacts on EG, and 3) the range of outcomes of transboundary networks for various aspects of EG. We then introduce our study case, the MAP Initiative, noting how it constitutes an example of a transboundary network in support of EG. We then discuss our methods of data collection, which combine review of historical documents, participant observation, and key informant interviews. We organize our findings around a history of the evolution of the MAP Initiative, and a thematic framework of network contributions to EG, which together address the three research foci. We conclude with a discussion of the implications of our findings for transboundary networks and their contributions to EG.

1.1. Networks and environmental governance

There are various theoretical perspectives on EG (Partelow, et al. 2020), notably including network approaches that feature the structures of ties among stakeholders. In a network perspective, EG encompasses various approaches that highlight relationships among diverse stakeholders. A prominent example is adaptive management, where stakeholders periodically come together to review performance data on a managed ecosystem in order to take decisions about whether to adjust management (e.g., Chaffin, et al. 2014; Salafsky, et al. 2001). Other approaches include co-management (e.g., Armitage, et al. 2009;

Carlsson and Berkes 2005), collaborative management (e.g., Colfer 2010; Galat and Berkly 2014), and multi-stakeholder platforms (e.g., Kapetas, et al. 2019; Warner 2007). All such approaches involve multiple stakeholders to permit collaboration on the assumption that the participants contribute complementary knowledge for EG (Perz 2016).

Increasingly central in discussions of EG are concerns of global and multi-level efforts (e.g., Lemos and Agrawal 2006; Newig and Fritsch 2009; Paavola 2016). In both instances, networked stakeholders must span jurisdictional divides to pursue EG. While multi-stakeholder approaches afford the advantage of complementary knowledge and experiences, transboundary EG imposes additional challenges due to the differing legal frameworks, administrative systems and national cultures in different countries. This has motivated attention to the particularities of networks as an appropriate organizational form to manage the challenges of EG when crossing boundaries.

A key asset of networks is that they facilitate the dissemination of information among members to support learning (e.g., Scott and Carrington 2011; Wenger-Trayner, et al. 2015). The decentralized structure of networks implies that there are multiple sources of complementary information, whether from diverse local experiences, specialization of knowledge funds, and/or differing research programs. The horizontal ties in networks allow information to flow relatively freely in multiple directions among members. In turn, information sharing facilitates learning, which constitutes a shared knowledge base for collective action. As information is one key input for planning processes and implementation of concrete actions, networks stand to support EG (Watkins, et al. 2018).

The advantages of networks apply across national and other boundaries under specific conditions. Network members are likely to find benefits of collaboration across boundaries to the extent that they have complementary capacities and shared interests (Huxham and Vangen, 2005; Lank 2006). Recent literature on multi-level EG has examined structural aspects of how network members organize themselves by establishing linkages with each other (Hamilton, et al. 2020). However, work on networks and transboundary EG has focused on structures of ties rather than the operations of ties among members. This leaves open questions of the effectiveness of network ties to motivate collaboration among members, especially across boundaries, to support EG.

Work on networks and EG has other important limitations, notably with regard to the breadth of outcomes. Although networks are good at generating and circulating information relevant to EG, that by itself falls short of realizing bottom-line goals like protecting habitats, saving species or mitigating carbon emissions (Conservation Measures Partnership 2016). A crucial question then concerns whether networks generate outcomes beyond information dissemination.

Previous publications on networks and outcomes regarding EG have offered valuable insights about the challenges at hand. Collaboration in networks on any level is demanding of time and effort by participants (Bodin 2017; Perz 2016). There are many challenges to collaboration, especially collaboration across boundaries (Alexander, et al. 2016; Perz 2016). There has been theoretical discussion about networks and EG (Lubell 2015; Partelow et al., 2020), though there remains a need for empirical evaluations of theoretical propositions about networks and their contributions to strategic outcomes.

Insights in this regard are available in the literature on networks and social movements (e.g., Diani and McAdam 2003; Diani 2011; Saunders 2007). Whereas the social movement literature has featured the importance of tactical repertoires with regard to achievement of movement goals, network perspectives on social movements highlight structural features of movements as related to their goals and achievements. Social movement research informed by network perspectives highlights the structure of relationships in movement networks, which are often made up of clusters of individuals that may involve vertical as well as horizontal relationships. Network approaches to social movements have thus paired a structural perspective with a focus on

movement operations, highlighting e.g. how individuals with leadership roles are situated in networks vis-à-vis other members.

Similarly, the structural emphasis in network studies has motivated calls for qualitative inquiry about how network members collaborate to generate outcomes (Hollstein 2011). This is because the importance of networks goes beyond formal quantitative accounts of structure to focus on the strategic content of activities among network members and how shared goals drive collaboration (Fuhse & Mützel 2011). Qualitative inquiry into the operational details of clusters in networks suggests that the combination of horizontal and vertical relationships helps explain the generation of concrete outcomes and achievement of shared goals (e. g., Kennedy et al., 2015; Klärner et al., 2016). However, available empirical cases come from domains other than EG, and have tended to focus on localized rather than multi-level or transboundary networks.

1.2. Network analysis: structure and dynamics

EG is a complex process that unfolds over extended periods of time. Networks also change over time, as via stakeholder turnover or structural changes (Dakiche, et al. 2019). Networks may also change due to strategic adaptation as governance priorities change, which may require modifications in network goals, collaborative practices and activities (Angst and Hirschi 2017). These observations raise questions about how network structures change over time and whether they change in ways that help achieve strategic goals such as EG.

Recognition of the importance of network dynamics has informed discussions of network evolution (Dakiche, et al. 2019). However, the emphasis on formal approaches and the demand for comparability among data sets across time points pose challenges to the study of network dynamics (Bright, et al. 2019). Recent work reports methodological innovations to evaluate structural changes in ties and clusters in networks (Wang, et al. 2018; Mulder and Leenders, 2019). This has proceeded alongside valuable studies of changes in network clusters over time (Ouellet et al., 2019) and the use of historical data to capture network evolution (Zhao, et al. 2019).

Work on network evolution has included attention to the dynamics of networks with respect to EG. Innovative modeling approaches have permitted evaluation of structural changes in EG networks in terms of tie formation and dissolution (Berardo 2014, Bodin, et al. 2016, Angst and Hirschi 2017). There is also recognition of the importance of qualitative approaches to network dynamics, including attention to changing goals, leadership roles, and activities of members (Angst and Hirschi 2017; Bodin 2017).

The foregoing review of previous work on networks and EG, network analysis and social movements makes evident that our understanding of networks as an organizational form to support transboundary EG remains limited in certain respects. While the literature on EG is extensive, there remain important gaps in our understanding of how transboundary networks operate to support EG. For one thing, there is the question of how participation in transboundary networks motivates members to collaborate across boundaries despite the costs in time and effort. There remains a need to better understand how transboundary networks can create the conditions for collective action for EG. For another, while research on networks is extensive, we know more about network structures than network evolution. There is important network research on tie formation and dissolution, as well as governance literature on adaptation of strategies. But we know rather less about how networks evolve structurally in light of shifts in strategy to achieve key goals. There remains a need to better understand how network members pursue structural modifications as specifically related to strategic changes. A third question concerns outcomes of networks for EG. While it is well-established that networks permit the multi-directional flow of information, the time required to produce other EG outcomes leaves a relatively thin empirical literature on results like public policies or implementation of management plans. Where empirical work on networks and governance has pursued these issues, it has largely fallen

outside the domains of transboundary networks and/or EG. It is thus important to focus on the potential breadth of outcomes of transboundary networks for EG.

The foregoing discussion thus raises a trio of research questions about transboundary networks and EG. First, do participants in transboundary networks find benefit in cross-border exchanges of experiences to pursue collaborative activities? This question addresses the gap in prior work left by the focus on quantifying network structures over qualitative understanding the operations of network members as they pursue EG. We argue that transboundary networks offer especially valuable opportunities for social learning that influences participants and their institutions to pursue cross-boundary collaboration for EG, despite the challenges of collaboration across boundaries. Second, do transboundary networks evolve in terms of structural as well as strategic changes to increase their impacts on EG? This question addresses the limitations in network analysis stemming from a structural focus on change by relating it to the emphasis on adaptation of strategies in the social movement literature with regard to EG. We suggest strategic shifts in transboundary networks result in structural changes as a means of responding to new challenges and seizing new opportunities. This yields complex dynamics that modify what transboundary networks do, increasing their impact on advancing EG. Third, do transboundary networks generate outcomes for EG beyond information sharing, such as formulation of policies and promotion of their implementation? This addresses the relative paucity of attention to transboundary network outcomes beyond information dissemination. We argue that even with the additional challenges of spanning divides, transboundary networks can generate a wide range of outcomes with regard to various aspects of EG.

1.3. The MAP initiative as a transboundary network for environmental governance

To address these issues, we focus on the case of the "MAP Initiative" of the southwestern Amazon, named for the states sharing the tri-national "MAP" frontier there, shown in Fig. 1. The MAP frontier is a useful study case for inquiry about EG, for several reasons. It is known for its high levels of biodiversity (e.g., Myers, et al. 2000), and it has been the epicenter for extreme climatic events that herald climate change (e.g., Brown, et al. 2011). Further, because the region has experienced conflicts over natural resources among diverse stakeholders, governments and social movements in the region have produced influential proposals for environmental policy (e.g., Gomes, et al. 2018; Kainer, et al. 2003). Together, these considerations about the MAP frontier make the MAP Initiative an eminently worthy study case for inquiry about transboundary EG.

The MAP Initiative constitutes a transboundary network, organized around participation of diverse stakeholders across the three sides of the MAP frontier. Observers articulated what the MAP Initiative was not (Gudynas 2007; Pereira 2007; Rioja Ballivián, 2007; van Oosten 2004). MAP was not an organization, because it encompassed many organizations, groups and individuals. It was not a governmental entity, nor did it seek to supplant governmental organizations. Neither was it a social movement, because it included stakeholders with different interests, including local and regional governments, and it did not operate via cycles of protest. Nor was it a project, because it largely functioned without budgets and it unfolded organically based on voluntary stakeholder participation. Rather, the MAP Initiative constituted a transboundary network in which diverse stakeholders could pursue various goals shared with counterparts in the same region but from other countries (Chávez et al., 2005; Francisco 2007; Gudynas 2007; Pereira 2007; Rioja Ballivián, 2007).

The MAP Initiative emerged in response to the prospective paving of the Interoceanic Highway through the tri-national frontier (Brown, et al. 2002; Wagner Tizón and Gadea Duarte 2002). The highway was a prominent early project in the Initiative for Integration of Regional
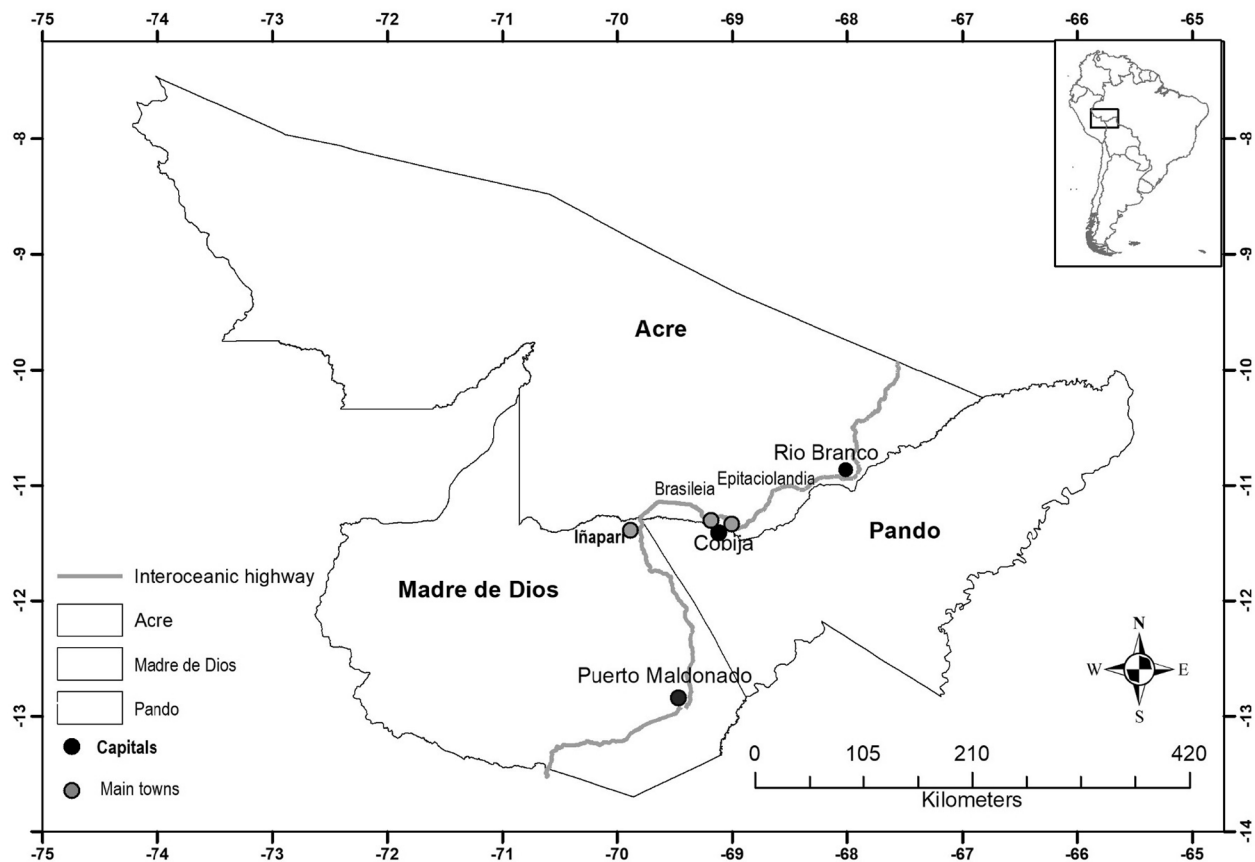
Fig. 1. Map of the Tri-National "MAP" Frontier: Madre de Dios (Peru), Acre (Brazil) and Pando (Bolivia).

Infrastructure in South America (IIRSA), an ambitious continent-wide program of transboundary infrastructure projects with the goal of integrating neighboring economies (Wagner Tizón and Gadea Duarte 2002; van Dijck 2013). Infrastructure projects are controversial in the Amazon, and have stimulated intense policy debate, usually squaring up the proposed economic benefits of development and poverty reduction via increased connectivity against ecological harms like forest degradation and biodiversity loss via habitat fragmentation (e.g., Dourojeanni, et al. 2010; Killeen 2007; Perz, et al. 2012). In the southwestern Amazon, paving the Interoceanic Highway would improve transit between Brazil and Peru, and the road ran along both of their borders with Bolivia; hence there was great environmental risk that would likely cross national borders. Indeed, as the Interoceanic Highway was paved in the 2000s, deforestation rose in all three sides of the MAP frontier (e.g., Southworth, et al. 2011), and a gold boom facilitated by the highway arose in Madre de Dios (e.g., Swenson, et al. 2011), along with increased illegal timber extraction (e.g., Asner, et al. 2013).

Anticipating such threats, the MAP Initiative emerged as numerous academics and local organizers began to bring together people who shared common concerns about the highway in discussions across the tri-national frontier (Gudynas 2007; Pereira 2007). MAP advanced a highly participatory model for EG in terms of broad stakeholder participation in regional environmental planning (Brown, et al. 2002). MAP organizers formulated the philosophical foundation for that model of EG by invoking the UN Framework on Human Rights, especially the Right to Know and the Right to Participate, as hallmarks of their understanding of EG. MAP thus constituted a multi-stakeholder platform for EG, open to whomever wished to contribute ideas and proposals (Queiroz de Sant'Ana, 2008). MAP's model of EG thus ran well beyond government, viewing "governance" as a more inclusive term, while recognizing the importance of public input, governmental authority, and shared responsibility for implementation of proposals.

A key characteristic of the MAP Initiative concerns its scale of operation: it was simultaneously local, regional and tri-national. In the context of global economic integration and debate about the meaning of national boundaries in Latin America (Torres Cisneros et al., 2004; van Dijck, et al. 2000), MAP organizers recognized national sovereignty, but sought integration of local and regional stakeholders from the three countries in a shared tri-national space of dialogue (Chávez et al., 2005; Gudynas 2007; van Oosten 2004, 2007, 2010). The MAP Initiative thus constituted a multi-level platform for transboundary EG, in which stakeholders spanned scales from the local to the international, albeit in a regional space. It was because of the MAP Initiative that the MAP frontier came to be called such, in recognition that it constituted a region with shared concerns among local stakeholders, instead of a tri-national space divided by jurisdictional borders (Chávez et al., 2005; Rioja Ballivián, 2007).

The MAP Initiative provided a platform to advance EG by serving as a public space for 1) exchange of knowledge and experiences, 2) generation of proposals for collective action, and 3) deliberation about implementation of those proposals. The MAP Initiative held tri-national forums for these activities, thus creating spaces for dialogue about proposals and recommendations for action (Queiroz de Sant'Ana, 2008). MAP forums featured plenary presentations with discussions and breakout groups, and thus placed great emphasis on exchanges of knowledge for learning (Francisco 2007). MAP Initiative organizers complemented the public forums with a website to broaden knowledge dissemination and thus social inclusion (Schmidlehner, et al. 2007). These activities allowed for "self-management" (*autogestión*) in the vetting of proposals via public forums for consideration by governments and other implementing organizations (Francisco 2007; Gudynas 2007). Public deliberation about proposals for action led to identification of priority goals with the support of diverse stakeholders across the MAP frontier. The MAP Initiative thus combined inclusive practices for

deliberation with a process for advancing from learning to proposals to action, which constituted a model for transboundary EG.

2. Methods and data

Our analysis takes up the MAP Initiative as a transboundary network to consider the three research questions noted earlier. To that end, we pursued a combination of qualitative historical methods to compile information about the legacy of the MAP Initiative, including document analysis, participant observation, and in-depth interviews. The first author pursued the document analysis. These include historical

documents such as MAP forum agendas, reports and letters, as well as publications. Documentary sources also include reports and websites from spinoff projects, as well as governmental policy publications and media releases. The documents supported construction of a history of the MAP Initiative, featuring its evolution over time.

In addition, the first author selected eight long-time coordinators of the MAP Initiative for in-depth interviews. The first author and the coordinators participated in and observed the activities of the MAP Initiative for most or all of its two-decade existence, constituting a record of firsthand experience. The coordinators span all three sides of the tri-national frontier (two in Bolivia, three in Brazil, and three in Peru)

Table 1
Tri-national Forums of the MAP Initiative, 1999–2015.

Year	MAP Forum	Title of Forum	Substantive Issues	Structural Changes	Activities and Outputs
1999	Rio Branco, Acre	*Encuentro de universidades para desarrollar un Programa de Cambios Globales relacionados con el uso de la tierra en la amazonia sudoccidental*	First forum, focused on regional land use and global environmental change		Declaration of Rio Branco, 15 priorities for capacity building
2000	MAP I, Rio Branco, 25 participants	*Indicadores de Mudanças na Cobertura e no Uso da Terra na Região Acreana*	Focus on application of scientific findings by the broader society	Strategic decision to hold annual forums and rotate the location among countries	
2001	MAP II, Puerto Maldonado, 70 participants	*Construindo uma História de Cooperação para o Desenvolvimento Regional*	Focus on forms of cooperation to address regional development and global environmental change		Onset of spinoff meetings focused on particular topics
2002	MAP III, Cobija, 220 participants, 53 organizations	*Desenvolvimento Sustentável na Região MAP (Madre de Dios (Peru), Acre (Brasil) e Pando (Bolivia)*	First public forum, broader stakeholder participation; agenda broadened beyond conservation	Reorganization around four thematic round tables: conservation, development, equity, policy. Emergence of working groups (network clusters) under each round table.	Letter from Cobija, strategic shift to emphasize proposals for action. Working groups began advancing toward concrete actions on proposals
2003	MAP IV, Brasiléia & Epitaciolândia, 600 participants, 164 organizations	*Construindo uma História de Cooperação para o Desenvolvimento Regional na Região MAP*	Greater focus on social inequalities. Sessions dedicated to *campesino* and indigenous demands	Rapid growth in scale and diversity of participants. Proliferation of mini-MAP working groups. Sustained strategic pivot from information exchange to proposals for concrete actions	Working groups reported back on advances on proposals for action. Emergence of key priorities for policies and other actions
2004	MAP V, Puerto Maldonado, 1200 participants, 220 organizations	*Educação sem Fronteiras a Serviço da Integração e do Desenvolvimento Sustentável da Região MAP*	Focus on cross-border educational models. Participation by national and international organizations, greater focus on funded activities.	Semi-autonomous functioning of numerous mini-MAPs, each with three national coordinators and members	Planning for implementation of concrete activities. Emergence of spinoff projects with external funding
2005			Critique of outside organizations advancing projects in MAP without consulting local stakeholders	Institutional development of MAP. Many mini-MAPs holding their own tri-national meetings, generating outputs outcomes beyond MAP forums	Implementation of funded projects in education and other topics. Numerous policy recommendations from MAP to governments
2006	MAP VI, Cobija	*Fortalecendo as Raízes de um Futuro Comum*	Debate over questions of institutionalization.	More bureaucratic organizational elements via projects. Institutionalization of some mini-MAPs. Increasing engagement of MAP with governments	Reporting of results from mini-MAP activities. USAID ABCI program, onset of G-MAP Consortium
2007	MAP VII, Epitaciolândia	*Mudanças Globais, Soluções Regionais*	Sustained focus on climate change via extreme events	Prominent role of regional governments in public forum	Broad array of new policy recommendations. Declarations of adoption of MAP policy recommendations by regional governments
2008	MAP VIII, Puerto Maldonado		Increased focus on topics of expanding mini-MAPs, e.g. agrarian health, watersheds, risk management	Some mini-MAPs grew, others stagnated or declined	Ongoing projects with MAP Initiative participant organizations. Increased implementation of MAP recommendations by governments
2012	MAP IX, Cobija, 150 participants	*Una Región en Movimiento: Avances y Perspectivas en la Región MAP 2002–2022*	Reorganization of MAP Initiative vision around strategic priorities and outcomes	Continued work by a few mini-MAPs, broader network less active but in contact	New projects with outside organizations and MAP partners and allies
2015	MAP X, Rio Branco, 477 participants, 150 organizations	*Novos caminhos para adaptação e resiliência a eventos extremos climáticos na região MAP, Amazônia sul-ocidental*	New set of MAP strategic priorities. Continued focus on topics of prominent mini-MAPs	Multiple ties to governmental institutions in Acre.	Selected mini-MAPs continue work with governments on policy implementation

and have worked in different organizational types (governments, NGOs and universities) and in different working groups in the MAP Initiative. Interviews focused on the experiences of the coordinators in MAP and the larger history of MAP. The interviews particularly addressed MAP's legacy, understood in terms of its direct support for EG, as well as indirect or unexpected contributions.

We pursue the analysis in two parts, which draw in varying degrees on our three methods of data collection. First, we offer a history of the MAP Initiative, which addresses the research question about how transboundary networks evolve to increase their contributions to EG. Second, the first author organized the data from the interviews about experiences in terms of a suite of prominent themes, each representing a distinct type of outcome of MAP. The thematic coding of interviews addresses the other two research questions, about collaborative practices to support EG and activities beyond information sharing to other outcomes.

3. Results

3.1. A history of the MAP initiative: structural change and strategic evolution

The MAP Initiative changed enormously over time, not only in terms of its structure but also in terms of its scale, goals, and activities (Chávez et al., 2005, Rioja Ballivián, 2015). Table 1 presents selected details about the MAP Initiative, organized as a chronology featuring the tri-national MAP forums. The first event was a meeting of Brazilian researchers in Rio Branco, Acre in 1999 who invited Peruvian and Bolivian counterparts (Chávez et al., 2005). This event focused on the relationship between regional land use and global environmental change. While it was a small event involving academics, it stimulated discussion to continue tri-national meetings. That led to the organization of the first forum, MAP I, a year later in 2000. MAP I turned attention to the application of scientific findings by the broader society. MAP I also led to the decision to rotate the location of MAP forums, so MAP II was held in Puerto Maldonado, Madre de Dios in 2001 (see Fig. 1). The MAP Initiative began to grow: participation nearly tripled over that of MAP I, the thematic focus was broadened to feature regional development alongside global environmental change, and the programmatic agenda focused on multiple forms of cooperation. MAP II also began to generate spinoff meetings on specific topics, the first of which focused on environmental impact assessment.

MAP III was held in Cobija, Pando in 2002 and constituted a key moment in the evolution of the MAP Initiative (Chávez et al., 2005; Rioja Ballivián, 2005; van Oosten 2004). MAP organizers advertised the meeting as a public forum open to all stakeholders across the MAP frontier, and invited participants from organizations outside the region. Consequently, participation again tripled, and over 50 organizations were represented. That year, paving of the Inter-Oceanic Highway in Brazil reached the Peruvian border. With that as context, MAP III was reorganized around four thematic round tables: environmental conservation, economic development, social equity, and public policies. This modified the structure of the MAP network, creating clusters of members across countries within each theme. The structural replication of the tri-national organization in each of four round tables in turn reflected a strategic shift in the MAP Initiative to differentiate among groups working on distinct goals, all related to EG. The creation of tri-national round tables expanded the number and thematic scope of discussions, with over 50 presentations spread across four groups of parallel sessions. The structural shift to round tables also coincided with the strategic shift from information exchange toward proposals for concrete activities to improve EG. Participants self-selected into working groups focused on specific goals, which in turn permitted identification of proposals for action. On the final day of MAP III, the working groups presented 21 proposals concerning participatory environmental planning, and committed to pursuing actions toward that goal during the next year.

Because the MAP Initiative was public and activities were ongoing, interest in participating grew, and led to further structural changes (Chávez et al., 2005; Rioja Ballivián, 2005). Participants in quarterly planning meetings for MAP IV rose from 25 to 50 to 70. Growth in participation prompted the emergence of working groups that focused on specific topics within each round table. These working groups, the "mini-MAPs", proliferated within all four of the MAP round tables (Pereira 2007). The mini-MAPs constituted numerous tri-national clusters in the MAP network, and supported the strategic pivot from information exchange to production of proposals for action concerning EG. At MAP IV, held in the sister towns of Brasiléia and Epitaciolândia in Acre in 2003, participation of individuals and organizations roughly tripled over that of MAP III, and working groups reported back on their activities (Rioja Ballivián, 2015). The reports led to recommendations for public policies and tri-national projects.

As mini-MAPs proliferated, differences among participants in MAP forums also became evident, including in the form of social inequalities. At MAP IV, rural producers and indigenous peoples complained that MAP coordinators did not issue invitations to include them or provide funding to help support their participation. Other groups with more institutional power and resources, such as government representatives, university academics, and NGO personnel, thus tended to be highly represented at MAP forums. MAP organizers observed that MAP forums were open events and did not require invitations to participate. Rural producers and indigenous groups thus formed their own mini-MAPs, and at MAP IV, those working groups issued their own demands for policies and actions (Rioja Ballivián, 2005).

By 2004, the MAP Initiative had evolved in terms of structure as related to its strategy for EG. From countries to themes to working groups, MAP's transboundary structure had multiplied its number of tri-national clusters. By one count (Pereira 2007), there were 5 mini-MAPs under environmental conservation (watersheds, biodiversity, Agenda 21, risk management, and remote sensing), 11 under economic development (castanha (after the tree, *Bertollethia excelsa*), agrarian health, tourism, timber, regional planning, highways, microenterprises, rubber, cupuaçu (after the tree, *Theobroma grandiflorum*), non-timber forest products, and farming/ranching), and 9 under social equity (education, child and adolescent rights, indigenous people, rural producers, health, universities, social communication, art/culture/sport, and human rights). Each mini-MAP had its own coordinators and functioned more or less autonomously of the others, though many individuals were members of multiple mini-MAPs. Strategically, the mini-MAPs promulgated various proposals for action, which increasingly spanned a range of policy sectors relevant for EG. The result was a portfolio of recommendations for concrete policies and implementation procedures to ensure stakeholder participation in regional environmental planning.

The structural and strategic evolution of the MAP Initiative continued to stimulate public interest in participation. Attendance at MAP V doubled that of MAP IV, and the number of participating organizations again rose. MAP V featured Mini-MAP Education and discussions about cross-border educational models (Rioja Ballivián, 2015). MAP V also involved the participation of representatives of national governments and international donors (Chávez et al., 2005).

This marked the "arrival" of the MAP Initiative on a larger stage, which led to further changes. Attention from donors to mini-MAPs led to the first spinoff projects, which began to implement concrete actions beyond knowledge exchange. This led to another structural change, as projects with external funding meant that mini-MAPs had to deal with bureaucratic formalities like budgets and vertical structures (Perz 2015). At the same time, power issues again arose, this time from outside the MAP Initiative. A consortium of international NGOs secured funding from the Dutch Embassy in Bolivia to advance tri-national activities in the MAP frontier (Rioja Ballivián, 2015). The project however emerged as NGOs claimed the name of the MAP Initiative, without first consulting participating stakeholders. Other MAP network members thus repudiated the project because the proponents had not engaged in a

consultative process to jointly identify goals and define activities. The funder consequently dropped the project, in an expression of support for the MAP Initiative's commitment to inclusion and deliberation as key requirements for proposing concrete actions for implementation with regard to EG.

At the same time, the context of the MAP Initiative continued to change. The severe drought and fires of 2005 and the historic flooding of 2006 called new attention to global environmental changes in terms of extreme climatic events (Brown, et al. 2011). Meanwhile, the Peruvian state approved contracts to large Brazilian construction companies, which began work on paving the Interoceanic Highway (Dourojeanni 2006; CAF, 2013).

The structural and strategic evolution of the MAP Initiative, toward externally funded projects and implementation of concrete actions for EG, prompted debate among participants about the purpose of the MAP Initiative. MAP VI in 2006 featured that debate and the implications for the role of the MAP Initiative with respect to EG. Participants discussed whether MAP should remain a horizontal, informal network, or instead evolve into a more vertical, formal institution (Chávez et al., 2005). For MAP Initiative organizers, the answer was elements of both: MAP served as a platform for dialogues to generate proposals for action, and constituted a catalyst of policy recommendations and projects for participants to implement (Rioja Ballivián, 2007). MAP VI therefore featured results and policy recommendations from numerous mini-MAPs (Rioja Ballivián, 2015).

The MAP Initiative was evolving toward institutional formality. By MAP VI, MAP had a Scientific Ethics Committee with review protocols for outside organizations seeking to work with local stakeholders (Francisco 2007; Rioja Ballivián, 2015). Beyond spinoff projects in mini-MAPs, the first MAP consortium project, G-MAP (for "Governance in the MAP Region"), began working with funding from the US Agency for International Development (Perz 2015). MAP also increasingly engaged governments. The drought and fires stimulated Mini-MAP Risk Management, which worked closely with governments to coordinate emergency responses across the tri-frontier (Brown, et al. 2011).

MAP VII thus focused on the threat of extreme climatic events (Brown & Ferreira 2015; Rioja Ballivián, 2015). MAP VII featured governmental representatives, and Mini-MAP Risk Management provided policy recommendations to improve emergency response preparedness (Brown, et al. 2011). Other mini-MAPs also provided policy recommendations on education, land tenure and other issues. Onstage in front of the attending public at MAP VII, all three regional governors outlined the MAP Initiative policy recommendations that their governments had or would adopt. In that sense, by 2007, the MAP Initiative had evolved to achieve a strategic imperative for EG: it had gone from creating a platform for public dialogue to promulgating proposals to seeing those adopted for implementation by governments.

In 2008, the MAP Initiative exhibited new dynamics (Rioja Ballivián, 2015). While MAP VIII was another large public forum, the most important changes of the MAP Initiative resided elsewhere, in the diverse fortunes of different mini-MAPs. Some mini-MAPs exhibited declines in activities. Others like Mini-MAP Indigenous People spun off and operated autonomously. A few, like Mini-MAPs Agrarian Health, Watersheds and Risk Management, continued to work and advanced policy proposals.

More recent MAP forums have occurred less frequently. MAP IX would wait until 2012 (Reyes, et al. 2012). Attendance declined from previous MAP forums. MAP IX focused on reviewing the achievements of the MAP Initiative from 2002 to 2012, and engaged in a strategic planning process to identify a new list of priorities to 2022. MAP X transpired in 2015, with increased participation over MAP IX (Iniciativa MAP 2015). MAP X advanced a new array of strategic priorities: environmental risks, forests/soils/water, economy and infrastructure, regional land use planning, and environmental and human rights. MAPs IX and X can be viewed as embodying further strategic evolution of the MAP Initiative in the early 2010s.

In sum, the career of the MAP Initiative followed a specific trajectory. In the 2000s, it exhibited rapid growth, structural change and strategic evolution. Structurally, it evolved from a single tri-national network to a suite of thematic round tables to a larger constellation of mini-MAP working groups to an array of externally funded projects with formal organizational elements. Strategically, MAP evolved from an academic focus on scientific exchange to a public forum for inclusive dialogue and information dissemination to a suite of network clusters promulgating proposals for policies and action to formal projects that focused on implementation of proposals. In the 2010s, the MAP Initiative continued to evolve, via periodic public forums that featured identification of new strategic priorities, diverse trajectories among the mini-MAPs where some declined and others advanced, and institutionalization via spinoff projects and engagement with governments for implementation of actions for EG.

The MAP Initiative also incurred criticisms. Nationalists asserted that the MAP Initiative was the instrument of foreign powers seeking to advance a neoliberal agenda of open frontiers or the internationalization of the Amazon to prevent development in the name of conservation (Souza and Andrade de Paula 2009). Such arguments ignored the role of the MAP Initiative in making policy recommendations for governments, and overlooked local and regional governments as participating organizations in MAP. Of greater concern was a second critique, that the MAP Initiative had grown but then declined without contributing to EG. The second part of the analysis addresses that critique, and sets the MAP Initiative in the broader context of the discussions about the contributions of transboundary networks to EG.

3.2. Contributions of the MAP Initiative to Environmental Governance

The interviewees reported seven themes as contributions of the MAP Initiative to EG: 1) convening public spaces for dialogue about regional environmental planning, 2) fostering collaborative relationships that changed individual and organizational practices, 3) promulgating models of cross-border capacity building, 4) advancing models of transboundary EG via policies and plans, 5) supporting cross-border governmental coordination of policy implementation via joint activities, 6) generating spinoff projects for implementation of diverse priorities for EG, and 7) fostering cross-boundary sustainable development enterprises. The seven themes can be visualized as a model for how transboundary networks can support EG, shown in Fig. 2. We therefore organize the discussion of our findings around the themes, with prominent examples of each.

3.2.1. The MAP initiative as a convening space for dialogue

MAP forums constituted shared spaces for dialogue about EG. The keys were that MAP forums were freely accessible, they focused on issues of interest to stakeholders, and stakeholders could demand discussion of additional issues. This made participation very attractive for many stakeholders, who found benefit in knowledge exchange and social learning. Consequently, many participants returned, even at their own cost. Such participants exhibited genuine interest in the shared problems of the MAP frontier and became *MAPienses de corazón* (people of MAP at heart).

Because dialogues involved social learning that participants saw as a benefit, forums were also important for forming and sustaining relationships. Relationships motivated individuals to develop collaborative partnerships, sometimes via spinoff projects. Even after projects ended, participants had counterparts with whom to continue to dialogue about EG. When new EG issues arose, *MAPienses de corazón* would contact their counterparts. The result was that partners in various sectors sustained relationships, not just among university researchers or NGO directors or governmental technical staff, but also among business people, police, and soccer teams.

A key challenge to sustaining relationships in the MAP network concerned the differing political dynamics across boundaries in the MAP
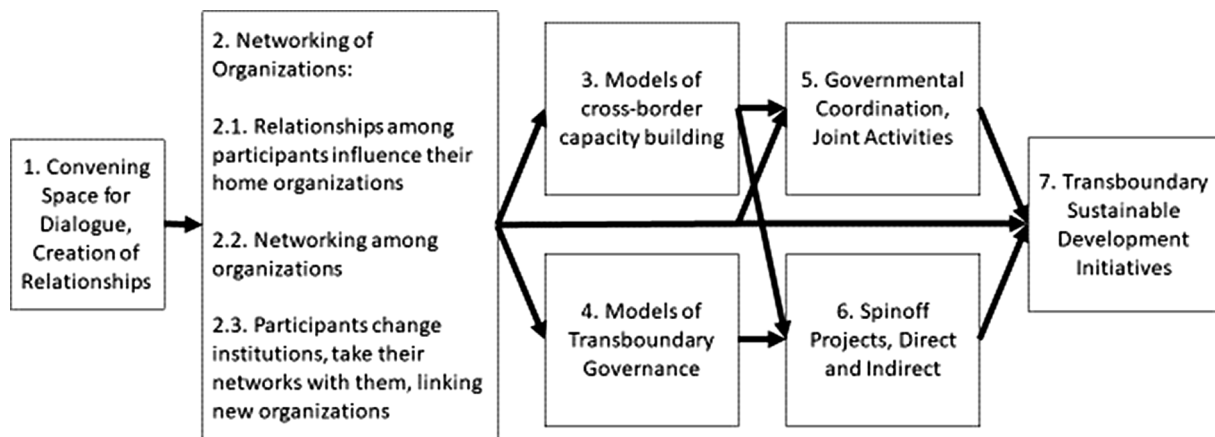
Fig. 2. Outcomes of the MAP Initiative.

frontier. Whereas the MAP Initiative had a long-term EG partner in the "Forest Government" of Acre (cf. Kainer, et al. 2003), it had varying support from governments in Madre de Dios, and faced a shift toward a more difficult political context in Bolivia. That said, a key advantage of the MAP Initiative as a transboundary network was precisely its organization around numerous relationships across borders. That made the MAP Initiative relatively resilient to political changes. Even in the difficult political context in Bolivia, *MAPienses de corazón* could continue to collaborate with counterparts on shared concerns regarding EG.

3.2.2. MAP and networking of organizations

The formation of relationships via MAP transpired in the broader institutional context of the home organizations of MAP participants. Social learning about EG via MAP activities broadened the perspectives of many participants, who were motivated to change how their home organizations worked. Networking of individual participants thus became networking among organizations across the MAP frontier.

3.2.2.1. Influence of MAP Participants on Home Organizations. Multiple coordinators noted how MAP participants returned to their home institutions with new knowledge, perspectives and motivations with regard to EG. This linked the transboundary network of individuals to organizations, and thereby influenced the priorities of those organizations. MAP participants became aware of experiences in other places, or training and other opportunities to improve technical inputs into policy. That added value to those participants in their organizations, and in several cases they leveraged that value added to take on managerial or leadership roles.

In turn, leadership influenced by MAP experiences led to institutional change in those organizations concerning EG. The influence of MAP was most evident in the Government of Acre. One MAP participant wrote a thesis on the MAP Initiative, and in part due to her in-depth knowledge of the opportunities it presented, she later become the Chief of Staff to the Governor. In that role, she advanced innovative policies based on MAP recommendations, which we detail below (Section 3.2.4). Another MAP participant became a state representative in the Government of Acre; a third participant with a similar trajectory went on to become a federal representative of Acre. Other MAP participants went on to work in the Public Prosecutor's Office (*Ministerio Público*) of Acre. In all such cases, coordinators noted that those individuals cited the MAP Initiative as an influence on their visions for the role of government in EG in the region.

3.2.2.2. MAP participants and networking among organizations. Whereas MAP participants influenced their home institutions, those individuals also constituted links among organizations regarding EG. This occurred among peer governmental agencies working on similar issues in

different places, universities with personnel who provided training opportunities to government personnel, and NGOs who strengthened ties to community associations.

As MAP participants influenced their respective home organizations, others in their organizations saw benefits of networking about EG, which broadened the number of points of contact. Governments of neighboring municipalities strengthened their ties as they perceived shared interests from attending MAP events. Those ties broadened over time as more department directors and their technical staff recognized common concerns with neighboring governments. It is not a coincidence that inter-municipal consortia appeared on all three sides of the MAP frontier in the 2000s: CONDIAC (the Consortium for Development of the Upper Acre and Capixaba) in Acre, AMFROMAD (the Association of Frontier Municipalities of Madre de Dios), and the Tahuamanu Consortium in Pando. In each case, municipal consortia exchanged knowledge and strategies with regard to specific issues concerning EG.

The reach of networking due to the MAP Initiative also extended beyond the MAP frontier itself. In the Government of Acre, the Public Prosecutor's Office increasingly sought to work with peers in other states of Brazil and in Bolivia and Peru on EG. The Climate Change Institute regularly received visiting delegations from regional governments in different parts of Peru. Such visits have resulted in the formalization of working relationships on EG issues like responding to extreme climatic events and watershed management. Mini-MAPs have also impelled intergovernmental exchanges on EG, as in the cases of Risk Management and Watersheds. Transboundary networking from MAP is also evident in non-governmental exchanges relevant to EG, as in visits among community associations to compare agroforestry practices.

3.2.2.3. MAP participants switch organizations and change network structure. Over time, many MAP participants changed their home organization for various reasons. They thus took their network ties with them, which modified the way in which individual ties map onto organizational ties across the MAP frontier. Coordinators noted that over time, the tendency was for networks to expand in reach and become denser.

Insofar as MAP participants influenced their home organizations, when those individuals changed organizations, they increased the institutions touched by MAP. Such changes are especially noteworthy when MAP participants enter or leave government; having been on the "outside" and then moving to the "inside", and vice versa, offers an inter-institutional perspective with regard to EG. This supported EG insofar as former governmental personnel worked for NGOs, and vice versa, which broadened institutional understandings of the roles of different organizations in supporting EG. Adding this dimension to the international dimension of MAP gives such individuals a broader set of institutional contacts to align shared goals across multiple types of boundaries.

Whereas elections may change the interest groups in power, having MAP participants who have changed home institution is to have nodes in the transboundary network who can interpret government motives and more readily approach new regimes. This was especially valuable for sustaining collaborative activities for EG, particularly coordination among governments. For example, MAP participants with experience in diverse organizations were able to approach the new government in Pando, which had been suspicious of foreign interests. They influenced the government to adopt a more open perspective on transboundary EG issues like coordinating civil defense responses to extreme climatic events.

3.2.3. MAP and models of cross-border capacity building

MAP not only constituted a platform for democratizing access to knowledge, it also advanced models for capacity building to support EG. Here we note two such endeavors: one which increased the scale of knowledge exchange, and one which supported capacity building that MAP disseminated across the tri-national frontier.

The "knowledge exchange train" (KET) is an outreach model that expands the scale of dissemination of knowledge between researchers and communities (Mendoza, et al. 2007). The KET was developed out of Mini-MAP Highways and involved a group of MAP participants traveling together to various towns across the tri-national frontier to make stops for workshops to engage local peoples on issues of global importance and local concern, like road paving and EG. The KET thus brought the MAP Initiative to communities, which incorporated groups who had difficulty affording travel to MAP forums. KET workshops often prompted participants to take the knowledge they received and share it with others in their communities. KETs also allowed MAP participants to engage local governments and other organizations for downstream activities concerning EG, like municipal environmental planning (Mendoza, et al. 2014).

The MAP Initiative also "imported" innovative models for capacity building and disseminated them across the tri-national frontier. A prominent example is the "Children's Forest" (*Bosque de los Niños* in Spanish and *Floresta das Crianças* in Portuguese), developed by the Peruvian NGO, Association for Childhood and Environment (ANIA, 2020). The Children's Forest involves educational activities for children to learn about EG by engaging in the care and management of local ecosystems. The Bolivian NGO Herencia brought the Children's Forest to MAP, where it has since been implemented in communities on all three sides of the frontier. The Children's Forest model underscored the importance of citizenship, skills training, transmission of knowledge from children to parents, and supported broader discussions about environmental education for EG in MAP.

3.2.4. MAP and models of transboundary environmental governance

Some mini-MAPs went beyond knowledge dissemination by developing models of transboundary EG. A prominent example is the planning process developed by Mini-MAP Watersheds (Camargo et al., 2007). In light of droughts and floods, transboundary watershed governance became a priority in MAP forums, because several rivers in MAP cross national boundaries. The focus went to the Acre River, a tri-national watershed that originates in Madre de Dios and forms part of the Acre-Pando border before turning north into Acre.

Mini-MAP Watersheds brought together stakeholders from across the MAP frontier to pursue a planning process for EG of the Acre River watershed (Camargo et al., 2007). Conceptually, the focus went to integrated planning that incorporated maintenance of tree cover in riparian landscapes to "sow water" and thereby avoid floods and water scarcity. That provided a hydrological argument against deforestation to which regional populations could relate. Central to the planning process were several classic hallmarks of EG: the inclusion of diverse stakeholders, a highly participatory process, compilation of scientific data and local knowledge, identification of critical areas for conservation of vegetation cover and water sources, collective decision making about management practices, and direct engagement with governments in formalizing decisions about management and its implementation (Camargo et al., 2007).

Mini-MAP Watersheds thus included consortia of municipal governments (CONDIAC, AMFROMAD and the Tahuamanu Consortium) and regional governmental agencies, which permitted formal adoption of the planning model as policy. Via "MAP Consortium" projects (Section 3.2.6), Mini-MAP Watersheds produced management plans for sub-basins of the Acre watershed that were approved by local governments across the tri-national frontier and served as demonstrations of implementation of the planning model. This institutionalized the watershed management planning process as policy and led to scaling up of the planning model on higher administrative levels. Key participants in Mini-MAP Watersheds had entered the Government of Acre, including the State Secretariat of Environment (SEMA). Mini-MAP Watersheds led to creation of the Acre River Working Group (*Grupo de Trabalho do Rio Acre*), under the umbrella of the Technical Board for Transboundary Water Resources (*Câmara Técnica de Recursos Hídricos Transfronteiriços*), in turn part of the National Council of Water Resources (*Conselho Nacional de Recursos Hídricos*) (Pereira 2007). With those steps to formalize an inclusive administrative apparatus for EG of watersheds, the Government of Acre enshrined the watershed planning process in state policy (Governo do Acre 2012).

The MAP Initiative's watershed planning process became influential on larger administrative scales, and beyond the MAP frontier. A key MAP coordinator, who worked for SEMA, represented the MAP Initiative's participatory planning model to federal agencies in Brazil. In the Government of Brazil, the National Water Agency (ANA), Ministry of Foreign Relations, and the Brazilian Cooperation Agency officially recognized the MAP Initiative planning process for EG of transboundary watersheds. In 2014, the Amazon Cooperation Treaty Organization (ACTO), a pan-Amazonian entity that serves as a policy discussion forum for all of the national governments of countries sharing the Amazon basin, recognized the MAP watershed planning process as a model that should be adopted by all Amazonian countries (ACTO, 2014). In 2018, ANA and MAP participants were invited to attend the World Water Forum in Brasília, where the MAP watershed planning process was officially recognized as a model of EG to be emulated worldwide (Governo do Acre 2018).

3.2.5. MAP and joint governmental action

Mini-MAPs also facilitated joint action among government agencies across boundaries in the tri-national frontier for EG. Two prominent examples concern Mini-MAP Risk Management and Mini-MAP Agrarian Health. Major drought and flood events have transpired repeatedly in MAP since 2005 (Brown 2019; Brown and Ferreira 2015; Brown, et al. 2011). Beginning in 2006, civil defense authorities from across the frontier began holding meetings as Mini-MAP Risk Management to coordinate preparedness and thereby improve EG via emergency response to extreme climatic events. Consequently, governments signed cooperative agreements permitting joint actions during emergencies, including cross-border actions. Civil defense authorities held joint planning meetings for specific kinds of emergencies, and conducted simulations with communities to improve preparedness. They traveled together to establish weather and flood monitoring stations along the Acre River, to permit monitoring for purposes of warning communities in that watershed on all three sides of the frontier. Across the tri-national frontier, they shared rainfall and fire data from national governments, and circulated weather bulletins from regional NGOs conducting environmental monitoring. During extreme climatic events, they coordinated their operations, including transboundary cases where civil defense from one country could reach and rescue people across a border more quickly than their counterparts could.

The significant economic damage from fire and flood events broadened the participation of governmental agencies in the work of Mini-MAP Risk Management. Planning processes for extreme climatic

events and long-term climatic risks increasingly included national governmental agencies. In Bolivia, the Ministry of Environment and Water (MMAYA) exchanged information with Mini-MAP Risk Management about Pando. That led to coordination between Mini-MAP Risk Management and the Directorate of Water Resources within MMAYA. By the 2010 s, cross-border coordination of emergency response was institutionalized in MAP. Measures proposed by Mini-MAP Risk Management were accepted by governmental authorities and codified in written protocols for coordinated implementation by police, fire and civil defense. The coordination has continued ever since, and came to be seen as natural, precisely because it was effective.

Mini-MAP Agrarian Health worked via ties formed among governmental agencies to advance governance of communicable diseases among wildlife, livestock, crops and humans. Highway paving led to concerns that increased livestock husbandry in proximity to wildlife and transportation of animals across borders would lead to a rise in disease transmission. Local networks therefore emerged concerning rabies, hoof-and-mouth, and other diseases. By 2003, Mini-MAP Agrarian Health brought them together in meetings to support tri-national coordination. That attracted the attention of Ministries of Foreign Relations and other government agencies charged with enforcing sanitary standards to permit agricultural exports. The Government of Brazil was pushing to rid ranching areas of hoof-and-mouth disease to facilitate beef exports. The Institute for Defense of Agriculture and Forestry (IDAF) of the Government of Acre led a vaccination campaign, and supported its counterparts, the National Service of Agrarian Health (SENASA) of Peru and the National Agricultural Health Service (SENASAG) of Bolivia, who signed a cooperative agreement for coordinated action. These actions have made possible the control of hoof-and-mouth in the MAP frontier.

Other diseases involving wildlife and crops also posed threats, which led Mini-MAP Agrarian Health to broaden its work. One priority concerned aflatoxins that can spoil the nuts of the castanha tree (*Bertollethia excelsa*). This is a key non-timber forest product harvested for export, but only if contamination-free. Via Mini-MAP Agrarian Health, SENASA visits to Acre led to involvement of the Brazilian Agricultural Research Corporation (EMBRAPA) on aflatoxin prevention. As a result, governments established inspection posts at borders and harmonized their sanitary requirements, inspection procedures, and reporting on contaminated shipments.

Bats and other wildlife are known to carry rabies, which poses health threats to livestock and human populations. Mini-MAP Agrarian Health therefore compiled rabies cases across the MAP frontier to identify source locations and develop a prevention plan. They discovered that environmental changes induced by the highway modified wildlife movements, including across borders, which required a coordinated tri-national response. Mini-MAP Agrarian Health thus involved national agencies from the three countries to address rabies transmission along the highway corridor. Cooperative agreements followed to facilitate coordination of preventive measures. Mini-MAP Agrarian Health thus advanced transboundary EG by convening spaces for dialogue that permitted cross-border harmonization of sanitary practices.

3.2.6. MAP as generator of spinoff projects

MAP served as a "public think tank" (van Oosten 2004) where stakeholder deliberations generated proposals for projects with concrete activities and outcomes. MAP coordinators pointed to numerous projects catalyzed or influenced by MAP, directly or indirectly.

Prominent among the direct spinoffs were the "MAP Consortia," funded by the US Agency for International Development (USAID), initially under its Amazon Basin Conservation Initiative (ABCI) (USAID, 2006). USAID was among the donors who attended MAP forums and found value in MAP's model of transboundary EG (Perz 2015). The MAP Initiative thus influenced the design of the ABCI call for proposals, which incorporated the following MAP hallmarks: 1) collaboration among organizations in three or more Amazonian countries, 2) highly

participatory work with local stakeholders, and 3) a focus on deliberative processes for EG outcomes. MAP coordinators thus found themselves in an ideal position to submit a proposal, and were consequently awarded an agreement. That resulted in the G-MAP Consortium, consisting of university, NGO and governmental partners across the MAP frontier. Together, the partners advanced EG in the MAP frontier by training nearly 10,000 people in sustainable resource management, producing and supporting implementation of various types of management plans on roughly 2.4 million hectares, and supporting formulation and adoption of 27 policies, laws and regulations (Perz 2016). ABCI was followed by the Initiative for Conservation of the Andean Amazon (ICAA), and under ICAA II, the Madre de Dios (MDD) Consortium supported EG in MAP.

Another prominent project that directly resulted from MAP was "Ecominga", which supported capacity building of "eco-leaders" for "community eco-development" as a form of local EG (Rioja Ballivián, 2017). Ecominga focused on Pando, and it pursued capacity building models stemming from MAP. Ecominga personnel worked closely with local communities for members to engage in participatory dialogue to elect their eco-leaders. The eco-leaders received training in pedagogy and then returned to their communities to provide environmental education curricula.

There were also numerous projects in the tri-national frontier that were indirect results of the MAP Initiative. Here we mention a selection of such projects. The international NGOs who were repudiated by MAP stakeholders later adopted a more participatory consultative process germane to the MAP Initiative. The result was the Tri-national Amazon Project (PAT), which bore the hallmarks of the MAP Initiative in terms of its process, tri-national structure, and goals (Rioja Ballivián, 2015; SPDA, 2010; WWF-Peru, 2010). The Moore Foundation funded the Natural Capital Project, led by Stanford University (NatCap, 2020), which engaged participants from Mini-MAPs Risk Management and Watersheds to advance EG in transboundary watersheds. The Center for Amazon Scientific Innovation (CINCIA) project, led by Wake Forest University, works with regional institutions on issues of mercury contamination, landscape restoration and science communication (CINCIA, 2020). The MAP-MAC project funded by the MacArthur Foundation works on watershed resilience, and leveraged activities of Mini-MAP Watersheds to support MAP participation in the World Water Forum in Brasília in 2018.

3.2.7. MAP and sustainable business enterprises

The MAP Initiative also played a generative role in sustainable development initiatives via the private sector. In the economic development round table, there were multiple mini-MAPs that pursued business enterprises to grow a sustainable economy. Prominent among such enterprises was Mini-MAP Tourism. MAP forums brought together eco-tour operators and hospitality businesses from across the MAP frontier. In tri-national meetings, participating enterprises identified joint business opportunities. Brazilians following the Inter-Oceanic Highway passed thru the MAP frontier on their way to Cusco and other Peruvian tourist destinations. Eco-tour operators in Madre de Dios therefore coordinated with hotels and restaurants in Puerto Maldonado and tourism agencies in Brazil to offer tourist packages for international visitors. Participating enterprises thus formalized their network ties across boundaries via contractual relationships for commercial exchange. Consequently, Mini-MAP Tourism evolved from a working group into a transboundary sustainable business sector. Insofar as this business model promotes sustainable development by combining local incomes with environmental conservation, it constitutes a concrete private sector contribution of the MAP Initiative to transboundary EG.

There were other cases, like Mini-MAP Castanha, which organized tri-national meetings that brought together researchers, communities and buyers in the commodity chain to improve product quality and thereby reach export markets. In the 2000s, Mini-MAP Castanha worked with Mini-MAP Agrarian Health on the aflatoxin issue to support quality

control of product harvesting and processing, and thus ensure exports to the EU. Mini-MAP Castanha was reinvigorated in the 2010s by new MAP participants concerned about the aging castanha tree population and a significant drop in the castanha harvest in 2017.

4. Discussion

There are now many transboundary networks active in the Amazon, and in many other regions where multi-stakeholder EG is pursued. Recent work on transboundary networks in the Amazon highlighted the MAP Initiative among others, like the tri-national ACTO/CAF program in Colombia, Ecuador and Peru, and the Guiana Shield Initiative in Brazil, Colombia, Guyana, Suriname and French Guiana (Sguerra Castañeda et al., 2017). Other transboundary networks include the Amazon Network for Socio-environmental Information, which compiles geospatial data (RAISG, 2020), and the Amazon Dams Network, which distributes information about the negative impacts of dams to support grassroots resistance (ADN, 2020). All such networks merit systematic analysis of their contributions to EG. But few networks in the Amazon are as old as the MAP Initiative, which affords are more complete reflection on its legacy in terms of its participants, evolution, and outcomes.

Our first research question thus focused on how participation in a transboundary network can motivate collaboration across boundaries for EG. The findings showed that the MAP Initiative supported collaboration for EG by convening spaces for cross-border dialogues. MAP forums brought together diverse stakeholders with shared concerns, and they were able to exchange ideas and experiences, which supported social learning due to complementary knowledge and experiences. That in turn facilitated networking among organizations, and offered opportunities to participate in innovative models of capacity building. Those activities were viewed as beneficial to many participants, and influenced them, and through them their home institutions, with regard to their strategies for pursuing EG. MAP thus served as a platform for various forms of joint education among stakeholders from different places, including skills training, notably on skills unavailable in one's home town or home institution. Participants valued social learning and skills training, which motivated various forms of partnering, from coordination of activities to direct collaboration. Finally, MAP motivated collaboration by facilitating dialogues among practitioners and stakeholders that yielded proposals for concrete activities, while calling the attention of donors seeking to fund projects to implement those activities. This introduced new opportunities for action by participants, what with funding to support additional social learning as well as implementation of proposals, which together were seen as singularly valuable for EG. As a result, regardless of their country, training background or home institution, MAP participants came to view transboundary collaboration as highly beneficial for EG.

The second research question centered upon the ways in which the structures and strategies of transboundary networks may jointly evolve to increase their impact over time to advance EG. Our history of the MAP Initiative revealed various structural and strategic modifications that were consequential for the ways in which it pursued EG. Structurally, the MAP Initiative evolved by replicating the tri-national collaborative structure, first into each of four round tables, then into numerous mini-MAPs, then to various spinoff projects. Early on, the multiplying challenges in the MAP frontier prompted the structural modifications that produced mini-MAPs as network clusters in order to work on specific issues. As the challenges proliferated, so did the mini-MAPs. The increasing challenges also motivated growth in participation in the MAP Initiative, which sustained structural differentiation via the creation of the mini-MAPs. Somewhat later, funding opportunities and governmental overtures for policy recommendations led to institutionalization of mini-MAPs as spinoff projects with more vertical organizational elements to implement concrete activities. Such structural changes constitute examples of network flexibility, even when operating across

national boundaries, via the replication of tri-national collaborative structures via mini-MAPs and their subsequent institutionalization in tri-national spinoff projects. In both moments, structural changes were explicitly taken as strategic decisions to permit larger impacts of the MAP Initiative on EG in the tri-national frontier. The whole point of making the structural changes was to support modification of the strategy of the transboundary network to make it more effective in advancing EG. During the growth phase, new challenges prompted the emergence of mini-MAPs to work precisely on those challenges, broadening the range of problems the MAP Initiative could address, creating the conditions to produce more proposals for action, including institutional responses. During the institutionalization phase, funding and governmental policy opportunities led to spinoff projects designed precisely to address the challenges at hand, which supported development of policy recommendations and management plans that were often adopted and implemented. Structural differentiation in mini-MAPs and institutionalization in spinoff projects were thus jointly structural and strategic decisions, and together they constituted key changes that increased the MAP Initiative's impacts on EG. Via joint structural and strategic changes, the ways in which the MAP Initiative advanced EG thus evolved, from dialogues about shared concerns to mini-MAPs with proposals to spinoff projects to implement the proposals. Crucially, decisions to embark on structural and strategic changes were taken via deliberation in MAP forums and working group meetings. The evolution of MAP was thus eminently democratic, both during growth and institutionalization.

Our third research question concerned whether transboundary networks contribute to EG beyond information dissemination. The themes identified by MAP coordinators revealed a plethora of outcomes for EG, which begin with knowledge exchange but then ran well beyond to other results. The MAP Initiative generated participatory models of transboundary governance, which found application in various forms of management plans, and provided the legitimacy to promulgate policy proposals for adoption by governments, and led to coordinated governmental implementation via joint actions. Mini-MAPs were important for producing policy proposals for adoption by governments. Spinoff projects from mini-MAPs in turn developed those proposals and provided demonstrations of local implementation to show their value. Salient examples included mini-MAP Risk Management and emergency management plans, mini-MAP Watersheds and watershed management plans, and mini-MAP Agrarian Health and sanitation standards. In each of these cases, the policies and plans promulgated by mini-MAPs and spinoff projects were adopted in coordinated fashion by governments in multiple countries, and jointly implemented in their respective jurisdictions. In some cases, successful local implementation led to endorsement at higher levels of government for broader adoption beyond MAP. While policy adoption and implementation was the most visible concrete outcome of the MAP Initiative, mini-MAPs and spinoff projects yielded other concrete outcomes via capacity building for improved natural resource management, and management plans that were adopted by other stakeholders, such as communities. Finally, mini-MAPs catalyzed other concrete outcomes, notably sustainable businesses that spanned national boundaries, such as in the eco-tourism sector.

These findings provide evidence that transboundary networks contribute to EG in ways going beyond previous work. First, while previous work had shown that networks are an efficacious organizational form to address EG, it was less clear how transboundary networks operate across boundaries for EG. By unpacking the processes at work in MAP dialogue spaces, like social learning, we see more clearly how transboundary networks offer benefits to participants due to complementary knowledge and experiences despite the challenges to efforts to span divides. Such benefits motivate participation in capacity building, changes at home institutions, and formation of cross-boundary collaborative relationships, all of which support transboundary EG.

Second, while previous work on networks has advanced new

methods and generated insightful results concerning network evolution, there remained a need to go beyond purely structural approaches to network dynamics to consider how structural and strategic changes interrelate. It was thus important to clarify how exactly the joint evolution of structures and strategies might increase the impact of networks, especially transboundary networks, on EG. The history of the MAP Initiative revealed specific forms of structural changes that were decided via collective deliberation to differentiate the network into clusters of participants in the form of the mini-MAP working groups. That strategic differentiation in turn multiplied the capacity of the network to broaden the range of topics on which it could work, proposals it could produce, government agencies it could engage, and more, all for tri-national EG. Decisions made to structurally differentiate the network by multiplying tri-national clusters were explicitly taken as strategic pivots to respond to multiplying challenges.

Third, while previous work on networks often features their capacity to foster knowledge exchange, there has been less confirmation about other outcomes of networks for EG. The findings here pointed to a broad array of outcomes beyond information dissemination, up to and including policy adoption and implementation, even across national boundaries. What is more, the broader suite of outcomes applied trinationally in various policy sectors tied to distinct EG challenges (watersheds, climate, health) and on multiple scales (from the local to the international).

While the findings highlight achievements of the MAP Initiative and advance our understanding of the contributions of transboundary networks to EG, the results also bear implications concerning challenges to such networks in achieving their goals. One challenge with transboundary networks concerns their sustainability. As MAP evolved, it exhibited a trajectory of expansion but then decline alongside institutionalization. Following a period of rapid growth, there was a decline in activity among many mini-MAPs, and longer periods in between MAP forums. However, during that period of "decline", MAP generated some of its most significant EG outcomes, such as the watersheds planning policy, joint governmental action in emergency management, agreements on sanitary standards, and sustainable businesses. The key shift in the MAP network was thus toward fewer platforms that were more focused on concrete outcomes. That said, there also emerged the issue that the original MAP organizers were not being followed by a new generation. By the 2010s, MAP coordinators had become key personnel on large projects or in government agencies and other organizations, which limited the time they could dedicate to the network. Dissemination of knowledge as via KETs and publications did attract new participants, and many new participants attended recent MAP forums. But there remains the challenge of recruiting and supporting new network coordinators.

Another challenge is that against large-scale drivers of change, even transboundary networks struggle to respond on an adequate scale. Even as the MAP Initiative was tri-national, it was regional, and many change processes like road paving and deforestation reflected drivers operating on national or global scales. While the MAP Initiative produced recommendations for policies and plans, most such cases were regional. To impact processes with larger-scale drivers like deforestation and illegal gold mining, proposals had to be adopted by national governments for enforcement to have impacts. One response strategy would be to establish ties between regional networks to permit scaling up their reach and coordination. This could occur by ties between specific clusters focusing on shared issues. If regional transboundary networks can be scaled, then perhaps the impacts of such networks can be scaled up as well.

5. Epilogue: political turbulence, COVID, and the MAP initiative

Since 2018, the political context of the MAP frontier changed significantly. In Brazil, the election of far-right politician Jair Bolsonaro as president led to widespread replacement of agency heads and staff with military figures and other personnel hostile to environmental conservation and grassroots participation in EG. The Bolsonaro government then used COVID as a distraction to make numerous changes in federal conservation policy that threaten various environmental regulations and enforcement of environmental laws (Ferrantes and Fearnside, 2020; Vale, et al. 2021). In Peru, the "Lava Jato" scandal erupted in 2016, and involved Brazilian construction firms like Odebrecht who had bribed multiple Peruvian presidents to receive contracts for infrastructure projects, notably the Interoceanic Highway (Durand 2018; Pari 2017). The scandal provoked numerous investigations and widespread political fallout via impeachments, early elections and other political turbulence in Peru. This was compounded by the COVID crisis, which complicated efforts at EG. In Bolivia, the 2019 presidential election involved irregularities that shifted the results to favor President Evo Morales, which led to his exile from the country, followed by hotly contested elections at all levels. The COVID-19 pandemic greatly complicated the political context by impeding political participation via lockdowns and other virus containment measures. In the MAP frontier, COVID compounded other challenges like dengue and extreme climatic events. Active Mini-MAPs like Risk Management have continued to function, albeit via cell phone networks rather than in-person meetings. Planning for the MAP XI forum in 2020 was delayed due to COVID. The main effect of the political turbulence and COVID on the MAP Initiative has been to undermine the continuity between the transboundary network and its ties to government agencies. As with the need for the network to identify a new generation of leaders, rapid turnover in governmental personnel undermines collective memory and the continuity of relationships. This imposes challenges to the transboundary network in terms of its ability to convey proposals for policies and action plans to governments for implementation.

Author contributions

GRB and SGP conceived of the paper; all authors contributed to the findings; SGP led the writing; all authors participated in the internal review process; SGP wrote responses to reviewer comments and suggestions.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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