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Place-based solutions for global social-ecological dilemmas: An analysis of locally grounded, diversified, and cross-scalar initiatives in the Amazon

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ABSTRACT

The Amazon has a diverse array of social and environmental initiatives that adopt forest-based land-use practices to promote rural development and support local livelihoods. However, they are often insufficiently recognized as transformative pathways to sustainability and the factors that explain their success remain understudied. To address this gap, this paper proposes that local initiatives that pursue three particular pathways are more likely to generate improvements in social-ecological outcomes: (1) maintaining close connections with local grassroots, (2) pursuing diversity in productive activities performed and partnership choices, and (3) developing cross-scale collaborations. To test these ideas we collected and analyzed observations of 157 initiatives in Brazil and Peru, applying a combination of quantitative and qualitative analyses. Our results show that initiatives maintaining groundedness in representing the interests and concerns of local actors while partnering with other organizations at multiple scales are more likely to develop joint solutions to social-ecological problems. Partnerships and support from external organizations may strengthen and enhance local capabilities, providing a platform for negotiating interests and finding common ground. Such diversified pathways demonstrate the power of local actors to transcend their own territories and have broader impacts in sustainability objectives. Our findings highlight the need to make governmental and non-governmental support (e.g., financial, technical, political) available according to local needs to enable local initiatives' own ways of addressing global environmental change.

1. Introduction

The Amazon basin encompasses diverse, conflictive, and complex social-ecological systems. During the last 50 years, agro-pastoral frontiers, mining, illegal logging and oil extraction have driven deforestation and land concentration to alarming levels, predicted to push the world's largest tropical forest toward an irreversible loss of water cycle self-regulation (Sant'anna, 2016; Lovejoy and Nobre, 2019). This

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regional transformation has worldwide implications because Amazonian deforestation and degradation affect global greenhouse gas balances and represent an internationally-important biodiversity hotspot (Foley et al., 2005). Meanwhile, rural and indigenous organizations, social movements and networks have emerged throughout the region (Brondizio et al., 2021a). To address issues of quality of life, social injustice, and/or environmental impacts, they have promoted more equitable, fair and ecologically-sustainable economies across the region. Place-based in nature, these initiatives focus on myriad issues: rights and governance of land and resources, productive systems, value aggregation, cooperativism, gender inclusion, food security, health, and territorial governance - connecting social and ecological aspects of sustainability (Allegretti and Schmink, 2009; Russo Lopes et al., 2021). Increasingly, they play key roles in local and regional public goods, employment opportunities, tax revenues, public safety, and other governance tasks (Cytron, 2010; Healey, 2015; Igalla et al., 2019; Torfing et al., 2019). Likewise, place-based initiatives shape regional responses to global environmental challenges, for instance by promoting agroforest production that is less impacted by weather extremes or diversifying income sources.

In Amazonia, single, small-scale organizations engaging with different aspects of sustainability are up against tremendous challenges, especially when acting alone. Many factors affecting their success are beyond the influence of these local organizations. This may require place-based initiatives to build alliances and partnerships with other actors to help them achieve their goals. In this context, which decisions and actions help explain why some initiatives advance social-ecological sustainability outcomes more effectively than others? There is growing interest in factors that sustain, replicate, and amplify bottom-up sustainability-oriented initiatives (Bennett et al., 2016; Pereira et al. 2018; Scoones et al., 2020). Bottom-up initiatives can be replicated and amplified under appropriate conditions (Pereira et al., 2018; Lam et al., 2020), but they can also fail to develop or even disappear. For instance, an emerging literature highlights the importance and complexity of cross-scale interactions in hindering or enabling the transformative potential of interventions and bottom-up initiatives (Olsson et al., 2007; Abson et al., 2017; Herrfahrdt-Pähle et al., 2020).

Sustainability-oriented initiatives including social movements in the Brazilian Amazon became prominent in the late 1970s. They have proliferated since the 1992 Earth Summit with support from national and international investments and government programs promoting sustainable and inclusive development (Brondizio et al., 2021a). Thousands of varied pilot projects have endeavored to stimulate community timber and non-timber forest management, artisanal fishing, social-biodiversity production chains, organic and fair-trade certification, among many examples. While these initiatives continue to expand (Porto-Gonçalves, 2001; Brondízio et al., 2021b), systematic evaluation of their outcomes has been limited (Le Tourneau et al., 2013; Le Tourneau and Do Canto, 2019).

Drawing upon participatory research and a novel database, we ask how place-based initiatives can achieve their goals in such a conflictive and changing regional context. Which pathways overcome existing pressures while advancing and sustaining goals? In this study, we quantitatively and qualitatively analyze 157 initiatives working in over 900 localities and 182 municipalities in the Brazilian and Peruvian Amazon (Fig. 2) to examine how certain pathways influenced social-ecological outcomes (including amplification of impacts - see methods). We considered possible pathways from contextual factors, governance processes and practices, and studied outcomes as positive impacts on sustainability, terming them social-ecological outcomes, recognizing the intertwinedness of Amazonian social-ecological systems (Janssen and Ostrom, 2006). First, we examine whether bottom-up initiatives that have local grassroots actors leading their development are more likely to reach social-ecological outcomes. Second, we examine how engagement with a diversity of activities (i.e. production, market access, social organization), partnership strategies (other initiatives, governments, NGOs, funders), and scales of action/interactions (local, regional, national, international) affects their intended outcomes.

We operationalized these inquiries in two specific propositions about factors and pathways leading to positive sustainability outcomes from place-based initiatives:

(H1) Initiatives firmly grounded in local grassroots organizations

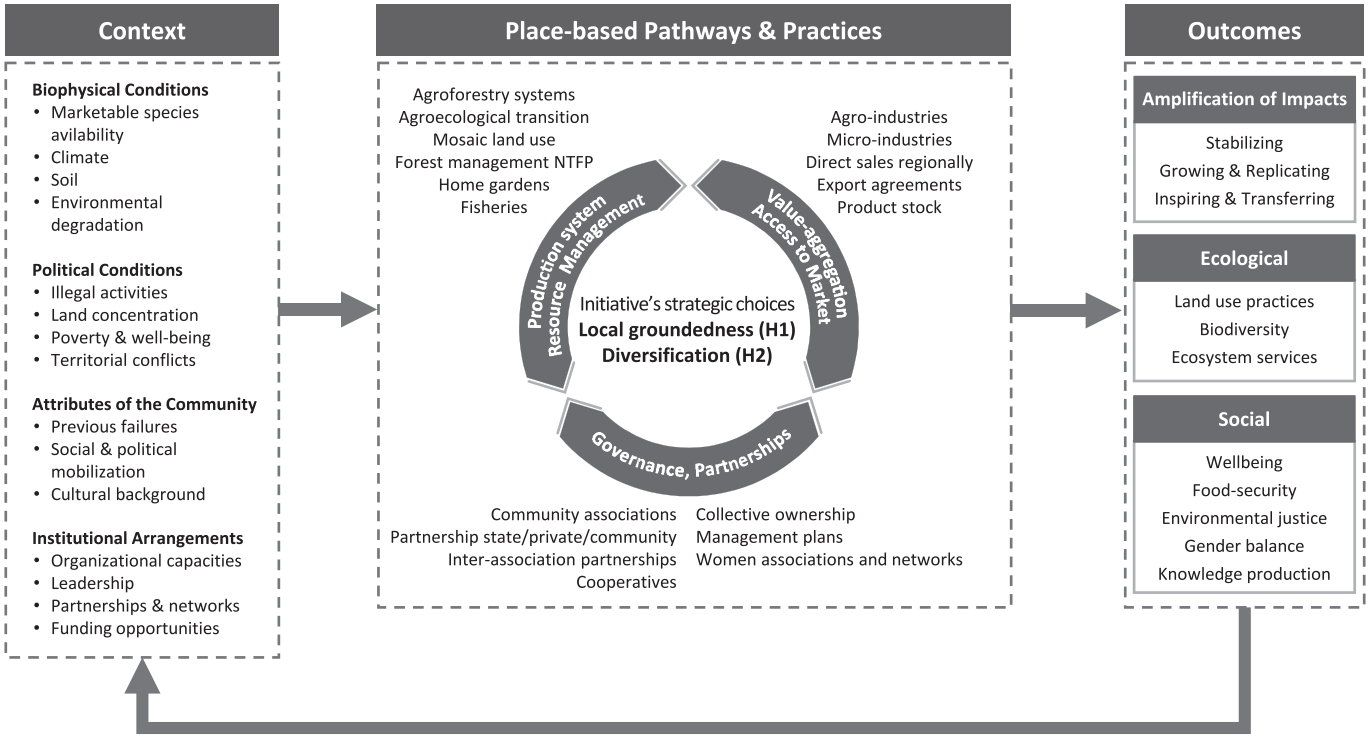

Fig. 1. Conceptual framework around our hypotheses and analyses.

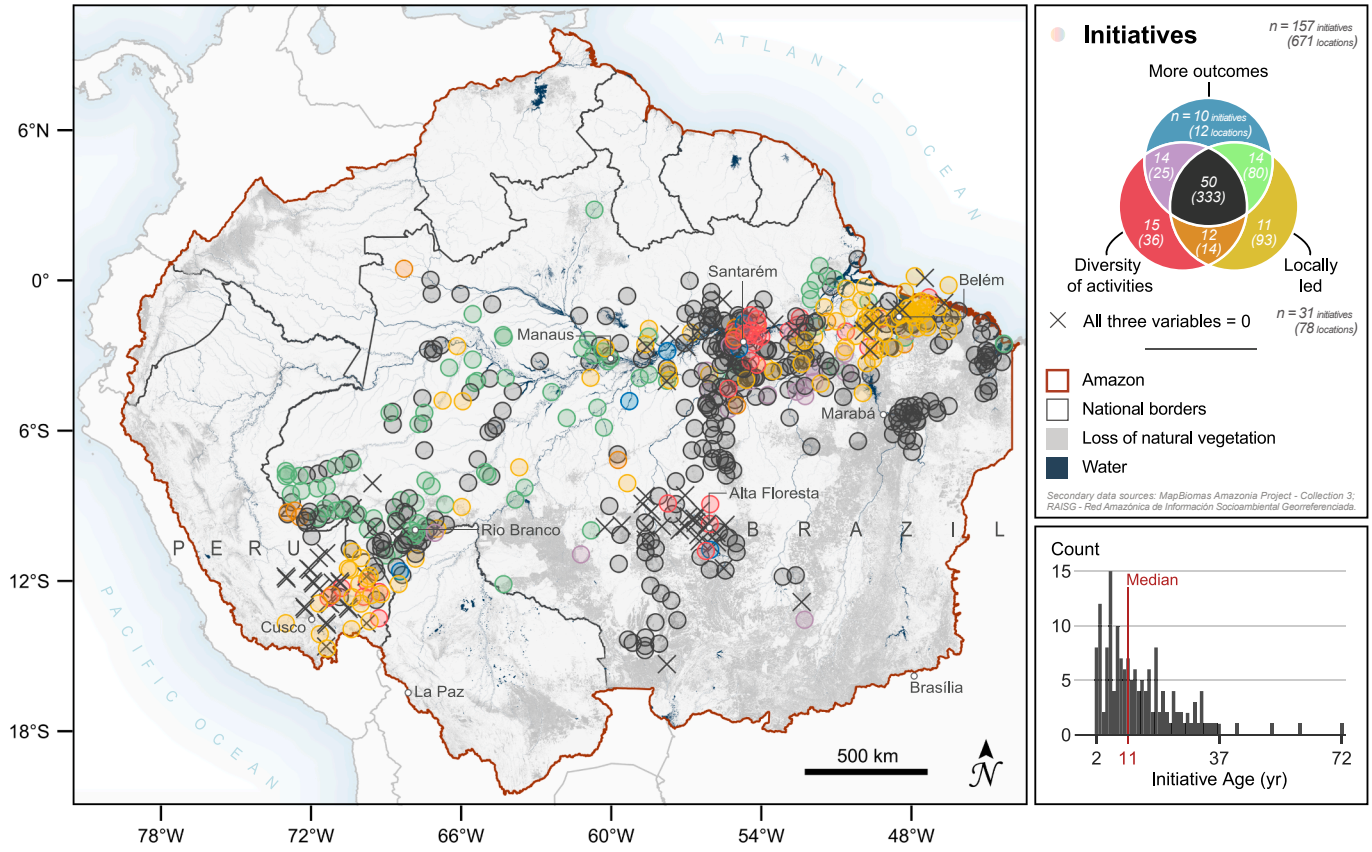

Fig. 2. Locations and features of initiatives used our analyses. Symbol colors broadly characterize initiatives as above or below the median value of three variables compiled from our database: (1) number of social-ecological outcomes, (2) number of activity types, and (3) local leadership. The lower-right panel shows the abundance of different initiative ages.

achieve more positive social-ecological outcomes.

(H2) Initiatives that pursue diversity in partnerships and funding, engage in multiple activities (e.g., food production, market engagement, social mobilization) and that connect with other initiatives and actors at multiple scales are more effective in achieving improved social-ecological outcomes.

This paper builds on the premise that emerging and evolving place-based initiatives are often overlooked but essential pathways toward the transformative change needed for Amazonian sustainability (Brondizio et al., 2021a). This study works toward an empirical understanding of how Amazonian place-based initiatives operate, the choices and pathways adopted to address social-ecological challenges, and how they matter for sustainability and wellbeing outcomes. The overall argument is that choices about activities, funding, partnerships, and market opportunities matter for social-ecological outcomes and for sustaining place-based initiatives over time. To analyze these hypotheses, the following sections outline the theoretical background underlying this discussion, followed by our data collection, statistical, and qualitative methods, quantitative results and illustrative cases. Finally, we discuss implications of our findings and analyze pathways and opportunities for place-based initiatives in Amazonia, and elsewhere.

2. Place-based initiatives and pathways to sustainability

The importance of particular places, their social-ecological context, and the lived experiences, agency, knowledge and rights of their different inhabitants are critical for understanding sustainability in many disciplines. Examples include land-system science (le Polain de Waroux et al., 2021; Switalski and Grêt-Regamey, 2021), political ecology (Adams et al., 2009; Bebbington et al., 2021), social-ecological systems research (Berkes et al., 2003; Cockburn et al., 2020; Martín-López et al., 2020), collective action and natural resource governance (Ostrom and Nagendra, 2006; Brondizio and Le Tourneau; 2016), and the emerging literature on transformations toward sustainability (Caniglia et al., 2020; Herrfahrdt-Pähle et al., 2020; Chambers et al., 2022; Fisher et al., 2022; Raj et al., 2022). These literatures exemplify how locally-grounded collective action and social movements create and shape pathways for sustainability.

Although there is no generally-accepted definition of 'place-based initiative', common elements include activities conducted on the ground and circumscribed to particular geographical locations (Gilbert, 2012) and the ability to deal with complex and intertwining social-ecological systems (Pisters et al., 2019). In contrast to local or jurisdictional initiatives, 'place-based' emphasizes the notion of bottom-up community-led endeavors attached to their specific territories but able to access and articulate broader networks of partnerships at regional, national and international levels that transcend their own localized activities (see Brondizio et al., 2021). This concept has been applied to analyses from watershed-management institutions (Cantrill, 2012) and indigenous justice movements (Gilbert, 2012), to organizations, associations and cooperatives (see Brondizio et al., 2021a; 2021b). Related concepts are community-based natural resource management (Agrawal and Gibson, 2001; Brosius et al., 2005), landscape or environmental stewardship (Bieling and Plieninger, 2017), social movements, and grassroots innovations (Raj et al., 2022).

Here, we adopt the definition of place-based initiatives from Brondizio et al. (2021a), "actions by on-the-ground actors who have ownership (and take the risks) in implementing ideas and actions, even if the initiatives are externally initiated and supported." We focus specifically on Amazonian rural initiatives, including smallholder and

grassroots actors, promoting changes in institutions, productive systems, and access to markets to improve living standards and environmental sustainability. Previous studies have analyzed the roles of place-based initiatives to develop ecological consciousness, human ability for compassion and creative living (Pisters et al., 2019), opportunities and risks of more environmentally-benign practices (Cantrill, 2012), social and political impacts on their communities (Backer and Kern, 2010), the context of their establishment (Cytron, 2010; Brondizio et al., 2021a) and their alignment across institutions (Cytron, 2010). Our database expands systematic knowledge of initiatives' main work practices and strategies in Amazonia. Therefore, this paper contributes to these literatures and conceptualizations (Table 1) by systematically testing how two frequently-mentioned factors, local groundedness and cross-scalar diversification, affect initiative success, with a large original sample.

H1 (that locally-grounded initiatives perform better) stems from the idea that knowledge, capacity and autonomy tied to local contexts (in contrast to top-down projects) are key to social-environmental solutions (see also Lawrence, 2006). Such groundedness also promotes experimentation and innovation (Mulgan, 2012). One of the main motivators behind H1 is that active involvement of members creates a sense of ownership, facilitating accountability and transparency of the implemented activities (Smith and Seyfang, 2010; Hargreaves et al., 2013; Maschkowski et al., 2017; Smith et al., 2017). In addition, local knowledge, values, visions and needs may inform the design and facilitate interventions' success (Smith and Stirling, 2016). Top-down sustainability projects may stumble when a one-size-fits-all approach or lack of ownership necessitates increased monitoring (Hoefle, 2000; Rodriguez-Ward et al., 2018). In contrast, locally-grounded bottom-up initiatives seek community involvement in management of associated outcomes (Danielsen et al., 2009; Commodore et al., 2017).

Table 1
Explanations and definitions of some key concepts.

Processes	Repeated interactions with other individuals and natural resources. When individuals agree to act collectively and make decisions for the group, then the group is involved in a governance process.
Governance processes	The creation and enforcement of socially-binding agreements among members of a group.
Practices	What is allowed, encouraged, or prohibited, by particular governance practices and the consequences are for not respecting these agreements.
Pathways	Causal processes encompassing one or more strategies and/or governance processes, linking multiple causal factors to social-ecological outcomes.
Local groundedness (H1)	Involvement of local grassroots in the design, implementation, development, establishment, innovation, or knowledge sharing of a given place-based initiative. Here, we operationalized local groundedness by whether the initiative was created, designed, co-designed or implemented by grassroots actors, as well as implementation of productive activities based on traditional knowledge and values (more details about index variables in Table 2).
Cross-scalar diversification (H2)	The diversification of intersectoral connections among local, regional, national or international scales, and diversification of productive activities (i.e., NTFPs, agroforestry systems, forest management, fisheries) and strategies (i.e., governance, commercialization, political articulation, gender inclusion).
Social-ecological outcomes (response variable)	The results of a given pathway for a group's social relations, well-being and environmental soundness in its surrounding territory.
Amplification of impacts (response variable)	The transformative change derived from the initiatives' actions. We used the Lam et al. (2020) typology that includes: amplification within (stabilization overtime/speeding up), amplification out (growing/replicating the same initiative or transferring/spreading similar initiative), and amplification beyond (changing rules and values).

H2 (that initiatives with cross-scalar diversity perform better) posits that achieving sustainable development outcomes requires substantial knowledge about many factors that mediate and regulate people's interactions with one another and their natural environments (Andersson, 2004; Andersson and Ostrom, 2008). A diversity of resources (human, financial, physical infrastructure) may also help implement local initiatives' development visions. In addition, locally-grounded initiatives depend on activities and institutions at other levels of governance, creating a need for connections at local to international scales (Brondízio et al., 2021b). Decision making around land-ownership regimes, funding, etc. are nested at different levels. Thus, success will require awareness and action on issues at different scales than the initiative operates at (Olsson et al., 2007). Local organizations rarely have all required resources in house. To access all assets needed for successful outcomes (expertise, skills, and financial resources), local organizations often partner with external organizations having complementary skills and resources (Newman et al., 2008; Dale et al., 2010; Ernstson et al., 2010; Somerville and McElwee, 2011). We expect that place-based initiatives linked with a variety of partner types (e.g. governmental, non-governmental, research, etc.) at multiple scales are more likely to achieve positive sustainable development because they have access to more resources and support to expand or strengthen their activities (Brondizio et al., 2009). Furthermore, we expect that initiatives engaged in multiple strategies (e.g commercialization, social issues) and dimensions of sustainability (ecological, social, economic, cultural) are well positioned to evolve, adapt, and stay relevant amid changing external conditions, ultimately achieving more robust social-ecological outcomes.

These factors do not operate in a vacuum, but form complex feedback loops. In our conceptual framework (Fig. 1), local groundedness (H1) and diversification (H2) are foundational to successful outcomes. Initiatives develop their knowledge, skills and social capital, creating and solidifying partnerships and connections across sectors and scales (H2). Meanwhile, grassroots actors generally face multiple barriers (institutional, political, organizational, market chains) to success on one front, which leads them to multi-specialize around governance, production systems and market arrangements. These solutions are ultimately the social-ecological outcomes. This systemic and operational learning process amplifies impacts, allowing initiatives to stabilize over time, grow, complexify, replicate in different places, inspire similar initiatives (transferring/spreading) and even influence formal legislation at different jurisdictional levels (cf. Lam et al., 2020). Together, these phases create opportunities for the further development of place-based initiatives (Fig. 1).

3. Methods

3.1. Data collection and resulting database

We identified Amazonian place-based initiatives through dialogue with local and regional actors. Such actors were selected with help of key informants in our networks. These people helped select further actors, focusing on local leaders, smallholders and traditional populations in rural areas, seeking to ensure a gender and generational balance whenever possible. Ethical procedures were approved by data collectors' universities, including the State University of Campinas, Indiana

University, and the University of Amsterdam.

We used quantitative analyses and qualitative case studies to test our hypotheses. Both components rely on a database of 157 initiatives in the Amazon region collected through the following mixed-methods approach. First, during exploratory fieldwork in 2019 in Acre, Rondônia, Mato Grosso and Pará we interviewed dozens of key stakeholders from academia, public sector, private sector, civil society and local communities (e.g., indigenous, quilombolas, rubber tappers, family farmers). In 2019 we also held local participatory workshops with leaders of local communities in Belém and Santarém (Pará) and Rio Branco (Acre). Some identified initiatives were followed up with field visits, internet-based research (websites, news, reports and articles) and calls with initiative leaders. Under Covid-19 restrictions, in 2020–2021 we conducted online workshops and phone interviews with stakeholders from Pará (Brazil) and Madre De Dios (Peru). Third, we used publicly-available information to fill data gaps, such as initiatives' date of foundation, financing sources, leading members, and geographical scope. Detailed information about the variables can be found in Tables 1 and S1.

Initiatives were included based on their intended scope and recognition by consulted local actors as aiming for positive environmental and social transformations at different scales. This happened primarily in the workshops but initiatives repeatedly mentioned during field visits were also included. Initiatives where detailed information could not be found through web search or interviews were removed. The final sample indicates the breadth of initiatives happening today in the region (Fig. 2). Nearly half of the initiatives are on community or private lands, ~18% in communities within protected areas, ~15% in Indigenous or Quilombola (Afro-Brazilian) lands, and ~17% in rural settlements. Most engage in multiple varied activities (e.g., production, commercialization, social organization and political contestation), so we avoid grouping initiatives into categories. Initiatives average 14.5 years old (range 2–72 yrs.; Fig. 2), operational scales ranged from municipal to multistate, 58% of the initiatives were locally founded or led, and 85% received external funding. The average initiative engaged in 12 out of 28 possible production, market or governance arrangements and involved 5.7 out of 14 different stakeholder types (Table 2).

Our open-ended and participatory approach has certain advantages and disadvantages. It included numerous variables on diverse concerns while avoiding pre-determined ideas of sustainability and pathways for change potentially disconnected from local priorities (Jiménez-Aceituno et al., 2020). This information allows quantitative analysis of our research questions and theoretical propositions. Because systematic records on place-based initiatives in the region are lacking, the initiatives are not a randomized sample. Thus, our analyses do not (and cannot) seek to characterize Amazonian place-based initiatives, but rather seek inferences about relationships among variables of theoretical interest in explaining such initiatives' relative success.

3.2. Variables used in the analysis

To test our hypotheses, we first had to distill two practical outcome variables from our database. The first summed the total of twelve potential transformative social-ecological outcomes (Tables 1, S1) from each initiative (Tables 1, S1). The second counted the five potential types of amplification (see Lam et al., 2020): 1) amplifying within, stabilizing an initiative (establishing over time); amplifying out, either 2) growing or replicating the initiative elsewhere, i.e. connecting additional communities to a co-op, or 3) transferring or spreading a similar initiative elsewhere, i.e. starting a new co-op inspired by but independent from the original; amplifying beyond, either 4) scaling up, changing rules or practices at higher institutional levels, or 5) scaling deep, changing fundamental values, e.g. the role of women in farming (Table S1). Because the social-ecological and amplification indices were strongly positively correlated ($r^2 = 0.296$; $p = 6.1*10^{-14}$), we summed them into a single outcome index for our analyses. We also tested the

Table 2
Control, outcome and predictor variables used in this analysis. Most of these variables are composite indices of individual binary variables from the database (see Table S1).

Variable	Description	Use	Range	Mean
Initiative age (yr)	Age in years of the initiative as of 2021	Control	2–72 years	14.47
Scale	Geographical scale of the initiative	Control	Categorical:	
			(A) Municipal	0.46
			(B) State	0.36
			(C) Multi-state	0.18
Country	Country of the initiative	Control	Categorical	
			(A) Brazil	0.83
			(B) Peru	0.17
Outcomes (#)	The total number of transformative outcomes including transformative and amplification outcomes	Outcome for H1 and H2	1–17	9.37
Land rights	Does the initiative improve land rights?	Outcome for H2	Binary 0/1	0.32
Market access	Does the initiative improve market access?	Outcome for H2	Binary 0/1	0.54
Local stakeholder types (#)	Number of local stakeholder types	Predictor for H1	0–4	2.07
Local funding	Does the initiative have local funding sources?	Predictor for H1	Binary 0/1	0.52
Co-designed	Is the initiative co-designed?	Predictor for H1	Binary 0/1	0.72
Community-based	Is the initiative a community-based organization?	Predictor for H1	Binary 0/1	0.77
Locally led	Is the initiative locally founded or led?	Predictor for H1	Binary 0/1	0.58
NTFP	Does the initiative involve non-timber forest products?	Predictor for H1	Binary 0/1	0.48
Medicinal plants	Does the initiative involve medicinal plants?	Predictor for H1	Binary 0/1	0.21
Honey production	Does the initiative involve honey production?	Predictor for H1	Binary 0/1	0.18
Indigenous org.	Is the initiative an indigenous organization?	Predictor for H1	Binary 0/1	0.33
Retro innovation	Does the initiative build on retro innovation?	Predictor for H1	Binary 0/1	0.55
External funding	Does the initiative receive external funding?	Predictor for H2	Binary 0/1	0.85
Activities (#)	How many types of activities is the initiative engaged in?	Predictor for H2	0–28	12.20
Stakeholder types (#)	Number of stakeholder types	Predictor for H2	0–14	5.69
Funding types (#)	The total number of funding types the initiative receives	Predictor for H2	0–9	4.06
Stakeholder scales (#)	Number of stakeholder scales	Predictor for H2	0–3	2.27
Funding scales (#)	Number of scales of funding that an initiative has	Predictor for H2	0–3	1.63
Network	Does the initiative engage with a network (group of organizations that act on common purposes and agendas)?	Predictor for H2	Binary 0/1	0.43

relationships between the various hypothesized predictors and individual outcomes. Except where notable patterns were seen, these results are reported in the supplement.

These aggregate outcome variables carry certain drawbacks. First, they are mostly on self-reported. While independent verification of biophysical outcomes would be ideal, these initiatives have scattered and imprecisely-known realms of influence. Thus, our biophysical outcome information is likely less heterogeneous and more precise than remote sensing or expert evaluation of outcomes (Nagendra and Ostrom, 2011; Salk et al., 2020). Second, the indices may reflect the size of an initiative rather than its effectiveness. If larger initiatives have sufficient resources to address many issues, they would thus likely show a larger number of transformative outcomes and amplification types. As a control for initiative size, we used a geographical scale variable (single municipality, two or more municipalities within one state, or multi-state). Further, we repeated many of our analyses with only single-municipality initiatives to verify whether the results hold within a single geographical scale. Similarly, how long an initiative has been working may affect how many outcomes it has achieved, for which we computed the age of each initiative at data collection (2021) as a control variable.

3.3. Analytical methods

To test H1 (that locally-grounded and -led initiatives achieve more social-ecological outcomes), we used several outcome variables, including the number of local stakeholder types (see Table S1 and SI25-codebook for detailed explanations of this and following variables). Similarly, we used a count of local funding types used by an initiative, plus several stand-alone variables as measures of local groundedness. These were Co-design, Community organization, Non-timber Forest Product NTFP, Medicinal plants, Honey production, Indigenous organization and Retro-innovation, which means reconfiguring traditional knowledge and expertise for new purposes (Zagata et al. 2020; Kilis et al., 2022). In all cases, we used the total outcome types as the response variable and included initiative age and spatial scale as control variables.

To test H2 (that initiatives with diverse partnerships, funding sources and activities achieve more social-ecological outcomes), we used variables reflecting several facets of this process rather than a composite index to understand specific beneficial initiative features (Table 2). These were: presence of external funding, number of different activities of an initiative, the total number of stakeholder types and the total number of funding types. To test whether initiatives that connect scales have more social-ecological outcomes, we used the number of stakeholder scales, and the number of funding scales along with the initiative age and scale control variables (Table S1).

To assess H1 and H2 we used ordinary least squares regression with heteroskedasticity-robust standard errors on counts of outcome types which were approximately normally distributed (See SM Fig. S2). When re-run using Poisson regression, the results showed no substantial differences. We also used logistic models to estimate associations with binary dependent variables (i.e., improving market rights). We tested different specifications to assess the sensitivity of our estimates to our analytical choices. We first checked the impacts of our decision to include the initiative age and scale as controls (Table S23). We also tested regressing our outcomes on all the predictors in the same model (Table S24).

4. Results

Our hypotheses were broadly supported by the specific analyses. Only a few specific predictor variables were not found to have significant positive relationships with outcome indices. Further, these results were robust to inclusion or exclusion of control variables, and were consistent within a single geographical scale. After discussing these quantitative findings in more detail they are explored qualitatively in case studies chosen to examine the implications of the hypotheses on the ground via more detailed field observations. These qualitative cases were a subset of the wider database chosen for being successful (number of transformative outcomes between 9 and 12 out of 12), but being from widely-separated areas, involving different sorts of stakeholders, and being of different ages (range: 8–32 years).

4.1. Hypothesis 1 (locally-grounded and -led initiatives achieve better social-ecological outcomes)

The number of total outcomes was significantly positively related to the number of local stakeholder types involved in the initiative (Tables 3, S2). However, having local funding did not significantly increase the total number of reported initiative outcomes (Tables 3, S3), but co-design features (Tables 3, S4), community-based organizations (Tables 3, S5), and local initiation or leadership (Tables 3, S6) all saw significantly more social-ecological outcomes. Similar outcomes were observed in initiatives for cultivation and use of natural products based on local/indigenous knowledge, including non-timber forest products (Tables 4, S7), medicinal plants (Tables 4, S8), and honey (Tables 4, S9). Interestingly, indigenous organizations did not show a significantly higher number of social-ecological outcomes (Tables 4, S10); this is due to frequent success of non-indigenous initiatives and possibly also that relatively few indigenous organizations were sampled. Finally, initiatives using retro-innovation also saw significantly more total outcomes (Tables 4, S11). These patterns were broadly similar for all variables when only single-municipality initiatives were analyzed.

4.2. Hypothesis 2 (initiatives with diverse partnerships, funding sources and activities, and that connect scales have better social-ecological outcomes)

Many successful initiatives do not have external funding. Externally-funded initiatives had slightly (and insignificantly) fewer total outcomes relative to initiatives without external funding (Tables 5, S12). However, initiatives involving more stakeholder types showed significantly more total outcomes (Tables 5, S14), as did initiatives engaged in more types of activities (Tables 5, S13) and more types of funding sources (Tables 5, S15).

Initiatives involving more stakeholder scales had significantly more total outcomes. However, controlling for initiative scale reduced the significance of the number of stakeholder scales variable (Tables 6, S16). The number of scales of funding was also significantly positively related to the total number of outcomes (Tables 7, S17). We found a positive and significant average marginal effect of the number of stakeholders on improving market access (Tables 7, S21). However, evidence was inconclusive on the impact of the number of stakeholders and funding scales on improving land rights and the number of funding scales on improving market access (Tables 7, S19, S20, S22).

In general, the control variables had a big impact on the number of self-reported outcomes (with significantly fewer in single-municipality than multi-municipality or –state initiatives; ANOVA, $F_2 = 15.73$, $p = 5.81*10^{-7}$; Tukey's HSD, $p \leq 0.0001$; Tables 3–7). However, scale had a minimal impact on the parameter estimates of predictor variables (Table S23). Similarly, older initiatives had significantly more total outcomes ($r^2 = 0.108$, $p < 0.0001$. Fig. S1) as did Peruvian initiatives compared to Brazilian initiatives. Most of the parameter estimates did not change significance with controls included (Table S23). Only seven changed, five from significant to insignificant, meaning the controls make our results more conservative (Table S23).

4.3. Case studies

Because the quantitative analyses are correlational it is not possible to determine causal direction. Thus, other information is needed to

Table 3
Regression models associating social-ecological outcomes to different predictors related to grassroots stakeholder involvement in initiatives.

Dependent Var.:	Outcomes achieved (#)				
	Local stakeholder types (#)	Local funding	Co-designed	Community-based	Locally led
Predictor of interest	**1.282*** **	**0.4561**	**2.160*** **	**3.342*** **	**2.556*** **
	(0.2417)	**(0.5685)**	**(0.6228)**	**(0.6000)**	**(0.6315)**
Initiative age (yr)	0.0537	0.0622	0.0593*	0.0520	0.0470
	(0.0279)	(0.0328)	(0.0298)	(0.0297)	(0.0309)
Scale (reference: Multi-state)					
Municipal	−1.413*	−2.097**	−1.940**	−2.044**	−2.936***
	(0.7154)	(0.8008)	(0.7385)	(0.7752)	(0.8192)
State	0.2505	0.5519	0.4354	0.2517	−0.2454
	(0.7403)	(0.8205)	(0.7755)	(0.7931)	(0.8421)
Country (reference: Brazil)					
Peru	−3.212***	−4.292***	−4.119***	−3.660***	−3.180***
	(0.7409)	(0.7811)	(0.7171)	(0.6923)	(0.7474)
(Intercept)	7.049***	9.733***	8.399***	7.519***	9.189***
	(0.9485)	(0.9807)	(0.9357)	(1.024)	(0.9071)
Observations	157	157	157	157	157
Adj. R^2	0.43923	0.33670	0.38444	0.43548	0.40477

Notes: Standard errors are heteroskedasticity robust. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Table 4
Regression models associating social-ecological outcomes to different predictors related to engagement in activities based on local and/or indigenous knowledge.

Dependent Var.:	Outcomes achieved (#)				
	NTFP	Medicinal plants	Honey production	Indigenous org.	Retro-innovation
Predictor of interest	**2.648*** **	**3.252*** **	**1.871** **	**0.3132**	**2.481*** **
	(0.5331)	**(0.5580)**	**(0.6765)**	**(0.6207)**	**(0.5537)**
Initiative age (yr)	0.0718*	0.0568*	0.0683*	0.0651*	0.0717*
	(0.0354)	(0.0280)	(0.0317)	(0.0328)	(0.0360)
Scale (reference: Multi-state)					
Municipal	−2.495**	−2.143**	−2.082*	−1.985*	−2.145**
	(0.7817)	(0.7385)	(0.8267)	(0.8341)	(0.7638)
State	0.2693	0.1745	0.3323	0.6059	0.1613
	(0.8045)	(0.7686)	(0.8616)	(0.8302)	(0.7956)
Country (reference: Brazil)					
Peru	−3.483***	−4.507***	−4.012***	−4.434***	−3.864***
	(0.7629)	(0.7454)	(0.7991)	(0.8262)	(0.7450)
(Intercept)	8.712***	9.559***	9.574***	9.781***	8.547***
	(1.016)	(0.8657)	(0.9857)	(1.006)	(1.012)
Observations	157	157	157	157	157
Adj. R^2	0.42540	0.42982	0.36085	0.33500	0.41476

Notes: Standard errors are heteroskedasticity robust. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

demonstrate whether initiatives are effective because they have more diverse partnerships and funders or if they attract these partners because they are successful. Here, we analyze qualitative case studies to illuminate why place-based initiatives that choose to diversify their partnerships and funding sources might be more likely to report progress on sustainability outcomes.

Case 1: Cofruta

This locally-initiated agricultural cooperative is in Abaetetuba, a municipality in the Amazon estuary in Pará state, with rich cultural and biological diversity and history of grassroots social movements. In this context, Cofruta has been contributing to social-ecological outcomes. In the early 1990s, island and inland family producers created an association with over 600 members through the Rural Workers' Union to finance family production of wild and domesticated tree fruits, açaí management and agroforestry systems.

The initiative was successful, with abundant harvests, but no market to sell them in. After several meetings, they collectively rented a truck and transported part of their production (mostly açaí) to the state capital Belem's biggest market, the famous "Ver-o-Peso". There, they rapidly sold the products, and contacted potential buyers including a representative of CAMTA, a well-established producers' cooperative. This relationship evolved and inspired their own cooperative.

During the early 2000s, Cofruta used non-repayable financing sources to expand (including municipal, state, and federal funding, plus some international funds from Japan and Belgium), and by constructing a growing network of partnerships (buyers and supporters). This network grew from their participation in national fairs of small rural producers, organized by the Workers Party governments, and international organic fairs and support by NGOs such as FASE, who aided their networking efforts.

Currently, Cofruta has about 90 members. They carefully maintain a diversity of strategies. Each main product has a separate factory unit: (1) processed açaí, (2) fruit pulp and (3) native tree-seed oils. According to the cooperative's president, they generate considerable income from seed oils, which come from the most diverse agroforestry systems. They sell their products to multiple buyers, locally, nationally and internationally, avoiding buyers who ask Cofruta to sell a product exclusively to them.

Ecologically, Cofruta incentivized a transition to agroforestry in different ecoregions (islands, floodplains and inland), replacing annual monoculture crops. Forest cover grew, enhancing landscape-scale biological diversity and environmental services. Socially, incomes

Table 5
Regression models associating social-ecological outcomes to different predictors related to the diversity of partnerships, funding sources, and activities.

Dependent Var.:	Outcomes achieved (#)			
	External funding	Activities (#)	Stakeholder Types (#)	Funding Types (#)
Predictor of interest	**−0.1737**	**0.3890*** **	**0.5925*** **	**0.2817***
	(0.7644)	**(0.0314)**	**(0.0834)**	**(0.1088)**
Initiative age (yr)	0.0658*	0.0669*	0.0200	0.0477
	(0.0332)	(0.0308)	(0.0302)	(0.0320)
Scale (reference: Multi-state)				
Municipal	−2.049*	−1.104	−0.6962	−1.824*
	(0.8137)	(0.6844)	(0.6569)	(0.7971)
State	0.5650	0.4809	0.9357	0.7670
	(0.8224)	(0.6936)	(0.6607)	(0.8235)
Country (reference: Brazil)				
Peru	−4.314***	−3.005***	−3.464***	−4.233***
	(0.7780)	(0.6839)	(0.7478)	(0.7823)
(Intercept)	10.05***	4.508***	6.287***	8.827***
	(1.114)	(0.9625)	(0.8577)	(1.051)
Observations	157	157	157	157
Adj. R^2	0.33411	0.61795	0.45841	0.36013

Notes: Standard errors are heteroskedasticity robust. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Table 6
Regression models associating social-ecological outcomes and partnership scales to different predictors related to the diversity in scales of partnerships, funding sources, and networks.

Dependent Var.:	Outcomes achieved (#)		Stakeholder scales (#)
	Stakeholder scales (#)	Funding scales (#)	Network
Predictor of interest	**0.8111***	**0.6825***	**0.0354**
	(0.3773)	**(0.2959)**	**(0.1296)**
Initiative age (yr)	0.0594	0.0479	0.0073
	(0.0333)	(0.0329)	(0.0057)
Scale (reference: Multi-state)			
Municipal	−1.576	−2.117**	−0.5917**
	(0.8052)	(0.7902)	(0.1904)
State	0.6012	0.4280	−0.0439
	(0.8048)	(0.8210)	(0.1692)
Country (reference: Brazil)			
Peru	−4.341***	−4.123***	0.0167
	(0.7544)	(0.7755)	(0.1678)
(Intercept)	7.925***	9.090***	2.430***
	(1.356)	(1.036)	(0.2341)
Observations	157	157	157
Adj. R^2	0.35199	0.35407	0.13501

Notes: Standard errors are heteroskedasticity robust. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

increased and marginalized rural workers were empowered and more visible in a context of uneven and resource distribution and displacement of local communities for multinational megaprojects. Producers' food security increased and municipal school meals gained healthy locally-produced food. Local capacity grew, enhancing local governance, organization, transparency and profit sharing. These outcomes far surpassed the original goal of market access, as grassroots actors built partnerships and sustained a local producers' cooperative that achieved multiple social-ecological outcomes.

Table 7
Logistic regression models associating land rights and market access outcomes to diversity in scales of partnerships and funding sources.

Dependent Var.:	Land rights		Market access	
	Stakeholder scales (#)	Funding scales (#)	Stakeholder scales (#)	Funding scales (#)
Predictor of interest	**0.038**	**0.019**	**0.108** *	**0.063**
	(0.049)	**(0.036)**	**(0.052)**	**(0.042)**
Initiative age (yr)	0.002	0.002	−0.003	−0.004
	(0.003)	(0.003)	(0.004)	(0.004)
Scale (reference: Multi-state)				
Municipal	−0.434 ***	−0.461 ***	0.155	0.087
	(0.111)	(0.106)	(0.112)	(0.112)
State	−0.318 **	−0.327 **	0.250 *	0.236 *
	(0.113)	(0.113)	(0.112)	(0.115)
Country (reference: Brazil)				
Peru	−0.167	−0.158	−0.218 *	−0.197
	(0.093)	(0.095)	(0.106)	(0.108)
Observations	157	157	157	157
Squared Cor.	0.18198	0.18209	0.09125	0.08138
Pseudo R^2	0.15557	0.15395	0.06930	0.06038
BIC	196.25	196.56	231.90	233.83

Notes: The estimates report the average marginal effect. Standard errors are heteroskedasticity robust. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$. The dependent variables - Land rights and Market access - are (0, 1) indicator variables that take on the value 1 if true and 0 otherwise.

Case 2: Amabela

Amabela (Belterra Womens' association) is a women-led small-scale locally-grounded initiative founded in 2015. It has linked with diverse actors and sectors to promote social-ecological change while resisting commodity frontier expansion. Belterra municipality in western Pará has a mosaic landscape including traditional and indigenous communities inside and outside the Tapajós Forest Conservation Units. Soybean monoculture expansion in Belterra, which family farmers say led to increased use of pesticides, forced many small farmers to sell their land and move to smaller plots nearer the city. Others remained, but were surrounded by soy monocultures. In this context, Amabela was born, encouraged by the Belterra Rural Workers Union and supported by the NGO FASE. The initiative began with funding offered by Fase Amazonia and the Dema fund to support collective projects organized by indigenous, riverside and family-farming initiatives among others. Women in Belterra wanted to have a structured system to access resources to support their varied productive initiatives. Through the association, women experimented with producing teas, baked goods, compotes, and handicrafts. They support each other by collective learning and support, reaching approximately 75 members by 2017.

Amabela's members have gained recognition by resisting pesticide use and agribusiness expansion in the region, while acting for environmental stewardship and female empowerment. Amabela has used knowledge acquired through contact with regional universities, NGOs and government agencies to safeguard their production against increasing pests with organic pesticides and sun shading. Furthermore, these women gained access to regional agroecological fairs due to their diversity of synthetic-pesticide-free products, from coffee and seed oils to handicrafts. All Amabela women participate in Santarem's Family Agriculture Fair, and many also sell at the Alter do Chão Agroecological Fair. With partnerships and support networks, women strengthen their agroecological practices and gain financial independence, furthering their empowerment. As one Amabela member says,

"I used to make the garden just for my family, but I had a great incentive from Amabela and Emater to produce for selling it in the fairs. They came here and helped us by giving courses. If we have any questions, they will come to our home. With the courses and information they offer, I now have the incentive to produce for sale."

Case 3: RECA

The Consortium and Densified Economic Reforestation Project (RECA) is located in Nova Califórnia, Rondônia, close to the border with Acre. Here the arc of deforestation pushes north due to the expansion of cattle ranching (Fearnside et al., 2009). RECA was founded in 1989 by two main groups of actors: local rubber tappers and migrant family farmers relocated to the Amazon from southern Brazil by national land-reform policies (de Paula Pereira et al., 2022). These policies often encouraged local actors to deforest their areas as a way to demonstrate 'economic use' and gain land rights (Alencar et al., 2016). Through agroforestry systems, RECA provided an 'economic use' based on reforestation for food production, or a 'forest of food' as the initiative's slogan emphasizes. One member highlights that "[RECA] is about transforming the lives of families. It's working to bring security and autonomy without having to harm the environment." Ultimately, RECA provides an alternative to national policies that often pushed local actors towards deforestation (Russo Lopes et al., 2021).

RECA consolidated a model of sustainable livelihoods based on forest restoration for food production grounded in local knowledge and external partnerships. Knowledge exchange between farmers and local rubber tappers was key to developing such agroforestry systems tailored to the Amazonian context. According to RECA's members, the different actors' partnership was also central to creating and strengthening the initiative's social capital (Castro Ribeiro and Costa Matos, 2021): "Caring for the forest goes beyond just keeping it standing. It is also the valorization of local knowledge, the respect for living beings. It is another culture and mentality". In the same vein, RECA's website summarizes the initiative's collective efforts and history, emphasizing the its local groundedness:

"We started to meet with the region's original peoples, the rubber tappers, and planned solutions to improve everyone's lives, seeking alternatives that respected the climate and the way of life of local peoples. We combined the knowledge on organization and cooperation brought by peoples from other states with regional knowledge about the forest. We started to elaborate a project for agroforestry systems, the so-called SAFs, using the region's native and well-known plants, which bear rich fruit. This reunion marked the onset of our social organization. In 1989, RECA – Consortium and Densified Economic Reforestation Project – was officially founded"[1].

Even in the context of a deforestation frontier (see Ioris, 2021), RECA has expanded its agroforestry activities for more than thirty years, now encompassing about 300 families. Such an achievement has been possible, on the one hand, due to the establishment of external partnerships and market channels for commercialization that supported RECA's organizational needs at key moments. As one RECA member summarized, "A family farming organization is a fragile seed, so it's important to act fast, to identify the leadership and support these leaders, according to the needs of the farmers."

On the other hand, another crucial element was the engagement of its members since the beginning, fostering a decentralized and participatory management and decision-making processes within the initiative (see Maciel et al., 2017). "In RECA the associate is the owner of the business. He has a voice, he is heard, the assemblies allow for participation," a founding member highlights. The active community has mediated the initiative's priorities over the years, such as the creation of rural schools, women's groups and a focus on creating long-standing commercial relations with key partners. These characteristics help the initiative's members feel part of a collective effort, fostering the feeling responsibility for the initiative's goals, social reproduction, and success in the long term. As such, this case illustrates the importance of diversified forest-based activities grounded in local leadership for better social-ecological outcomes.

Case 4: Rede de Sementes do Xingu (RSX)

This case also illustrates the importance of diverse production based on local leadership associated with strategic partnerships at broader scales. Founded in 2007, this initiative originated from a multi-stakeholder campaign to preserve and restore water resources around the Xingu Indigenous Territory in Mato Grosso state (Sanches et al., 2021). RSX has become a multidimensional initiative which "focuses on valuing people, local knowledge, traditional food, and also on transmitting this knowledge between generations", as put by a member. The purpose was to restore native vegetation in the region, which had been intensely deforested due to agricultural expansion over the last decades (Silvério et al., 2015).

At present, RSX is active in 21 municipalities in the Xingu, Araguaia and Teles Pires basins[2]. Native seeds are collected and sold to larger actors (e.g., farmers, offsetting projects) for reforestation activities (Sanches and Futemma, 2019) by residents of the Xingu Indigenous Territory, family farmers in Land Reform settlements and city dwellers who seasonally collect seeds as supplementary income. A member points out the need for diversified partnerships and support since the initiative's birth: "In the beginning, the RSX was a network of organizations that gave support to the formation of seed-collecting groups in the territories." In this sense, the initiative also has close external partners, such as the national NGO Instituto Socioambiental which substantially supported the initiative's creation, regional social movements like the Pastoral Land Commission, large-scale farmers reforesting their farms in multiple Amazonian states and international actors. RSX further engages in the 'Redário', a national "network of seed collection networks" connecting actors facing the same challenges to exchange experiences and inspire common solutions. An indigenous leader of RSX highlights how the diversity of actors involved in their activities has been a crucial factor for their long-term success:

"RSX is very social and democratic (…) because RSX brings together several actors that traditionally do not talk to each other. Indigenous people, farmers and NGOs are all together despite the controversies that may exist. This is to recognize the importance of others and the contribution that everyone can make. It is a shared purpose of reforestation, a mission. So it is necessary to put aside differences and unite for a common goal."

5. Discussion

We hypothesized that socially- and environmentally-successful place-based initiatives are grounded in local knowledge and worldviews, adopt multi-specialized activities, and connect with diverse actors and institutions at multiple scales. A mixed-methods approach including participatory assessments, compilation and systematization of 157 initiatives, quantitative analyses and qualitative assessments, helped us understand the practices, processes and pathways of successful Amazonian place-based initiatives. The qualitative case studies helped overcome certain limitations of our statistical analyses when considered in isolation.

We found quantitative evidence to support the hypothesis that locally-grounded initiatives achieve social-ecological outcomes more successfully (H1). The number of outcomes including social, environmental and amplification variables increased when the initiative was initiated or led by local actors, was a community-based organization,

[1] See: https://www.projetoreca.com.br/en/about-us/.

[2] See: https://www.sementesdoxingu.org.br/historia-da-rede-de-sementes-do-xingu.

had co-design features, used retro-innovation, or engaged with cultivation and use of natural products based on local or indigenous knowledge (including non-timber forest products, medicinal plants, and honey). Over generations, local and indigenous peoples living with and in particular ecosystems and their constraints acquire sophisticated knowledge that can be key to contextually-sensitive forest conservation and restoration (Berkes, 2000, 2002; Chazdon et al. 2021), and strengthening local and regional livelihoods (Vadjunec, 2011; Reyes-García et al., 2019). Indeed, local knowledge and cultural memory are crucial for sustainability pathways because they maintain flourishing cultural and biological diversity (Nazarea, 2006; Merçon et al., 2019). While local knowledge is generally recognized as key to conservation and development programs, our quantitative analyses show that it is a prevalent part of conservation and development initiatives pursued and led by grassroots actors themselves on the ground (cf. Hill et al., 2012), helping individuals to deliberate and agree on specific collective pathways to pursue toward sustainability objectives. Our qualitative case studies indicate that local capacities and knowledge are not only inherently dynamic but also subject to external opportunities and limitations (see also Ellen and Harris, 2000; Nazarea, 2006; Lambin et al., 2001) and emphasize the links among H1 and H2.

Our quantitative analyses of H2 show that initiatives' diversity, including types of activities performed, number of stakeholder types involved and number of funding types, result in a greater number of positive social-ecological outcomes. The pattern related to the diversity of linkages and activities performed by initiatives is quite remarkable in our findings - in many cases a single initiative combined diverse activities such as agroforestry, forest management, and artisanal fishing with commercialization of forest products and governance innovations such as forming a cooperative or developing women's organizations. Even initiatives founded to address a specific issue often evolved to successfully engage with multiple dimensions of sustainability, as is illustrated by Cofruta. What began as a source of confusion when compiling the database, as initiatives could not be classified by their activity (e.g., agroforestry production), became an insight into pathways of transformative change.

For the quantitative analyses, our sample is not random, so not representative of all initiatives in the region; rather, the value of the analysis lies in uncovering trends and patterns among initiatives. Further, the statistical analyses are correlational, limiting inferences about causal direction. It is possible or even likely that actual causality flows both ways, so for instance locally-grounded and diversified initiatives may be more successful while successful initiatives may also create stronger links with local communities and diversify their activities. The analysis does not consider failed initiatives, but focuses on successes to help understand the conditions leading to them. Accumulating short-lived cases was difficult with our data-collection approach; as such initiatives are likely less well known, and less likely to participate, if they even still exist. However, our database provides rich material for a mixed-method analysis of what decisions and strategies support long-term pathways to success of place-based initiatives, with the case studies mitigating many of the quantitative limitations.

The case studies provide additional support for both hypotheses by giving detailed insights into some mechanisms and elements that may explain how and why local groundedness matters. In particular, the Cofruta and Amabela cases illustrate that when local actors create, own and lead an endeavor, they center local interests and concerns when navigating challenges and opportunities. Even while diversifying production methods and partnerships with other sectors and organizations at multiple scales (H2), the focus of activities can remain connected to the grassroots they represent. Local groundedness can also be maintained when external organizations and actors co-design initiatives with local grassroots to develop joint social-environmental solutions (as in the Rede de Sementes do Xingu and RECA). Both our quantitative and qualitative analyses support the idea that local groundedness helps initiatives achieve more positive social-ecological outcomes. Elements intrinsic to local groundedness, identified in Cofruta, Amabela, RSX and elsewhere, include technical and ecological knowledge of management practices (forest and agroforestry), native seed diversity, wild foods and remedies, and processing capacity (cf. Berkes, 2000; Merçon et al., 2019; Brondízio et al., 2021b). It further includes specific cultural systems such as human-nature relations, cosmovisions, collective work and principles of reciprocity (cf. Berkes, 2000; Vitebsky, 2003, Naess, 2013; Merçon et al., 2019). Such features link coping and adaptation mechanisms with context-tailored place-based innovations that may facilitate more sustainable outcomes.

Whereas place-based initiatives may have knowledge, know-how, and local support, they often lack institutional capacity (Malhado et al., 2017). Collective action and reliance on networks of partners can help provide this missing capacity (Brondizio et al., 2012; Bastos Lima et al., 2021). Isolated households or communities acting alone are rarely well positioned to defend their rights against centralized bureaucratic power or external threats (Menzies, 2007; Paudel et al., 2010). Community organizations, cooperatives, networks and other collective bodies strengthen the institutional and technical capacity of member organizations and can potentially mitigate negative forces they face by defending and increasing community rights and improving market arrangements (Edmunds and Wollenberg, 2001; Menzies, 2007; Larson et al., 2010; Paudel et al., 2010). Our case studies, particularly Cofruta and RSX, show that external partnerships and support can strengthen local capability for forest management, marketing, or governance, and provide a platform for negotiating interests and finding common ground over forest management arrangements (Menzies, 2007; Pokorny et al., 2010).

The case studies illustrate how initiatives can connect the local with regional, national or even international levels while defending local leadership and autonomy. The Cofruta case, for instance, diversified production systems and market mechanisms (processing, publicizing and selling), built multiple international partnerships, attracted tailored support from diverse funders across scales and connected with a wide range of buyers, regionally, nationally and internationally. These findings illuminate further questions about hypothesis 2: Which kinds of partners, and which kinds of partnerships can strengthen social-ecological outcomes over time? The Cofruta case further supports H2 as it shows the mechanisms (e.g., tailoring collaborations, convincing supporters that their cause is not just a business but a model of productive conservation that is socially inclusive and transformative) by which diversified types and scales of partnerships and activities bring financial and other resources key for achieving the initiative's goals.

The Rede de Sementes do Xingu (RSX) exemplifies how diverse actors and connections with multiple scales factored into the initiatives' successful development and social-ecological outcomes. The actors collaborate horizontally with different types of grassroots (indigenous, non-indigenous and even urban dwellers), NGOs, farmers and partnerships with distant organizations at broader scales, like the Redário national seed collection network. Amabela also demonstrated how diverse partnerships (including a university, several NGOs, and a government-extension body) brought complementary knowledge, skills and opportunities to build on local knowledge to develop food production and processing innovations and open promising markets (organic and agroecological fairs). The activities also supported the organization and empowered women's groups and their intentions to resist deforestation and the soybean and cattle commodity frontiers in the region. This result is consistent with studies exploring the success factors of grassroots initiatives (Feola and Nunes, 2014; Mayer and Knox, 2010; Wilson, 2012), which highlight the role of networks of supporting agents to promote effectiveness, facilitate social learning and connect target groups with organizations or actors to achieve shared goals (Edelenbos et al., 2021).

The quantitative analyses suggest that both cross-sector and cross-scalar partnerships and the diversity of stakeholders involved make local initiatives more likely to achieve social-ecological outcomes.

Arguably, diverse partnerships, involving multiple and diverse stakeholders, help pool capitals (natural, social, economic, knowledge, technical) needed to solve complex problems. What is it about partnership diversity that makes the biggest difference? What type of partnerships drive the overall result? Our qualitative analyses suggest an important role of certain key connectors, organizations deeply committed to local grassroots and the struggles they face (violence, market exploitation, food insecurity, poverty) with a long history of positive interventions and partnerships in the region and sensitivity to local knowledge systems and capacities. These could not be analyzed with the quantitative data, but our qualitative case studies help explain how such organizations provide local grassroots organizations with critical cross-sectoral and cross-scalar connections and partnerships. Some examples are the NGOs FASE and ISA, the Pastoral Land Commission (CPT) and even regional social movements and rural workers' unions that, although being grassroots, are more equipped to connect with actors of other sectors and scales.

6. Conclusion

Our paper focused on the value of place-based initiatives in facing interconnected context-specific social-ecological challenges. It is increasingly recognized that locally-emerging and -evolving sustainability innovations and governance models have an important role in mitigating and adapting to biodiversity decline, ecosystem loss and degradation, and climate change (Merçon et al., 2019; Brondízio et al., 2021b). Our findings carry several implications for theory, policy and practice for sustainable pathways in regions marked by inequality, unsustainability and injustice. Place-based initiatives promote sustainable pathways through local groundedness, diversity and partnerships. Our quantitative analysis revealed the relevance of these three elements in sustainable pathways whereas qualitative analysis unpacked the mechanisms shaping those pathways. Most fundamental is that the way external associations engage with local partners matters for the performance of local initiatives. Initiatives that are not firmly grounded in local grassroots and community organizations are less able to effect positive change. Additionally, place-based initiatives controlled by external actors have often faltered after funding ends. They may also cause contention between beneficiaries and donors. That initiatives connected to a variety of actors outside of their local sphere are better able to make progress on social and environmental development goals is particularly encouraging for suitably-designed policy and practice interventions.

These findings bear relevant policy implications, for place-based initiatives are a key factor in the implementation and ultimate achievement of globally-established objectives, such as the Sustainable Development Goals, Agenda 2030, the Paris Agreement and the UN Decade on Restoration. While major efforts to achieve these goals promote sociotechnical solutions to address large-scale production systems (e.g., Nepstad et al., 2014; zu Ermgassen et al., 2018), a wide range of place-based sustainability initiatives remain virtually invisible to policymakers and global actors. As highlighted by the empirical cases, place-based initiatives created and run by smaller-scale farmers and traditional communities contrast with technical solutions by also addressing environmentally-oriented goals - e.g., poverty, food security, inequality, gender equality, wellbeing - and by nurturing social capital, governance processes, resilience and sense of belonging in a vulnerable biome. Without the local transformations toward sustainability, international commitments lack grounded impacts and fail to materialize meaningful results. This is why it is critical to deepen our understanding of place-based initiatives' dynamics and ways to better foster, strengthen and support them - rather than ignoring or undermining their importance. This debate can benefit from nuanced local inquiries into the role of external actors in promoting transformations on the ground, as opposed to interventions inadvertently reinforcing power imbalances. With these findings in mind, we hope to have advanced the understanding of local dynamics and helped place-based initiatives flourish in the Amazon and other ecosystems under pressure around the world.

CRediT authorship contribution statement

Marina Londres: Conceptualization, Methodology, Data curation, Investigation, Visualization, Project administration, Supervision, Writing – original draft, Writing – review & editing. **Carl Salk:** Conceptualization, Methodology, Formal analysis, Supervision, Visualization, Funding acquisition, Writing – original draft, Writing – review & editing. **Krister Andersson:** Conceptualization, Methodology, Funding acquisition, Supervision, Writing – original draft, Writing – review & editing. **Maria Tengö:** Conceptualization, Methodology, Software, Funding acquisition, Supervision, Writing – original draft, Writing – review & editing. **Eduardo S. Brondizio:** Conceptualization, Software, Funding acquisition, Supervision, Writing – original draft. **Gabriela Russo Lopes:** Investigation, Writing – original draft, Writing – review & editing. **Sacha M.O. Siani:** Formal analysis, Visualization, Writing – original draft, Writing – review & editing. **Adriana Molina-Garzón:** Investigation, Writing – original draft, Writing – review & editing. **Taís Sonetti-González:** Investigation, Writing – original draft. **Diego Rázuri Montoya:** Investigation. **Célia Futemma:** Funding acquisition, Writing – review & editing. **Fábio de Castro:** Funding acquisition, Writing – review & editing. **Daiana C.M. Tourne:** Investigation.

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.

Data availability

The data will be made available in a public repository after other ongoing analyses are submitted for review.

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Appendix A. Supplementary data

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