Local mechanism of engagement in rural landscapes in the Nicaragua-Honduras sentinel landscape: examples of a local farmers' organisation and a multi-actor platform

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Photo 1.
Panoramic view of the Peñas Blanca Natural Reserve.
Photo N. Sepúlveda.

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RÉSUMÉ

Des mécanismes locaux pour promouvoir l'engagement dans la gouvernance des espaces ruraux d'un paysage sentinelle au Nicaragua et Honduras : étude de cas d'une organisation locale d'agriculteurs et d'une plateforme multi-acteurs

Les approches à l'échelle du paysage ont été encouragées comme moyen de relever les défis complexes liés à la gestion des ressources naturelles et au bien-être des utilisateurs des terres et agriculteurs. Cette étude présente deux mécanismes mis en œuvre pour le développement territorial : une plateforme multi-acteurs conçue pour améliorer la gouvernance dans une zone de réserve naturelle (dimension spatiale/géographique) et une coopérative locale devenue réseau d'apprentissage pour aborder les questions d'utilisation des terres et de gestion du paysage. L'étude est basée sur une évaluation de la mise en œuvre d'un outil de planification dans le cadre d'un projet local visant à renforcer la gouvernance du paysage et la coopération autour de la chaîne de valeur dans une réserve de la biosphère au Nicaragua. Nous avons interrogé 403 résidents et 29 membres d'une coopérative cacaoyère afin de recueillir leurs opinions sur l'efficacité des outils et méthodologies appliquées pour assurer d'une part la bonne gestion des ressources naturelles et d'autre part la résilience et le bien-être des cultivateurs de cacao locaux. L'analyse factorielle montre que les habitants de "Peñas Blanca" connaissent la plateforme multi-acteurs qui gère la réserve. En général, ils ont une opinion positive de la plateforme et de sa capacité à concilier les valeurs économiques et culturelles et la conservation des paysages. Depuis quelques années, la coopérative cacaoyère locale est confrontée à une crise financière et organisationnelle, et seul un petit nombre de membres y font appel pour vendre leurs fèves de cacao. Cette situation est due à une baisse de la productivité et de la qualité des fèves de cacao de certains agriculteurs, ce qui a réduit leurs possibilités de vendre leurs fèves à la coopérative. Toutefois, l'accès actuel au capital social et culturel favorise la résilience et la capacité d'adaptation des producteurs de cacao de la région. Ces études de cas démontrent l'efficacité des organisations multisectorielles et communautaires pour l'intégration d'objectifs économiques, écologiques et sociaux dans une région qui favorise la gouvernance paysagère, où les approches sectorielles s'avèrent être des points d'entrée utiles.

Mots-clés : cacao, gouvernance paysagère, outils de planification, plateforme multi-acteurs, zones protégées, territoire, Nicaragua.

ABSTRACT

Local mechanism of engagement in rural landscapes in the Nicaragua-Honduras sentinel landscape: examples of a local farmers' organisation and a multi-actor platform

Landscape approaches have been encouraged as a means of addressing the intricate challenges related to natural resource management and the well-being of land users/farmers. The study presents two mechanisms applied to territory development: first, a multi-stakeholder platform to improve governance in a natural reserve area (space/geographical dimension); second, how a local cooperative can become a learning network and address land-use and landscape management issues. The study evaluates the planning tool interventions of a local project, aiming to strengthen landscape governance and value-chain collaboration in Nicaragua's biosphere reserve. We interviewed 403 residents and 29 cocoa cooperative members to evaluate their view of the tools/methodologies' effectiveness in natural resource management and cocoa farmers' resilience and well-being, respectively. Factorial analysis showed that the people of "Peñas Blanca" were aware of the multi-stakeholder platform managing the reserve. Generally, they had a positive opinion of the platform and its ability to balance economic and cultural values with conservation. The local cocoa cooperative has faced a financial and organisational crisis in recent years, with only a small number of members using the cooperative to sell their cocoa beans. This is due to decreased productivity and quality of the cocoa beans for some individual farmers, which impacts their ability to commercialise the beans with the cooperative. However, current access to social and cultural capital is supporting the resilience and adaptive capacity of the cocoa farmers in the territory. The studied cases provide evidence of the effectiveness of multi-sectoral and community-led organizations in integrating economic, ecological, and social objectives in a territory supporting landscape governance with sectoral approaches as valuable entry points.

Keywords: cocoa, landscape governance, planning tools, multi-stakeholder platform, protected areas, territory, Nicaragua.

RESUMEN

Mecanismos locales para promover el compromiso en la gobernanza de paisajes rurales en el paisaje centinela de Nicaragua-Honduras: ejemplos de organizaciones de agricultores locales y plataformas multiactores

Los enfoques de paisaje se han incentivado como medios para abordar los retos intrincados relacionados con la gestión de recursos naturales y el bienestar de los usuarios de la tierra y agricultores. El estudio describe dos mecanismos aplicados al desarrollo territorial: primero, una plataforma multiactores diseñada para mejorar la gobernanza en un área de reserva natural (aspecto espacial y geográfico); en segundo lugar, cómo una cooperativa local puede convertirse en una red de aprendizaje y abordar problemas de uso de la tierra y de gestión del paisaje. El estudio se basa en una evaluación de los usos de una herramienta de planificación para un proyecto local, que está diseñada para reforzar la gobernanza paisajísta y la coloboración en la cadena de valor de la reserva de la biosfera nicaragüense. Entrevistamos a 403 residentes y 29 miembros de una cooperativa cacaotera para evaluar sus opiniones sobre la eficacia de las herramientas y metodologías aplicadas para garantizar la gestión de recursos naturales, por un lado, y la resiliencia y el bienestar entre los productores de cacao locales, por otro lado. El análisis factorial mostró que la gente de Peñas Blanca estaba informada sobre la plataforma multiactores que gestiona la reserva y generalmente tenían una opinión positiva de la plataforma y su capacidad de equilibrar valores económicos y culturales con la conservación. La cooperativa cacaotera local se ha enfrentado a una crisis financiera y organizativa en los últimos años, y solo un pequeño número de sus miembros utilizaba la cooperativa para vender el grano de cacao. Esto es debido a un declive en la productividad y la calidad de su grano de cacao para algunos agricultores individuales, lo que afectó a su capacidad de vender el grano de cacao a la cooperativa. Sin embargo, el acceso actual al capital social y cultural respalda la resiliencia y la capacidad adaptativa de los cultivadores de cacao de la zona. Estos estudios de caso muestran la efectividad de las organizaciones multisectoriales guiadas por la comunidad para integrar objetivos económicos, ecológicos y sociales, en un área que apoya la gobernanza paisajista, donde los enfoques sectoriales actúan como valiosos puntos de entrada.

Palabras clave: cacao, gobernanza paisajista, herramientas de planificación, plataforma multiactores, áreas protegidas, territorio, Nicaragua.

Introduction

Over the past few decades, the landscape approach, also known as integrated landscape management, has been increasingly advocated as a comprehensive approach for addressing complex social, economic, environmental, and political challenges in the realm of natural resource management (NRM) (Scherr et al. 2012; Ros-Tonen et al. 2013; Reed et al. 2016; Reed et al. 2020b). NRM refers to a specific set of natural resources, aiming to manage competing uses such as agriculture with conservation goals. (Robinson 2019). In landscape research, the focus is on the intersection of natural and human-modified environments (Robinson and Carson 2013).

The term "landscape" has its roots in the Germanic language. It was first documented in the 13th century and is derived from the Dutch word "lantscap" (also spelled "lantscep" and "landscip"), which refers to a portion of land or environment that has been organised by humans and its visual appearance (Antrop 2013; Antrop and Van Eetvelde 2019). Dutch painting introduced its meaning as "scenery" in the 17th century. When it was introduced to the English language, the emphasis was on scenery rather than the territory itself (Antrop 2013).

The various interpretations and meanings assigned to the term "landscape" combined with linguistic interpretations and translations added a lot of confusion to the word. The early stages of landscape research clarified its scientific meaning and concept (Jones 1991; Olwig 1996; Antrop 2005a). However, a universal definition was not reached (Jones 1991; Olwig 1996; Antrop 2005b). A formal definition for landscape is given by the European Landscape Convention, which defines landscape as "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors" (Council of Europe 2000).

To provide specificity and clarity of meaning, an adjective can be added to the term (i.e., cultural landscape, natural, rural landscape). Therefore, the definition of landscape is contingent on the context, the background of users and observers, and the methods and techniques employed to study it (Cosgrove 2003). Landscape research has evolved from its beginning in scientific research in the 18th century, following different trajectories (Antrop 2005a; Antrop 2013).

Landscape ecology introduced a transdisciplinary approach to landscape research, which gave rise to the field of landscape science. Landscape science is considered a meta-discipline, that has evolved through the synergistic application of theories, methods, and knowledge of several scientific disciplines, including agricultural science, forestry science, conservation science, geoscience, biology, social sciences, engineering sciences, and mathematics (Robinson and Carson 2013). Consequently, the landscape concept has become more applied, socially orientated, and less theoretical and academic (Antrop 2013; Antrop and Van Eetvelde 2019). In 2011, landscape emerged as an integrating concept with applications in policy, planning, and management, due to its transdisciplinary and holistic approach (Antrop and Van Eetvelde 2019). For example, researchers have used landscape concepts to understand complex socio-ecological systems and sustainability (Angelstam et al. 2013) and developed frameworks to analyse the complex interactions shaping local rural landscapes (Pinto-Correia and Kristensen 2013).

The landscape approach, as devised by Sayer et al. (2013) in the NMR arena, consists of providing tools and concepts for allocating and managing land to achieve social, economic, and environmental objectives in areas where agriculture, mining, and other productive land uses compete with environmental and biodiversity goals. Sayer et al. (2013) proposed ten summary principles to support the implementation of a landscape approach that emphasises adaptive management, stakeholder involvement, and multiple objectives. Similarly, Scherr et al. (2012) highlighted that to successfully implement landscape approaches, at least four institutional mechanisms are needed: multi-stakeholder planning, supportive landscape governance, resource tenure, and spatially targeted investment in the landscape that supports conservation/environmental objectives.

Landscape governance is related to the general process of steering human-nature interactions in a bounded geographical space (Lockwood et al. 2010). In landscape governance, three types of agents interact (land user managers, public agencies, and local community), shaping territorial (individual decisions) and spatial competence (policy interventions) (Primdahl et al. 2018). Local communities (for example, cooperatives and organisations of civil society interested in maintaining services and benefits from the landscape) can influence the spatial and territorial relationship in landscape governance.

Robinson (2019) emphasised the need to include the views and knowledge of "stakeholders" (mainly landowners/managers and community groups) when analysing landscape and NRM. Other researchers have acknowledged the crucial role of stakeholders in socio-economic development in rural landscapes (Ángel 2010). Similarly, Rana and Chhatre (2017) highlighted the importance of having hybrid forms of governance that involve state/government authorities, communities, and local governments interacting and negotiating socio-environmental aspects of an ecosystem to devise innovative solutions to solve complex problems.

This paper focused on two case studies, framed on sectoral approaches, within distinct geographical spaces, both of which are part of a protected area (PA). The first case study explored how inhabitants perceived the role of a multi-actor platform established to manage a private natural reserve, reflecting the concept of "new institutionalism," here referred to as a means for engagement of a community-based collaborative mechanism, while the second case study examined the perception of the members of a coo-

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perative operating within a global value chain commodity, acting as a learning network and representing an analysis of the organisation within. These case studies are presented as examples of existent mechanisms in a territory, providing the opportunity to assess them as entry points to advance landscape governance and integrated landscape approach for sustainable management. They also shed light on how land users and managers perceived the processes shaping spatial planning embedded in NRM landscape governance. These case studies were also part of CATIE's projects on the climate-smart territories approach in Central America (CATIE 2012; Mendoza Rivarola 2015; Mercado et al. 2017).

Methods

Concepts and evaluation framework

Local community engagement (e.g., cooperatives, local conservation groups) is considered a critical element in landscape governance and management (Primdahl et al. 2018). This study focuses on two sectoral arrangements contributing to local landscape governance in specific territories. The first institutional arrangement is a local multistakeholder platform that governs the access and management of resources in a natural protected area. Multistakeholder engagement platforms are acknowledged as crucial for approaching complex situations and advancing landscape approach and governance (Reed et al. 2020a; Bayala 2023). Multi-stakeholder platforms (MSPs) are defined as "participatory processes that include a wide range of actors in a topic or a landscape, to engage in dialogue, decision-making, and/or implement activities for common (landscape) goals" (CIFOR-ICRAF nd).

The second institutional arrangement is an agricultural cooperative acting as a learning network. A cooperative is defined as "an autonomous association of persons united voluntarily to meet their common economic and social goal as well as aspirations through a jointly owned and democratically owned initiative" (International Cooperative Alliance 1995). Cooperatives offer a means to increase collective actions by facilitating the insertion of smallholder farmers in agri-food value chains, thereby creating opportunities to advocate and motivate their members with tangible economic and social outcomes (Ubandoma 2022; Christian et al. 2024). Therefore, both cases represent some of the arrangements existent in a territory and can be needed as entry points to advance landscape governance and tackle the challenges faced by communities living in complex socio-ecological systems in the agricultural-forest landscape continuum (figure 1).

To analyse the first institutional arrangement, we use the concept of "good governance" to evaluate from the perspective of the land use manager/user the effectiveness of the multi-stakeholder platform in delivering the objectives of the management plan of the PA (socio-economic development and conservation). Good governance is characterised as "participatory, accountable, transparent, responsive, consensus-orientated, effective and efficient, equitable and inclusive, and follows rules of law" (UN Economic and Social Commission for Asia and the Pacific 2003). Governance could be referred to as "the exercise of authority, including the processes, acts, and decisions of a group or entity within a given context (i.e., protected area)" (Tucker 2010), or "the integrity of institutions and processes that govern forests in their countries" (GFI 2009).

Figure 1.
Process supporting landscape governance and spatial planning through two local arrangements.

We applied a questionnaire composed of selected indicators within the eight dimensions of the governance process at the local level proposed by Secco et al. (2014). However, we acknowledge the limitations posed by using this framework, as it did not offer the means to evaluate deeper local participation in the multistakeholder platform, as suggested by other authors (Ruano-Chamorro et al. 2021). The assessed dimensions were: 1) Sustainable glocal development, 2) Efficiency, 3) Effectivity, 4) Participation, 5) Transparency, 6) Accountability, 7) Capacity, and 8) Conscience. In this assessment, the term glocal (i.e., a combination of global and local processes) represents that global and local processes are strictly "intertwined" (Swyngedouw 1997 p. 137; Roudometof 2021). That is, the idea that local projects' performances can positively or negatively affect the society-environment systems globally (Berkes 2008; Secco et al. 2014). In the PA, for example, the decisions on forest cover-tree management on farms in the landscape can influence biodiversity conservation goals (i.e., deforestation, illegal logging) and national commitments on a global scale. In terms of the conscience dimension, in this study, we assessed the view of land users on the role of tree cover change at the farm level in reducing vulnerabilities linked to conditions of uncertainty (i.e., climate change, productivity, water quality).

In each dimension, 4 to 21 questions were included (table I). The questionnaire included 84 questions that used a 5-point Likert scale or yes or no questions. In the Supplementary Material, the statements evaluating each dimension are summarised. The scale used to evaluate the questions/statements was as follows: 1 = Completely disagree, 2 = Not agree, 3 = Undecided/Neutral, 4 = Agree, and 5 = Completely agree. We surveyed 403 residents, randomly selected from the residents of the PA, belonging to 39 communities of the four municipalities ascribed to the PA.

For the second institutional arrangement, a cooperative acting as a learning network and a key player in landscape management, we use the five-capital assessment framework for sustainability (Emery and Flora, 2006) as a vehicle to strengthen the capacity of the cooperative members to deal with climate change and help in the adaptation planning process (Altamirano Tinoco 2012; Rodríguez Cortes and Ospina Rojas 2016).

We performed a non-experimental quantitative evaluation using questionnaires in 2020 to assess, ex-post, the changes that occurred between 2012 and 2020 in the set of the 28 practices proposed in 2012 by Altamirano Tinoco (2012). These practices were designed to enhance the resilience of cocoa farmers and enable the community to plan more effectively, thereby preventing the loss of vital agricultural land uses. Using the information available from a local cocoa project and the results from the evaluation of Altamirano Tinoco, we recreated the initial situation (as of 2012) and then consulted the same cocoa farmers in 2020 to see changes in the practices and indicators perceived by cocoa farmers.

All individuals interviewed for this research have voluntarily agreed to be included in the study and they remain anonymous.

Two examples as case studies and regions

Case Study 1: Peñas Blanca Natural Reserve (PBNR).

In Nicaragua, the national system for natural protected areas (PAs) recognised 76 PAs, which account for 17.6% of the national territory. The Peñas Blanca Natural Reserve is co-managed by the Centre for Understanding for Nature (CEN, by its acronym in Spanish), in coordination with local governments of four municipalities, local organisations, governmental organisations (i.e., the Ministry of Agriculture office, the Ministry of Natural Resources office, and the Forestry National Institute office), and NGOs (Non Government Organisations). Together, these organisations formed a multi-actor platform known as CMC (short for management commission platform). The platform objectives are to conserve, restore, and conduct research in the protected area, as well as support the community in different domains, such as environmental education, support in the formation of local cooperatives, and search for opportunities for young and women. The CEN leads the local platform by working with 1) the municipalities, which support some activities in the reserve such as reforestation, risk management, and road building through their environmental or technical unit; 2) the CAPS (Drinking Water and Sanitation Commissions, CAPS for its acronym in Spanish); and 3) the Environmental Commissions (part of the Family, Community, and Life communal Groups). The CEN has a direct relationship with the local offices of the Ministries and has formed an alliance with MARENA (the Natural Resources Ministry) for the formulation and creation of the PBNR Management Plan, which is the legal instrument recognised to manage the protected area. The PNBR is one of the six nucleus areas of the Bosawas Biosphere Reserve, and its vegetation is characterised by cloud forests (photo 1).

All sustainable activities - defined as the set of actions that align with the ecosystem's potential, restore forest cover and the volume of water sources, eliminate water contaminants from agricultural and livestock activities, and guarantee sufficient income generation for families living in the PNBR and using natural resources - are permitted in the buffer zone and nucleus area of the reserve, as stated in the management plan (Centro de Entendimiento con la Naturaleza (CEN) 2011). MARENA is the local authority that supervises and authorises all the productive activities carried out in the PNBR (Bogarín Bermúdez 2014; Ministerio del Ambiente y los Recursos Naturales 2021).

A series of master´s theses were conducted by students from the CATIE-Graduate School under the Forest, Trees, and Agroforestry (FTA) research program of the CGIAR in the Nicaragua - Honduras Sentinel Landscape (NHSL) initiative (see Sepúlveda et al. 2020 for further information about the Sentinel Landscape initiative). The objectives of these theses were to support the governance and interaction of land managers in the landscape through the development of skills such as multi-stakeholder negotiations and analysis of rules (León Leiva 2014; Rodríguez Cortes and Ospina Rojas 2016) and procedure advising, such as updating the management plan of the PA (Bernales Leiva

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Table I.
Statements evaluating the eight dimensions of good governance applied to the multistakeholder platform existent in the natural protected area.

Governance dimension	Statement evaluated	Acronym
Glocal	CMC's formal commitment to sustainability and environmental, social, and economic objectives in the municipality.	S11gLOC
	The best practices are promoted for tourists and other users who visit the reserve.	S12gLOC
	The social impacts of the implementation of actions in the PBNR are favorable for your municipality.	S13gLOC
	Economic development projects are benefiting indigenous peoples in your municipality.	S14gLOC
	There exists a formal commitment to the sustainability and social, environmental, and economic objectives for your municipality and the PBNR.	S15gLOC
	Economic impacts of the projects implemented in the PBNR are positive.	S16gLOC
	Environmental impacts of the projects implemented by the CMC are positives.	S17gLOC
Efficiency	The CMC invests money in updating innovative technological tools to keep the population informed.	S27EFFI
	Residents know the essential aspects of the PBNR very quickly - the CMC informs you promptly about the critical changes in management in your municipality.	S28EFFI
	Implementation deadlines (of projects) are respected.	S29EFFI
Effectiveness	Projects promoted for the conservation of the forest are favorable for the community.	S32EFFE
	Residents have access to information immediately.	S33EFFE
	There exist mechanisms of coordination between CMC and the rest of the organizations in the municipality.	S34EFFE
	(my) The municipality is well represented on the Committees that make decisions regarding forest conservation.	S35EFFE
	Projects meet the objectives of the management plan for which they were designed.	S36EFFE
	CMC effectively manages its relationship with other actors.	S37EFFE
	CMC has high credibility in the territory.	S38EFFE
Participation	Representatives of your municipality have easy access to the CMC.	S41PART
	Your representative informs you of the decisions made in the CMC.	S42PART
	I believe that the CMC is willing to consider recommendations from civil society in general.	S43PART
	(My) demands - opinions are channeled by the representative of the municipality to the CMC.	S44PART
	The CMC handles conflicts appropriately.	S45PART
Transparency	I believe that I can access information on forestry projects and sound environmental practices if required.	S47TRANS
	Residents can give feedback to the representative of your municipality before the CMC without any problem.	S48TRANS
	If residents require information on activities related to forest management, they go to the CMC.	S49TRANS
	There is a flow of information between the municipalities that participate in the CMC.	S50TRANS
Accountability	All the decisions made by the CMC are documented in records.	S51ACCO
	Each member of the CMC has clarity in their role on the committee.	S52ACCO
	CMC has a clear mandate and vision, and there is no duplicity with any other institution/organization in the reserve.	S53ACCO
	The remuneration of CMC members who receive salaries is publicly known.	S54ACCO
	Indicators of the performance of the CMC are clear.	S55ACCO
	The external evaluations of the CMC have been robust to know the areas for improvement.	S56ACCO
Capacity	Members making the decisions in the CMC have the competencies, leadership, and required experience.	S57CAPA
	It is necessary to strengthen the functioning of the CMC (i.e., infrastructure - offices-equipment).	S58CAPA
	Subcommittees are optimal for the CMC to perform properly.	S60CAPA
	I believe that we need other institutions so that they can help in the management of natural resources.	S61CAPA
Conscience	Do you believe that planting trees on my farm helps to improve productivity?	S62CON
	Do you believe that trees favor infiltration and recharge of water sources?	S63CONS
	Do you believe that trees help in reducing the problems of climate change?	S64CONS
	I believe that farmers are the only ones who should plant trees on their farms.	S66CONS
	I believe that coffee growers are the only ones who should plant trees on their farms.	S67CONS
	I believe that the trees on-farm help reduce climate change.	S69CONS
	I have included trees on my farm because my best friends have recommended them to me.	S70CONS
	I always go to a member of the CMC when I need help with which trees to plant.	S71CONS
	Do you believe that trees help in reducing the effects of climate change?	S73CONS
	You consider that the actions promoted by the members of the CMC have influenced my opinion regarding the benefits I receive for planting trees.	S74CONS
	I usually implement on my farm the technical recommendations that CMC members give me.	S75CONS
	I believe that planting trees on the farm is an investment to earn income in the future.	S76CONS
	I believe that planting trees on the farm helps in reducing the effects of climate change.	S77CONS
	Do you consider that the natural regeneration areas are an investment to obtain income in the future?	S78CONS
	Do you believe that natural regeneration areas help water infiltration?	S79CONS

CMC: management commission platform.

and Bloomfield Melgar 2016), all aimed at supporting the CEN and CMC (photo 2). The NHSL initiative did not provide direct incentives to the residents of the PA or support any specific project promoted by the CMC or CEN.

Case Study 2: Building resilience of cocoa farmers and cocoa cultivation in Waslala with the CACAONICA farmer´s organisation case.

CACAONICA was the first cooperative of cocoa farmers in Nicaragua, involved in cocoa cultivation, processing, and exports. In the first half of the last decade, CACAONICA held a privileged position within the cocoa value chain (CATIE 2007; Escobedo 2010). Cooperatives are widely recognised as vehicles for community and rural development in poor territories (Majee and Hoyt 2011; Gutiérrez 2014). Cocoa cultivation is considered a promising crop for livelihood and restoration efforts as it can help stop deforestation. However, cocoa farmers face numerous challenges affecting their capacity to respond to shocks and natural hazards. In 2012, under the Central America Cocoa Project (PCC), a cooperation platform between CACAONICA and CATIE was established. Altamirano Tinoco (2012) identified, proposed, and co-created a set of climate-smart and resilient practices using the community capital assessment framework (see Emery and Flora 2006 for an in-depth review of the framework) to measure the adaptive capacity of cocoa cultivation as a sustainable livelihood. The capital assessment framework allows from a systemic perspective to look at how farmers perceive and face realities and how changes occur in a community (Emery and Flora 2006).

The indicators were built with 37 cocoa farms selected from the 250 cocoa farmers participating in the PCC project. The selection criteria were altitude (range from 200 m asl to 650 m) and previous records on livelihoods measurements. A total of 28 practices were recommended to evaluate resilience and adaptative capacity at the farm level, based on the score of 47 indicators.

Data analysis

For case study 1, the Likert-scale responses were analysed using the Likert package in R (R Core Team 2015) to rank the variables measuring the governance dimensions. A factorial analysis was run using the fa () function to run a model with varimax rotation to transform factors. We set five factors in the model (table II). The factorial analysis allows us to simplify complex data using statistical procedures to explore the underlying patterns or dimensions that explain the relationships between multiple items or variables. In our case, it can show what elements of the governance dimensions of the CMC are recognised by the residents of the PA. For case study 2, descriptive statistics and T-student analyses were run to analyse CACAONICA cocoa farmers' adaptive capacity and resilience changes between the two periods evaluated, according to the perceptions of CACAONICA members. These analyses will shed light on the elements that can further advance landscape governance.

Table II.
Standardised loadings > 0.5 (in bold) of each statement represent the correlation of each statement with a factor based upon the correlation matrix. See the text for the full explanation for each statement.

Governance Dimension	Statement	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Local development (glocal)[1]	S15gLOC	**0.52**	-0.02	-0.13	-0.13	0.09
	S16gLOC	**0.51**	0.03	-0.03	-0.03	0.15
	S17gLOC	**0.59**	-0.02	-0.17	0.17	0.06
Effectiveness	S32EFFE	0.17	0.08	0.1	-0.03	**0.56**
	S34EFFE	**0.54**	-0.06	0.02	-0.11	0.11
	S35EFFE	**0.6**	-0.16	0.01	0.11	-0.11
	S37EFFE	**0.54**	-0.06	0.21	-0.04	0.1
	S38EFFE	**0.65**	-0.08	0.11	0.05	-0.19
Participation	S42PART	0.11	-0.21	**0.56**	0.16	0.06
Accountability	S51ACCO	**0.53**	0.11	0.02	-0.02	0.06
	S52ACCO	**0.59**	0.14	0.01	-0.29	0
	S53ACCO	**0.51**	0.25	-0.01	-0.16	0.16
	S55ACCO	**0.5**	0.11	0.08	-0.25	0.04
Capacity	S57CAPA	**0.52**	0.03	0.07	-0.08	0.02
	S58CAPA	0.03	-0.04	0.02	-0.07	**0.59**
	S59CAPA	0.08	0.05	0.17	**0.51**	0.22
	S60CAPA	0.03	0.15	0.04	0.16	**0.51**
	S61CAPA	-0.06	0.12	-0.01	-0.01	**0.63**
Conscience	S63CONS	0.11	**0.65**	0.07	0.24	-0.38
	S64CONS	-0.05	**0.73**	0.18	0.08	-0.23
	S66CONS	0.18	-0.17	0.05	**-0.63**	0.04
	S67CONS	0.2	-0.17	0.07	**-0.67**	0.03
	S69CONS	-0.04	**0.81**	0	-0.02	0.14
	S70CONS	-0.14	0.2	**0.53**	-0.08	-0.06
	S71CONS	0.08	0.13	**0.61**	-0.04	-0.2
	S73CONS	-0.03	**0.77**	-0.04	0.03	0.12
	S74CONS	0.06	0.06	0.45	-0.07	0.18
	S75CONS	-0.05	0.12	**0.71**	-0.16	0.11
	S76CONS	0.03	0.32	-0.03	0.01	0.22
	S77CONS	0.07	**0.75**	-0.07	-0.03	0.21
	S78CONS	0	0.27	0.15	0.23	0.38
	S79CONS	0.29	0.44	-0.18	0.19	0.27
	S80CONS	0.05	0.12	-0.15	0.25	0.14

[1] = glocal (i.e., a combination of global and local processes. Global and local processes being strictly "intertwined" (Swyngedouw, 1997 p. 137).

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Results

Case Study 1: Governance of the Peñas Blanca Natural Reserve as seen by local users

Forty-seven per cent of the population interviewed were females, and 53% were males. On average, the age of the interviewees was 40 years old (median 38 years, sd = 15.7 years). Forty-four per cent of the participants live in the buffer zone, 20% in the nucleus zone, and the rest (36%) mentioned that they were outside the limits of the PA. Regarding education, only 8% of the interviewees were illiterate. Fifty-one per cent of the interviewed population had completed at least one school year of primary school, and 20% had completed at least one year of secondary school. Eight per cent of the participants took part in a state-promoted literacy program. Six per cent reported that they had completed secondary school, and only 7% of the interviewees had completed a university degree.

Governance indicators characterising the multi-actor platform (CMC) as perceived by local users.

The statements that scored high in factor 1 (loading > 0.5) were related to the governance dimensions of glocal (a combination of global and local processes) with three statements, effectiveness (four statements), accountability (four statements), and capacity (one statement). These statements referred to 1) members of the CMC having a clear understanding of their roles in the platform (S52ACCO); 2) the CMC having high credibility in the territory (S38EFFE); and 3) the existence of a mechanism of coordination between the CMC and the rest of organisations existent in the territory (S34EFFE). Other high-ranking statements are that the CMC platform effectively manages its relationship with other actors (S37EFFE), the CMC has a clear mandate and vision, and there is no duplicity with any other institution/organisation (S53ACCO) in the PA.

Other items that have a high load on factor 1 were: 1) the existence of a formal commitment to the sustainability and social, environmental, and economic objectives for the municipality and the PBNR (S15gLOC); 2) projects promoted/implemented by the CMC have positive environmental (S17gLOC) and economic (S16gLOC) outcomes. Therefore, factor 1 refers to the CMC's credibility, existing coordination tools, and CMC's ability to promote economic and environmental benefits for the communities.

In factor 2, the statements with a high load were the statements associated with the users' perspectives on trees within the conscience governance dimension. These statements include beliefs such as the recognition of trees' ability to improve infiltration rates and water recharge (S63CONS), the perception that trees (in a general sense) contribute to mitigating the problems caused by climate change (S64CONS), and the acknowledgement of the role of trees on farms in reducing climate change (S69CONS) and its effect (S73CONS), and the belief that planting trees on one's farm helps to fight against climate change (S77CONS). Overall, this factor reflects a positive outlook on the role of trees in addressing climate change, promoting productivity, and managing water resources.

In factor 3, the statements with a high load were the statements related to the dimension of participation (one statement) and conscience (three statements). The statement related to participation asks whether the representative informs users/residents of the PNBR of the decisions made in the CMC (S42PART). The remaining three statements relate to the conscience dimension, focussing on users/residents' decisions on tree planting (S70CONS and S71CONS) and whether residents typically implement the technical recommendations given by the CMC on their farms (S75CONS).

Factor 4 comprised three statements with the highest loadings. Two of these statements measured respondents' perceptions of who should be responsible for planting trees on their farms. The loadings for these statements were negative, indicating disagreement among the respondents regarding the belief that only coffee growers (S67CONS) or that only ranchers (S66CONS) should plant trees on their farms. The third statement was related to whether the CMC organises ongoing training meetings in which residents can participate (S59CAPA).

Factor 5 comprised four elements with higher loadings that include statements measuring indicators of the capacity and effectiveness dimension. The statements referred to respondents believing other institutions are needed to help manage natural resources (S61CAPA) and that it is necessary to strengthen the functioning of the CMC through equipment, allowances, and other means (S58CAPA). Additionally, subcommittees are considered optimal for the CMC to perform appropriately (S60CAPA). Finally, the respondents view projects promoted for the conservation of forests as positive (S32EFFE). Overall, this factor indicates that the respondents believe in the importance of including other actors influencing the PNBR and the need for external support to strengthen the CMC.

CMC performance using Likert-scale analysis.

The residents of the PBNR believe that the CMC is committed to the sustainability and socio-economic development of their municipalities in managing the reserve (S11gLOC, 71.2% agreement). They also believe that the implementation of activities delivers positive social impacts for their territories (S13gLOC, 81.5% agreement). However, only 30% of the residents interviewed knew that there was a formal arrangement for managing the PNBR when asked about who oversees the reserve management. Furthermore, 90% of the interviewees were not aware of the annual sustainability reports generated by the multi-actor platform co-managing the PBNR. Additionally, the majority of residents are not aware of the financial mechanisms existent to support the sustainability of the PBNR.

Regarding the efficiency dimension, the respondents mentioned that the multi-actor platform (CMC) does not inform them promptly about essential changes in the management regime of the PNBR. Furthermore, they reported not knowing the crucial aspects of the PNBR co-management plan (S28EFFI, 53% of responses) (Supplementary material, Appendix A).

Photo 2.
Offices of the municipal environmental commission and the environmental and natural resources ministry in Waslala, Nicaragua. Photo N. Sepúlveda.

In terms of effectiveness, 89% of the residents agreed that "implemented projects" seemed optimistic for forest conservation (S32EFFE, 89% of agreement). They also believed that there are coordination mechanisms between CMC and the local organisations (S34EFFE, 62% of agreement). Regarding the representation of their municipalities in the committees that make decisions about forest conservation (S35EFFE), 47% of the residents agreed that their municipalities are well represented in the committees, 25% showed neutrality, and 28% believed that local authorities are not well represented in the decision-making process (S35EFFE). Forty-one per cent of the respondents agreed that CMC has credibility in the territory (S38EFFE), and thirty-six per cent of the residents disagree with this statement.

Regarding participation, there was a high percentage of neutral responses in the evaluated indicators (Appendix A). In terms of transparency, 68% of respondents agreed that they could access information about current forestry and environmental good practices projects (S47TRANS) if they needed to. Additionally, 50% agreed that they could provide feedback to the CMC through their representatives (S48TRANS). However, 49% of participants indicated that they do not approach the CMC to request information related to forest management activities (S49TRANS).

Regarding accountability of the CMC, most indicators received a high percentage of neutrality and negative views from the interviewees. For instance, residents do not know if the decisions made by the CMC are documented in a registry (41% of the respondents) or if each member of the CMC has a specific role (S52ACCO, 46% of the responses). Additionally, 59% of the respondents concurred that there is no public information about the salaries of the CMC members (S54ACCO), and 35% neither agreed nor disagreed with this statement.

In terms of capacity, 90% of the respondents agreed that other organisations/institutions are needed to aid in managing natural resources (S61CAPA). Additionally, 85% of the respondents agreed that it is necessary to strengthen the functioning of the CMC, with only 3% showing disagreement with this statement (S59CAPA).

The respondents also believed that sub-committees are the best instrument for the CMC platform to perform adequately (S60CAPA, 79% of agreement), 16% of the participants gave no opinion, and the remaining 5% showed disagreement with the statement. Furthermore, 52% of the respondents agreed that the decision-makers of the CMC have the leadership, experience, and abilities required (S57CAPA).

Regarding indicators measuring conscience, there was a 99% agreement among respondents regarding the positive role of trees in climate change mitigation and climate effects regulation (S64CONS and S73CONS) and that trees have a positive effect at the farm level related to climate change (S69CONS). Additionally, 98% of the respondents agreed that planting trees on farms helps to reduce the effects of climate change (S77CONS) and increases the productivity of the farm (S62CONS). Furthermore, 94% of the respondents believed that planting trees on farms is an investment to obtain future incomes (S76CONS) and agreed that trees favour water infiltration and water recharge (S63CONS). However, a high percentage of disagreement was mentioned regarding CMC and dwellers' behaviour. For example, 42% of the respondents said that their beliefs about tree benefits had not been influenced by the actions implemented by the members of the CMC (S74CONS), whereas 45% mentioned that the CMC activities had influenced their beliefs. Likewise, 56% of the respondents indicated that they do not implement on their farms the technical recommendations received by the CMC members, whereas 45% agreed they implement the advice given by the CMC members. Regarding tree planting responsibility, a high percentage of agreement was reported (90% and 98%, respectively) among the respondents, indicating that it is not the responsibility of only ranchers (S66CONS) or coffee farmers (S67CONS) to plant trees, it is a shared responsibility. However, the respondents agreed in the importance of tree planting in their farms.

Tree cover changes on farms of the residents of the PNBR as reported by landowners.

Users of the PNBR were also asked about the number of trees managed on their agricultural lands. Landowners reported an increase in tree numbers in agricultural lands when we compared the number of trees registered in 2013 and 2020, and this difference was statistically significant ($t = -1.6469$, $df = 804$, $p < 0.005$). The positive changes ranged from 5.6% to 2757% and were reported by 86% of the respondents. Less than 1% of the respondents did not have trees in their agricultural lands in 2013. Four per cent of the residents retained the same number of trees in 2013 and 2020 in their agricultural lands. Five per cent of the interviewed reduced tree cover in their agricultural lands, with losses ranging from 7.7% to 98% of the total of individuals reported in 2013. Furthermore, 5% of the residents did not change their perspectives about trees as they did not include trees in their agricultural lands in 2020 or 2013.

Regarding existing natural regeneration areas on farms, 72% of the interviewees reported they do not have natural regeneration areas on their property. Two interviewees reported a decrease in natural regeneration areas (-16% and 100%). Additionally, 11% of the respondents reported the same natural regeneration area in 2013 and 2020. Only 8% of the interviewed reported an increase in size under natural regeneration areas compared to 2013, and 6% reported having natural regeneration areas compared to 2013.

Case Study 2: Resilient cocoa farmers through local-led organisations

Socio-economic characteristics

A total of 29 cocoa farmers participated in the assessment, 80% of the total participants of the 2012 study. Farmers were 58 years old on average. Most of the interviewees were men (96%), and only one woman was the head of the household. Eighty-three per cent were identified as farm owners, 10% were identified as owners and administrators, and the remaining 7% as "other" (i.e., son owners). On average, 5.7 persons live in a household. Participants reported an average of 41 years of agricultural experience, with 23 years on average involving cocoa cultivation (table III).

Despite a high literacy rate of 81% among the interviewed cooperative members, only 17% had completed primary school, 3% had completed secondary school, and 3% had obtained a technical degree. The remaining 19% either did not know or did not provide an answer.

Natural and built capital dimensions: changes in farm areas, cocoa cultivated areas, tree cover in cocoa, and use of cocoa AFS sub products between 2012 and 2020.

Interviewees reported a decline in the number of tree individuals in the shade canopy component intercropped with cocoa between 2012 and 2020 (table IV). However, only the number of individuals reported for bananas was statistically different between years ($p < 0.05$). There was a slight increase in the farm area and in the cocoa area between 2012 and 2020, but this difference was not statistically different. There was also an increase in cocoa plants cultivated per hectare.

Forty-five per cent of the farmers had diversified their farms mainly by including fruit and service trees in their cocoa plots and cultivating staple crops (maize and beans) in adjacent fields. The remaining 65% mentioned they did not diversify their cocoa farm in the last five years. When asked about the use of agroforestry products, there was an increase in the number of products used from the cocoa AFS for general well-being, household self-consumption, and feeding animals compared to the numbers of farmers reporting the use of agroforestry products in 2012 (table V).

Table III.
Socioeconomic characteristics of the cocoa farmers in Waslala, Nicaragua.

Variables	Value
Family Members (#)	5.7 (± 3.19)
Only sons/daughters	3.34 (± 2.88)
Years of experience in agriculture	41.83 (± 15.99)
Years of experience in cocoa cultivation	23.10 (± 8.47)
Years of membership with CACAONICA	17 (5.4)

Table IV.
Changes in the area and shade composition of cocoa agroforestry system of Waslala, Nicaragua.

Indicators	Value 2012	Value 2020	Change	*p* -value
Farm area (ha)	18.5	18.7	↑	0.9758
Cacao area (ha)	2.48	3.4	↑	0.1851
Cocoa trees (# individuals/ha)	646.8	709.9	↑	0.3484
Musaceae intercropped (# individuals/ha)	161.7	103.08	↓	0.08968
Shade trees (# individuals/ha)	73	65.5	↓	0.7247

p-value: statistical significance

Table V.
Responses of changes in the use of cocoa agroforestry systems products between 2012 and 2020 of Waslala, Nicaragua.

Indicators	2012*	2020*	% Change
Use of products from the companion trees/crops from the cocoa AFS			
Greater than five products	8	16	100.0
Less than five products	21	13	-38.1
Use of products from the companion trees/crops from the cocoa AFS for self-consumption			
Greater than five products	8	14	75.0
Less than five products	20	15	-25.0
Use of products from the companion trees/crops from the cocoa AFS for animal feeding			
Greater than three products	3	6	100.0
Less than three products	21	17	-19.0

*Values correspond to the number of farmers answering which use category is linked to a specific year.

Tree cover recognition

Thirty-eight per cent of the respondents did not report natural regeneration areas on their farms between 2012 and 2020. Only one cocoa farmer reported a decrease in the existent area under fallow (natural regeneration) in its property of 35% compared to the 2012 area. Twenty-four of the respondents (83%) maintained the same area under natural regeneration in their farms in 2012 and 2020. Ten per cent of the interviewed reported in 2020 that they now manage natural regeneration areas in their farms compared to 2012. Thirty-one per cent of cocoa farmers increased their natural regeneration area; the changes in areas ranged between 33% and 102% compared to 2012.

Based on the responses of cocoa farmers, there appears to be sufficient water from rivers and streams that cross their properties, so it is not common to build water reservoirs or other infrastructure to store rainwater. Only four farmers (14%) reported having infrastructure for water capture on their properties.

Financial capital: changes between 2012 and 2020

Fifty-five per cent of farmers reported a decrease in cocoa production for 2020 compared to 2012, with an average reduction of 45% in yields of dry cocoa beans (from 13.7 qq/ha in 2012 to 7.6 qq/ha in 2020, p = 0.04182; 1 qq equivalent to 1 bag of 46 kg). The negative changes ranged from 0.7% to 100% (total loss). The main reasons for these losses were attributed to weather factors (i.e., too much rain affecting flowering and fruit production), pests, and diseases (Moniliasis), ageing cocoa plantations, poor management practices, abandonment of cocoa plantations, and renovation of old cocoa plantations. However, 28% of farmers reported an increase in cocoa production, ranging from 11% to 76%, mainly due to good management practices (such as pruning of cocoa plants) and new plantations entering the production stage.

Regarding income generated from cocoa sales, 45% of farmers reported a decrease in revenue compared to 2012, with losses ranging from 8% to 80% per hectare per year. This decline was attributed to lower cocoa yields and prices in the local market for non-fermented cocoa. However, 48% of farmers reported an increase in income from cocoa sales, ranging from 3% to 107% compared to 2012. This increase was mainly due to higher global prices (43% of respondents) and certification (57% of respondents).

Interviewees reported a wide range of incomes from cocoa sales per hectare per year in 2012, ranging from USD 200 to USD 3500. The reported prices for cocoa beans in the national market in 2012 were USD 3.9/kg for certified cocoa and USD 2.2/kg for conventional-fermented cocoa. In 2020, reported incomes from cocoa sales per hectare per year ranged from USD 73 to USD 1575. The reported prices paid for cocoa beans in 2020 were between USD 2.8-3.1/kg for certified cocoa, USD 2.5/kg for conventional-fermented cocoa, and USD 1.8/kg for dry-non-fermented cocoa.

In terms of additional income from the sale of the produce from trees/crops associated with the cocoa AFS, only 17% of the farmers reported 2012 income from this activity. The income per ha/year was between USD 20 and USD 100/ha/year. In 2020, only 14% of the farmers sold any products from the companion trees/crops, and the income provided ranged from USD 30/ha/year to USD 900/ha/year. There was a decrease in the number of farmers reporting consumption of products from the cocoa AFS to reduce expenses (a reduction of 29%).

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Cocoa beans are typically transported from the communities to the municipality of Waslala via public transport, such as trucks and buses. The average distance reported by farmers to the nearest market (cooperative/intermediaries) is 12.99 km (±14.21 km), which takes around one hour (± 53.6 minutes) to travel from their farm. Currently, there has been no negotiation between CACAONICA and transport cooperatives regarding the transportation of cocoa beans to improve the service.

The social and cultural capital

According to table VI, 62% of cocoa farmers are currently members of CACAONICA, while 38% (11 farmers) have left the cooperative. Of those who left, four farmers have joined other cocoa cooperatives. The reasons cited for leaving CACAONICA include delayed payments, mismanagement of funds by the board of directors, and payments being made in-kind rather than in cash. Some farmers also stopped contributing monetarily to the cooperative, while others simply wanted a fresh start in other organizations. Currently, only 38% of cocoa farmers are actively involved with the cooperative, while 56% no longer maintain a relationship with CACAONICA either because they are no longer members or are not interested in cooperative activities.

According to the survey results, only 24% of the respondents sell their cocoa production to CACAONICA, while the remaining 76% sell their produce in local markets, intermediaries, or other local cooperatives. The reasons cited for not selling their cocoa to CACAONICA include no longer being cooperative members, the cooperative not having funds to pay farmers, and a preference for selling in the local market due to low cocoa quality.

Regarding training and capacity building, 79% of the farmers responded that they have participated in training events; on average, a farmer participated in 1.9 events per year between 2012 and 2020.

Human capital dimension

Twenty-one farmers (71%) mentioned participating in Field School (FS) programs between 2012 and 2020, with one farmer participating in up to nine events/sessions between 2012 and 2019. The farmers who participated in FS have put into practice what they learnt in the sessions, mainly to increase cocoa productivity. Additionally, half of the farmers reported that they had received technical assistance provided by the cooperative or projects, with an average of 2.7 visits per year.

Table VI.
Responses of cocoa farmers (number of farmers) regarding cooperative membership and educative program broadcasting.

Indicators	Yes	No
Still a member of CACAONICA (2012-2020)	18	11
Actively involved with the cooperative between 2012-2020	9	20
Between 2012-2020 farmers only sell cocoa beans to CACAONICA	7	22

Family labour in cocoa production.

Ten farmers (34%) indicated an increase in family labour to produce cocoa. This increase in labour was due to: 1) an increase in cocoa area; 2) better management/increase in yields; and 3) sons/daughters have come to working age. While seven cocoa farmers (24%) indicated that the family labour decreased because sons/daughters have moved, there was low interest in cocoa cultivation, elder/medical reasons, and less work in the cocoa plot. However, eleven cocoa farmers (38%) indicated that family labour was the same between 2012 and 2020. One farmer said he abandoned cocoa cultivation.

Discussion

In our study, we presented two types of analysis to demonstrate the influence of existing institutional arrangements on landscape governance from the spatial planning perspective. Specifically, we examined farmer and PA residents' opinions on the functioning of a multistakeholder platform and the contribution of a cooperative in building farmers' resilience aimed at coherent and coordinated decision-making within a bounded geography (Münter and Osterhage 2018). This was exemplified by the hybrid governance model, which involved the mobilisation of civil society, public offices, and the engagement of municipalities in the local land use planning. According to the results, this engagement model facilitated a collaborative process, a key principle towards landscape governance (Ros-Tonen et al. 2014). Additionally, we explored the strengthening process of a local organisation aimed at enhancing the social learning process and positively impacting the livelihoods of small cocoa farmers. This process also aimed to improve the member organisation's preparedness for changing climate conditions. Both study cases showcased the opportunities to increase awareness of the actors and entities in a bounded geography of how the multiple interests and uses influence decisions in a territory.

These stakeholders and the tools they use (i.e., management plan, cooperative engagement-farm planning) influence the landscape attributes, especially regarding land cover and land use configuration. Land users/managers (inhabitants) of the PNBR have great regard for the local platform in charge of the nexus between conservation, policies, and social and economic development of the territory. They believe the CMC has credibility and enough coordination mechanisms to work/engage with other organisations and institutions working in the PNBR. These features are key in landscape governance as decision-making networks (social actors) are diverse and continuously changing (Beunen and Opdam 2011). These findings are consistent with other scholars and practitioners' reports on the important role of multi-actor platforms as a mechanism of dialogue, concerted actions, and decision-making to address issues related to the management of natural resources or meet the needs of the communities living in a territory (Larson and Sarmiento Barletti 2020).

By involving all relevant actors in decision-making processes, it is possible to achieve sustainable outcomes that benefit both conservation goals and the people living in the area. For example, in Central Mexico, it was demonstrated the importance of participatory multi-actor engagement in achieving consensus and reconciling the goals of a PA with the needs of local communities (Caro-Borrero et al. 2020). In this case, the PA was created to protect the forest and aquatic resources. Water management was the common ground to reconcile the goals of the PA and the communities living in the PA, as some communities were facing water scarcity. Another key feature to advance the landscape approach (Sayer et al. 2013)

To facilitate effective integration and collaboration among the diverse actors involved, collaborative tools such as multi-level, multi-sectoral, and multi-organisational partnerships are implemented (Lockwood et al. 2010). Sarmiento Barletti et al. (2020) conducted a study to examine the effectiveness of multi-stakeholder forums (MSF) for sustainable land use management. Their findings indicate that the engagement of implementers and their willingness to learn from and listen to stakeholders is crucial. This requires understanding of the existing patterns of relationships among stakeholders and institutions and their power relations. In the PNBR, the CMC has been the platform for reconciling biodiversity conservation, ecological integrity, and socioeconomic development of the territory. As was shown in the analysis of good governance, the residents have agreed, in general, on the good intentions of the platform in bringing socio-ecological benefits to the communities.

Studies carried out by CATIE in the PA have shown that the residents and municipalities embedded in the buffer and area of influence of the PNBR recognised a plethora of environmental services provided by the PA, especially those associated with water provision, hydroelectric, non-forest and forest products, and crop production (see Bogarín Bermúdez 2014). Similarly, in our study, land users/managers recognised the positive role of trees in productivity, fighting climate change, and income generation. Therefore, these individuals reported an increase in tree cover on farms between 2012 and 2020. In the Paraíba Valley (Brazil), societal engagement and environmental policies (command and control) triggered forest/tree recovery in the region (Silva et al. 2017).

Cooperatives as a place-based approach and self-governance form of collaboration are recognised mechanisms that can further advance sustainability and adapt farming practices to restore and improve their endogenous resource base (Swagemakers et al. 2019). In our case, the cooperative CACAONICA has been involved in various initiatives aimed at strengthening its organisational, productive, processing, and commercial position in the cacao value chain of Nicaragua (CATIE 2007; Montoya et al. 2013). These efforts have been undertaken to improve the well-being of cocoa farmers in the region, who rely heavily on cocoa farming for their livelihoods. According to previous studies, cocoa farms in Waslala provide 40% of the total income to cocoa families (CATIE 2010). Local organisations, such as CACAONICA, have been identified as a key factor in strengthening farmers' livelihoods and reducing the negative impact of vulnerability factors, such as droughts, price instability, and social-political conflicts (Abruzzese et al. 2005). Although, according to our results, more than half of the cocoa farmers interviewed are members of CACAONICA, only a quarter of them sell their cocoa beans through the cooperative. Furthermore, there has been a decline in cocoa production and income, indicators evaluated as a proxy of financial resilience. This could be due to most farmers selling their cocoa beans in the local market through intermediaries rather than directly to the cooperative, endogenous factors affecting the performance of the cooperative, and the institutional arrangements maintained by the cooperative with their members, providers, and the main buyers (Montoya Zumaeta 2009).

We found a positive trend of farmers in managing natural resources on their farms. Yet, it has not translated into better financial status, probably because there is no alignment with processes outside the farm and the cooperative. Thus, there is still low reporting on the commercialisation of agroforestry products (trees/crops associated with cocoa) to generate income. Cocoa farmers recognise the value of trees in their plots; nevertheless, this recognition is not associated with having more trees integrated with cocoa plots or managing more natural regeneration areas in their properties, indicating that other factors are influencing tree cover change at the farm level (used here as a proxy of better adaptive capacity).

Our second institutional arrangement provided insight into how local self-governance mechanisms can enhance resilience and farmers' practices, however, well-implemented and organised cooperatives are needed to realise the full potential of this collaboration for advancing landscape management approaches.

Conclusion

The case studies presented evidence of the effectiveness of landscape governance as seen by local land users through the support of existing arrangements in a territory. The multi-stakeholder platform and agricultural cooperatives (i.e., as part of the learning process in a region) were catalysers for integrating new concepts/approaches in the territory and advancing sustainability issues and landscape decisions with stakeholders and local users. However, engaging with farmers' organisations is a double-edged sword, as cooperatives can lose their position, power, and influence in a territory and negatively affect their associates and their capacity to respond to stresses and shocks in the long term. Overall, our study contributes to the understanding of governance and social arrangements in landscape management. It emphasises the importance of engaging stakeholders and other actors of interest involved in shaping landscape structure, and different institutional

arrangements are needed (i.e., multi-actor platforms and cooperatives) to achieve sustainable landscape management outcomes.

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Data availability statement
The data that supports the findings of this study are available upon request to the corresponding author. The data are not publicly available for privacy reasons.

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Appendix A.

Table 1A.

Responses (in percentage) of the residents (n = 403) of The Peñas Blanca natural reserve around statements (indicators) evaluating governance performance of the CMC platform.

Governance dimension	Statements	Completely disagree	Not agree	Undecided/ Neutral	Agree	Completely agree
glocal	S11gLOC	1.0	8.7	16.4	64.3	9.7
	S12gLOC	0.5	12.4	32.8	52.4	2.0
	S13gLOC	0.0	5.7	11.7	**76.4**	6.2
	S14gLOC	2.7	10.9	40.9	43.7	1.7
	S15gLOC	2.2	10.4	17.9	**66**	**3.5**
	S16gLOC	2.2	7.7	19.1	**67.7**	**3.2**
	S17gLOC	0.0	6.7	25.3	**64.5**	**3.5**
Efficiency	S27EFFI	2.2	19.1	34.7	41.7	2.2
	S28EFFI	**5.7**	**53.3**	22.3	18.1	0.5
	S29EFFI	3.5	19.4	45.4	31	0.7
Effectiveness	S32EFFE	0.2	2.0	6.5	**70.2**	**21.1**
	S33EFFE	2.2	49.9	17.4	29.5	1.0
	S34EFFE	2.2	10.9	25.3	57.8	3.7
	S35EFFE	4.7	23.6	24.8	45.4	1.5
	S36EFFE	2.5	21.6	39.2	35.5	1.2
	S37EFFE	2.2	14.4	38.5	42.4	2.5
	S38EFFE	6.0	30.3	23.1	39.5	1.2
Participation	S41PART	0.7	7.7	**42.9**	42.7	6.0
	S42PART	6.2	55.3	14.1	23.8	0.5
	S43PART	4.0	27.0	30.3	38.5	0.2
	S44PART	5.0	31.0	36.0	27.3	0.7
	S45PART	5.5	20.6	44.7	28.3	1.0
Transparency	S47TRANS	1.0	13.4	17.6	**65.0**	**3.0**
	S48TRANS	4.5	25.1	20.3	49.1	1.0
	S49TRANS	3.0	44.9	14.6	36.2	1.2
	S50TRANS	3.5	15.6	38.7	37.5	4.7
Accountability	S51ACCO	1.5	7.2	41.4	47.9	2.0
	S52ACCO	1.2	12.9	45.9	39.2	0.7
	S53ACCO	2.5	10.9	**51.6**	34.5	0.5
	S54ACCO	6.7	52.1	34.7	6.0	0.5
	S55ACCO	3.0	17.1	47.9	31.8	0.2
	S56ACCO	3.5	16.1	49.4	29.8	1.2
Capacity	S57CAPA	2.5	14.1	31.3	51.1	1.0
	S58CAPA	0.0	3.5	11.9	**68.2**	**16.4**
	S59CAPA	3.0	37.0	18.1	40.2	1.7
	S60CAPA	0.0	4.7	16.4	**70.7**	8.2
	S61CAPA	0.5	3.2	6.2	**53.3**	**36.7**
Conscience	S62CONS	0.0	0.7	1.5	**59.1**	**38.7**
	S63CONS	0.0	0.7	5.7	**45.9**	**47.6**
	S64CONS	0.0	0.0	0.7	**47.6**	**51.6**
	S65CONS	0.7	6.9	5.7	**59.1**	**27.5**
	S66CONS	**56.6**	40.7	1.2	0.7	0.7
	S67CONS	**56.8**	41.2	1.2	0.2	0.5
	S68CONS	3.2	8.7	9.9	**68.0**	**10.2**
	S69CONS	0.2	0.0	1.0	**61.5**	**37.2**
	S70CONS	12.9	51.1	10.2	22.8	3.0
	S71CONS	14.1	64.0	12.9	8.7	0.2
	S73CONS	0.0	0.2	0.7	**60.0**	**39.0**
	S74CONS	4.0	37.7	13.2	39.7	5.5
	S75CONS	9.4	46.7	13.2	29.3	1.5
	S76CONS	0.0	1.5	4.7	**77.4**	**16.4**
	S77CONS	0.0	0.2	1.5	**59.8**	**38.5**
	S78CONS	0.2	5.7	16.4	**65.0**	**12.7**
	S79CONS	0.0	1.0	13.2	**68.0**	**17.9**
	S80CONS	0.5	11.2	11.4	**58.3**	**18.6**

In bold and highlighted values with high percentage of agreement, disagreement, or neutrality among respondents; S11gLOC: formal commitment to sustainability and environmental, social, and economic objectives in the municipality; S12gLOC: the best practices are promoted for tourists and other users who visit the reserve; S13gLOC: the social impacts of the implementation of actions in the PBNR are positive for your municipality; S14gLOC: economic development projects are benefiting indigenous peoples in your municipality; S15gLOC: there exist a formal commitment to the sustainability and social, environmental and economic objectives for your municipality and the PBNR; S16gLOC: economic impacts of the projects implemented in the PBNR are positive; S17gLOC: environmental impacts of the projects implemented by the CMC are positives; S27EFFI: the CMC invests money in updating innovative technological tools to keep the population informed; S28EFFI: residents know the important aspects of the PBNR very quickly – the CMC inform you promptly about the important changes in management in your municipality; S29EFFI: implementation deadlines (of projects) are respected; 3EFFE: residents have access to information immediately; S34EFFE: there exist mechanisms of coordination between CMC and the rest of organizations in the municipality; S35EFFE: (my) municipality is well represented on the Committees that make decisions regarding forest conservation; S36EFFE: projects meet the objectives of the management plan for which they were designed; S37EFFE: CMC manage effectively its relationship with other actors; S38EFFE: CMC has high credibility in the territory; S41PART: representatives of your municipality have easy access to the CMC; S42PART: your representative informs you of the decisions made in the CMC; S43PART: I believe that the CMC is willing to consider recommendations from the civil society in general; S44PART: (My) demands - opinions are channeled by the representative of the municipality to the CMC; S45PART: The CMC handles conflicts appropriately; S47TRANS: I believe that I can access information on forestry projects and good environmental practices if required; S48TRANS: residents can give feedback to the representative of your municipality before the CMC without any problem; S49TRANS: If residents require information on activities related to forest management, they go to the CMC; S50TRANS: There is a flow of information between the municipalities that participate in the CMC; S51ACCO: all the decisions made by the CMC are documented in records; S52ACCO: each member of the CMC have clarity in its role in the committee; S53ACCO: CMC has a clear mandate and vision and there is no duplicity with any other institution/ organization in the reserve; S54ACCO: The remuneration of CMC members who receive salaries is publicly known; S55ACCO: indicators of performance of the CMC are clear; S56ACCO: the external evaluations of the CMC have been robust to know the areas for improvement; S57CAPA: Members making the decisions in the CMC have the competencies, leadership, and required experience; S58CAPA: it is necessary to strengthen the functioning of the CMC (i.e., infrastructure - offices-equipment); S60CAPA: subcommittees are optimal for the CMC to perform properly; S61CAPA: I believe that we need other institutions so that they can help in the management of natural resources; S62CON: do you believe that planting trees on my farm helps to improve productivity; S63CONS: do you believe that trees favor infiltration and recharge of water sources; S64CONS: do you believe that trees help in reducing the problems of climate change; S66CONS: I believe that farmers are the only ones who should plant trees on their farms; S67CONS: I believe that coffee growers are the only ones who should plant trees on their farms; S69CONS: I believe that the trees on farm help to reduce climate change; S70CONS: I have included trees on my farm because my best friends have recommended it to me; S71CONS: I always go to a member of the CMC when I need help in which trees to plant; S73CONS: Do you believe that trees help in reducing the effects of climate change; S74CONS: you consider that the actions promoted by the members of the CMC have influenced my opinion regarding the benefits I receive for planting trees; S75CONS: I normally implement on my farm the technical recommendations that CMC members give me; S76CONS: I believe that planting trees on the farm is an investment to earn income in the future; S77CONS: I believe that planting trees on farm helps in reducing the effects of climate change; S78CONS: Do you consider that the natural regeneration areas are an investment to obtain income in the future; S79CONS: Do you believe that natural regeneration areas help water infiltration; S80CONS: I believe that trees provide economic benefits, but I have to wait a long time to reap the benefits.

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