Landscape and Urban Planning 129 (2014) 1–11

Landscape and Urban Planning

journal homepage: www.elsevier.com/locate/landurbplan

Research Paper

Integrated landscape management for agriculture, rural livelihoods, and ecosystem conservation: An assessment of experience from Latin America and the Caribbean

Natalia Estrada-Carmona[a,b], Abigail K. Hart[c,d], Fabrice A.J. DeClerck[e], Celia A. Harvey[f], Jeffrey C. Milder[c,d,*]

[a] Centro Agronómico Tropical de Investigación y Enseñanza, Turrialba 30501, Costa Rica
[b] Department of Fish and Wildlife Sciences, University of Idaho, Moscow, ID 83844, USA
[c] EcoAgriculture Partners, 1100 17th Street NW, Suite 600, Washington, DC 20036, USA
[d] Department of Natural Resources, Cornell University, Ithaca, NY 14853, USA
[e] Agrobiodiversity and Ecosystem Services Program, Bioversity International, Montpellier 34397, France
[f] Betty and Gordon Moore Center for Science and Oceans, Conservation International, 2011 Crystal Drive, Suite 500, Arlington, VA 22202, USA

HIGHLIGHTS

- We surveyed 104 integrated landscape initiatives in Latin America and the Caribbean.
- Such initiatives are growing as a means to manage for landscape multifunctionality.
- Multi-objective management is associated with greater numbers of positive outcomes.
- Unsupportive policy frameworks may limit effectiveness and scalability.

ARTICLE INFO

Article history:
Received 9 August 2013
Received in revised form 8 May 2014
Accepted 9 May 2014
Available online 2 June 2014

Keywords:
Latin America
Landscape planning
Multifunctional
Agriculture
Rural development
Biodiversity

ABSTRACT

Approaches to integrated landscape management are currently garnering new interest as scientists, policymakers, and local stakeholders recognize the need to increase the multi-functionality of agricultural landscapes for food production, livelihood improvement, and ecosystem conservation. Such approaches have been attempted in many parts of Latin America and the Caribbean (LAC) but to date there has been no systematic assessment of their characteristics, outcomes, and limitations. To fill this gap, we surveyed participants and managers in integrated landscape initiatives throughout the LAC region to characterize these initiatives' contexts, motivations and objectives, stakeholders and participants, activities and investments, outcomes, and major successes and shortcomings. Results from 104 initiatives in 21 countries indicate that integrated landscape management is being applied across the region to address a variety of challenges in diverse contexts, and that use of this approach is expanding. Initiatives reported investing across four key "domains" of landscape multi-functionality: agricultural production, ecosystem conservation, human livelihoods, and institutional planning and coordination. Initiatives reported positive outcomes across all four domains, but particularly with respect to institutional planning and coordination. Initiatives with larger numbers of objectives, investments, and participating stakeholder groups all reported significantly higher numbers of positive outcomes, suggesting significant value in the core precepts of the integrated landscape management approach. Key challenges identified by survey respondents—including the long time horizon required to achieve results at scale, unsupportive policy frameworks, and difficulty in engaging the private sector and other important stakeholders—offer insights for improving the future effectiveness of integrated landscape initiatives.

1. Introduction

Recent years have witnessed a proliferation of research on the impacts, tradeoffs, and ramifications of rural land-use management relative to the set of social and ecological goods and services

* Corresponding author. Current address: Rainforest Alliance, 233 Broadway, 28th Floor, New York, NY 10279, USA. Tel.: +1 6072552298.
E-mail address: jcm85@cornell.edu (J.C. Milder).

http://dx.doi.org/10.1016/j.landurbplan.2014.05.001

that society demands from landscapes, including food and fiber production, biodiversity conservation, ecosystem service delivery, poverty alleviation, and economic development (Barrett, Travis, & Dasgupta, 2011; Brussaard et al., 2010; Tscharntke et al., 2012). Much of this work has highlighted the scale and severity of agricultural impacts on ecological systems, as well as the formidable challenge of designing management approaches to meet escalating global demands for food production and ecosystem services in the context of limited land and water resources, climate change, and widespread ecosystem degradation (Ellis, Goldewijk, Siebert, Lightman, & Ramankutty, 2010; Foley et al., 2005). A parallel stream of work has elaborated a variety of landscape analysis, planning and management approaches to address some of these challenges (De Groot, Alkemade, Braat, Hein, & Willemen, 2010; Nelson et al., 2009; O'Farrell & Anderson, 2010; Selman, 2009).

The increasingly contested nexus between agricultural production, biodiversity and ecosystem service conservation, and economic development in rural landscapes is clearly evident in Latin America and the Caribbean (LAC). This region contains eight of the world's 34 biodiversity hotspots and provides key ecosystem services at local, regional, and global scales (Myers, Mittermeier, Mittermeier, da Fonseca, & Kent, 2000; Turner et al., 2012), but still contains high levels of rural poverty and inequality in many areas (Berdegué et al., 2012). During the last 30 years, the LAC region has accounted for the 35% of the growth in global food production (FAO, 2011). Looking ahead, as other regions of the world became increasingly land and water constrained, or continued to experience low productivity, the region's role as a food exporter is likely to grow, with agricultural land projected to increase 43% by 2050 (FAO, 2011). Historically, agricultural expansion in the LAC region has been associated with the loss of high-biodiversity tropical ecosystems (Clark, Aide, & Riner, 2012), often in a poorly regulated context where economic benefits associated with tropical deforestation accrued inequitably and did little to alleviate poverty (Schatan, 2002).

These dynamics highlight the need for strategies that support the delivery of multiple benefits from rural landscapes by increasing synergies and minimizing or mitigating tradeoffs among food production, biodiversity conservation, ecosystem service provision, and poverty alleviation. Approaches to "integrated landscape management" seek to do so by analyzing, implementing, and evaluating land management decisions relative to multiple landscape objectives and stakeholder needs (Sayer et al., 2013). This is achieved through landscape planning and design processes, improved coordination among sectoral activities and investments, enhancement of human and institutional capacities for decision support and negotiation, and supportive policies and incentives. Integrated landscape management processes may support the alignment of agricultural production and ecosystem conservation at a variety of scales, including both "land sharing" and "land sparing" approaches, as dictated by local context (Cunningham et al., 2013). Integrated landscape management has been practiced and studied under many names, including "whole landscape" management (DeFries & Rosenzweig, 2010), "multifunctional agriculture" (Jordan & Warner, 2010), "ecoagriculture" (Scherr & McNeely, 2008), "bioregional planning" (Brunckhorst, 2000), and "multifunctional landscapes" (Fry, 2001; Naveh, 2001), to name a few. Such approaches have recently garnered new interest as scientists, policymakers, and local stakeholders increasingly recognize both the need and the possibility for more synergistic management of mosaic rural landscapes (LPFN, 2012).

The LAC region has a history of integrated landscape management efforts dating back at least three decades. The region's first formal landscape management paradigm was likely the UNESCO's Man and the Biosphere program (established in 1977), which sought to balance human needs and ecological conservation through multi-objective management of critical landscapes. Beginning in the mid-1990s, the "new rurality" (*la nueva ruralidad*) was proposed as a framework for participatory, place-based economic development that linked agricultural production with rural poverty alleviation (Echeverry-Perico & Ribero, 2002). More recently, the concept of rural territorial development (*desarrollo territorial rural*) has been adopted in several LAC countries as a framework to support rural economic development, improve the multifunctionality of rural regions, and foster constructive interdependence between urban and rural populations (Bebbington, Abramovay, & Chiriboga, 2008; Schejtman & Berdegué, 2008). This approach has been catalyzed, in different places, by government-led efforts as well as by initiatives of rural communities and indigenous peoples.

Simultaneously, the biological corridor concept has been promoted—particularly in Mesoamerica—as a way to increase conservation value and habitat connectivity while improving livelihoods in fragmented landscapes that connect core nature reserves (Harvey et al., 2008; SINAC, 2008). More broadly, conservation-friendly management of agricultural mosaics is now regarded as critical for conserving the region's biodiversity while furnishing key ecosystem services (DeClerck et al., 2010; Perfecto, Vandermeer, & Wright, 2009). Various networks have emerged to support grassroots-led integrated landscape management efforts, such as the Ibero-American Model Forest Network, which was established in 2002 and now includes 27 "Model Forests" in 12 LAC countries, managed for multifunctional outcomes through participatory processes (IMFN, 2013). Beyond these specific paradigms for landscape and territorial management, other approaches such as community-based natural resource management (Armitage, 2005) and the establishment of indigenous and community conserved areas (Kothari, Corrigan, Jonas, Neumann, & Shrumm, 2012) have also been applied widely throughout the LAC region and often share some if not all of the characteristics of integrated landscape management.

But despite the growing practice of and interest in integrated landscape approaches in the LAC region, to date there has been little formal effort to characterize these approaches and their role in helping to address conservation, food production, and rural development challenges. Such work is urgently needed to take stock of the diverse forms, experiences, and results of integrated landscape approaches and to use this information to guide the design and implementation of new and ongoing efforts to reconcile agricultural production, economic development and biodiversity conservation. The purpose of this study is to begin to fill this critical need by conducting a systematic characterization of integrated landscape approaches in the LAC region. Specifically, the study seeks to document the location and context, motivations and impetus, participants and stakeholders, investments and governance structures, outcomes, and most and least successful aspects of integrated landscape approaches in the region, as identified by individuals involved in landscape approaches. Results of the study can help inform recommendations about where and when integrated landscape management may be an appropriate strategy and how landscape management efforts can be designed or conducted to address common challenges and barriers.

As integrated landscape management can take many forms—both explicit and nebulous—in the interest of clearly bounding the purview of this study, we focus our assessment on discernible "integrated landscape initiatives" (ILIs), which we define as projects, programs, platforms, initiatives, or sets of activities that: (1) explicitly seek to simultaneously improve food production, biodiversity or ecosystem conservation, and rural livelihoods; (2) work at a landscape scale and include deliberate planning, policy, management, or support activities at this scale; (3) involve inter-sectoral coordination or alignment of activities, policies, or investments at the level of ministries, local

government entities, farmer and community organizations, NGOs, donors, and/or the private sector; and (4) are highly participatory, supporting adaptive, collaborative management within a social learning framework (Milder, Hart, Dobie, Minai, & Zaleski, 2014). Within these broad parameters, ILIs can take a diversity of forms, including efforts initiated and carried out by grassroots actors and local organizations as well as those catalyzed or substantially supported by external donors, governmental bodies, regional initiatives, private companies, or civil society organizations.

We address seven key questions with respect to ILIs in the LAC region: (1) where and in what contexts are initiatives taking place? (2) What are the motivations behind these initiatives, and what challenges and problems do they seek to address? (3) Who is designing and implementing these initiatives, and how are stakeholders involved? (4) What investments, activities, and governance structures are included in the initiatives? (5) What positive outcomes have practitioners and stakeholders reported? (6) What were key successes and failures associated with these initiatives? (7) Which aspects of initiatives' design, structure, and stakeholder participation most strongly predict levels and types of reported outcomes?

2. Methodology

2.1. Contacted initiatives

We developed and administered a structured survey tool for ILI practitioners and local leaders to characterize a sample of initiatives throughout Latin America (including Mexico, Central America, and South America) as well as the major Spanish-speaking Caribbean jurisdictions of Puerto Rico, Cuba, and the Dominican Republic. We began by searching broadly for potential initiatives by performing online keyword searches, including in project databases and websites of conservation and rural development organizations operating in the LAC region (for a list of search terms, see Supplementary Material). We identified additional initiatives through the networks of experts and organizations participating in the Landscapes for People, Food and Nature Initiative (LFPN, http://landscapes.ecoagriculture.org). Finally, we asked all persons contacted to identify any other initiatives of which they were aware. We screened the initiatives identified to select only those that were currently ongoing and had been active for at least two years at the time of the survey (or, if less than two years old, were continuations of prior efforts in the same landscape).

This process yielded a total of 382 initiatives that appeared to meet the above-stated ILI definition and criteria for duration and active status. These candidate initiatives included grassroots-led efforts as well as projects or programs initiated by groups external to the landscape, such as state or national government, civil society, or research organizations. For each initiative, we contacted and sent the survey to one practitioner or leader (e.g., a community leader, local or international NGO representative, or government official) who we expected to be deeply familiar with the initiative and its components. Of the survey respondents, 84% identified themselves as the coordinator, manager, or executive leader (e.g., director) of their respective ILI. The remaining 16% identified themselves as technical specialists involved in the initiative. The plurality of respondents (44%) was affiliated with local organizations (i.e., within the subject landscape), while others were affiliated with national (30%) or international (26%) government, non-profit, or research institutions.

2.2. The survey

The survey questionnaire included a combination of closed- and open-ended questions oriented around our seven research questions to solicit information on the initiatives' location and context, motivations and impetus, participants and stakeholders, investments and governance structures, outcomes, and most and least successful aspects. The questions related to investments and outcomes were designed to gather information on four key activity domains: agriculture, conservation, livelihoods, and institutional planning and coordination (hereafter referred to as the four "domains"). To report investments and outcomes, respondents selected from a pre-defined set of options that were chosen to include common types of investments and outcomes in each of the four domains; respondents could also write in additional responses beyond these pre-defined choices. We asked respondents to differentiate between investments and outcomes included in or attributable to the initiative itself ("core" investments and outcomes) and those that were initiated or realized as a result of other activities or organizations present in the landscape ("associated" investments and outcomes). Prior to distributing the survey widely, we conducted a pilot test with practitioners from 15 initiatives and revised the survey as needed. The final survey included 45 questions and took about 40 min. to complete (for a copy of the survey, see Supplementary Material).

We used the online service, Survey Monkey, to administer the survey, which we made available in Spanish, Portuguese and English. We first contacted the selected representative of each initiative by email or telephone to request his or her participation. Representatives who did not respond to the survey after the first contact received a follow up email or telephone call. The survey had a response rate of 45% (173 out of 382). We screened the survey responses for completeness and for concurrence with our definition of ILIs. A total of 104 initiatives met these criteria and were included in subsequent analyses (for more information on the 104 initiatives, see the Supplementary Material).

2.3. Data analysis

We treated responses to the closed-ended questions as ordinal or binary variables, depending on the question. For instance, respondents reported on motivations according to their perceived level of importance (ordinal variable with four possible levels), while participation of each stakeholder group in the design and/or implementation of an initiative was reported as either present or absent (binary). We developed a set of indices to quantify the relative number of investments and outcomes in each domain, as well as the relative balance across all four domains. The "investment index" was calculated as the ratio of reported investments in each domain to the total number of possible investments (i.e., the total number of pre-defined choices offered on the questionnaire) in that domain. We normalized the ratio for each domain to a 25-point scale and summed these scores to derive an overall investment index, with possible scores ranging from 0 to 100. We calculated an "outcome index" in the same way. Although these indices do not necessarily reflect all core or associated investments and outcomes in a landscape, nor the magnitude of such investments and outcomes, they are useful for understanding the relative focus and breadth of each initiative across the four domains, as well as level of the "inter-sectorality" of the initiatives.

We analyzed the raw survey data and the derived indices to assess the distribution of each variable as well as the associations among the variables and trends among the initiatives. We used analysis of variance and Pearson's product-moment correlation analysis performed on the indices and other continuous variables to understand the relationship between investments and outcomes in general, and to compare investments and outcomes across the four domains. We used contingency table analyses to compare categorical variables with the index scores, which we transformed into high, medium, and low categories. For the open-ended questions

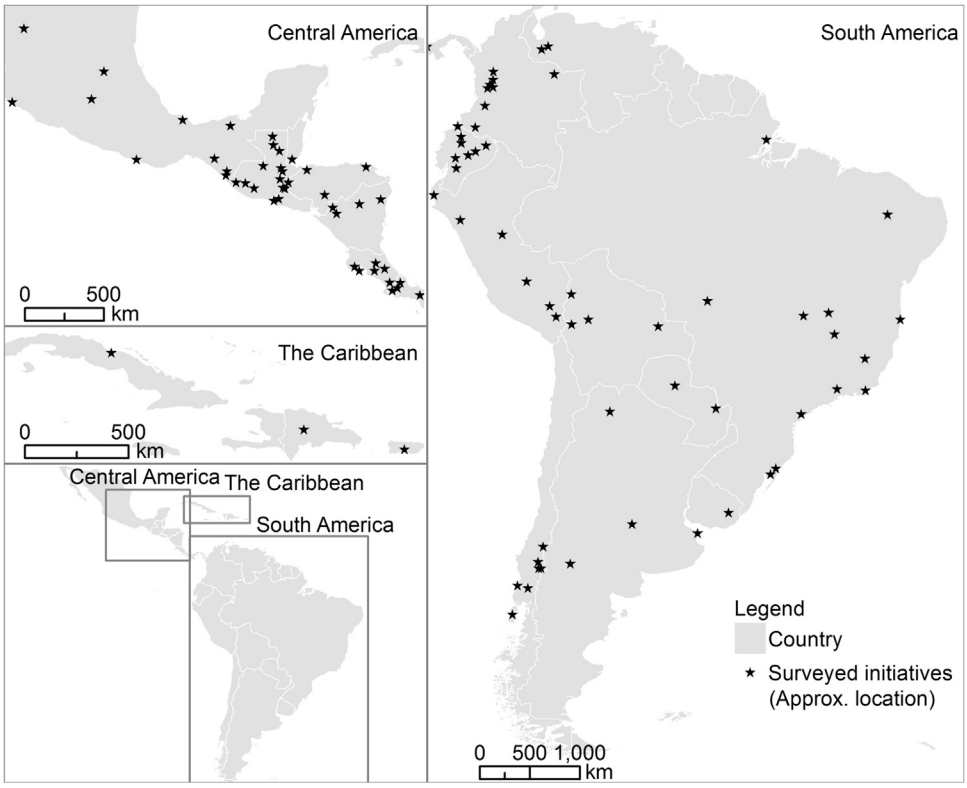

Fig. 1. Locations of the 104 surveyed integrated landscape initiatives across Latin America and the Caribbean.

on most and least successful aspects of the initiatives, we manually compiled responses to identify recurring themes, highlight illustrative examples, and clarify the significance of responses from the closed-ended questions.

3. Results

3.1. ILI locations and contexts

The 104 initiatives represented 21 countries, with the greatest numbers of initiatives in Brazil (13%), Guatemala (12%), Mexico (10%), Ecuador (9%), and Costa Rica (9%) (Fig. 1). Survey response rates were not significantly different from country to country (χ^2 test, $p = 0.29$) and follow-up interviews with non-respondents did not suggest other forms of self-selection bias that might have skewed the sample population ways unrepresentative of the full set of candidate initiatives. The main reasons that non-respondents elected not to participate were: (1) lack of interest, (2) the project or initiative had finished, (3) the contacted person no longer worked with the initiative and had lost contact with it, or (4) the respondent indicated that the initiative or project was not actually an ILI.

Twenty-nine percent of the initiatives were started prior to 2000, 62% began between 2000 and 2009, and 9% began in 2010 or later (Fig. 2). Several of the initiatives were associated with specific landscape management approaches such as biosphere reserves (17%), Model Forests (9%), and biological corridors (6%). Forty three percent had evolved from shorter-term projects into long-term or permanent initiatives. A majority of the initiatives (72%) reported that they used adaptive management. Eighty-eight percent included a monitoring and evaluation component, but only 60% had conducted a baseline assessment as part of monitoring and evaluation.

As expected, the initiatives generally took place in mosaic landscapes with multiple land uses. On average, these landscapes had a mean of five major land uses (SE = 0.2) that each occupied ≥5% of the landscape area and six (SE = 0.2) minor land uses that each occupied <5% of the landscape area. The most frequently cited major land uses were managed pastures with livestock (59%), tropical wet forest (50%), annual grain crops (45%) and montane forest (39%). Villages, towns or cities were present in 93% of the landscapes and considered a major land use in 32%. Industrial or mining areas were present in 43% of the landscapes and considered a major land use in 34%. The most common minor land uses across the surveyed landscapes were annual horticultural crops (65%), forest plantations (59%), and annual grain crops (45%).

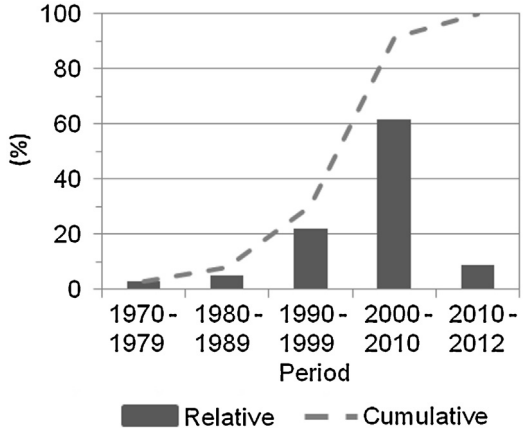

Fig. 2. Percent relative and cumulative frequency of surveyed initiatives ($n = 104$) based on the decade in which they began. Note that the surveyed sample included only initiatives that were currently ongoing and had been active for at least two years at the time of the survey (or, if less than two years old, were continuations of prior efforts in the same landscape).

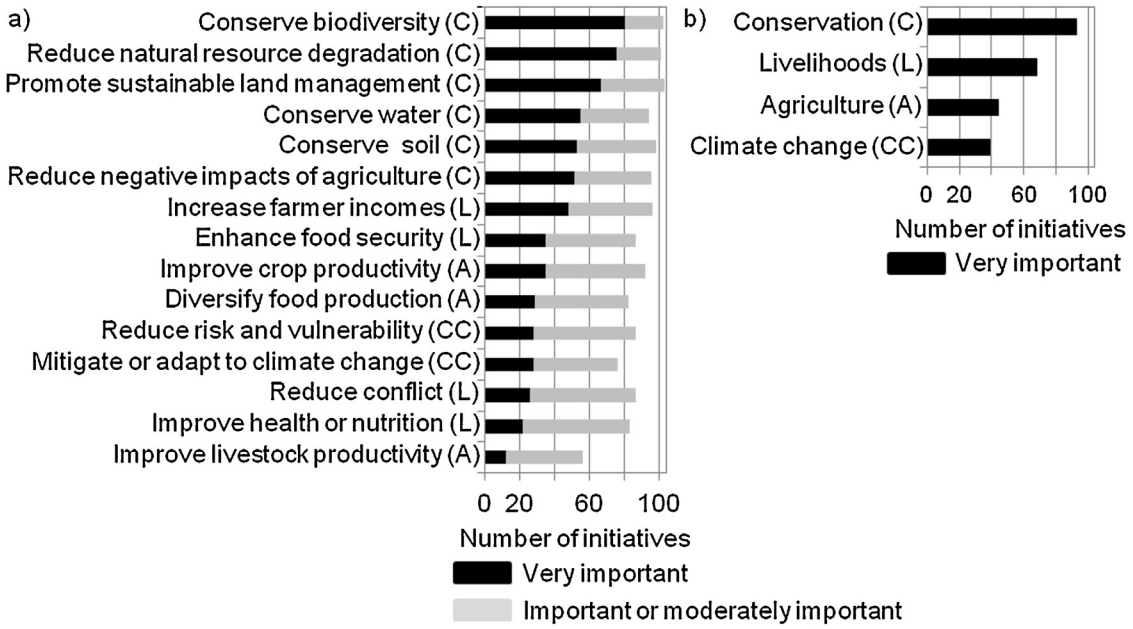

Fig. 3. Motivations for the creation of the surveyed ILIs ($n = 104$), as reported by initiative leaders or participants. Panel (a) indicates the number of initiatives that identified each given motivation as "very important" or as "important" or "moderately important." Abbreviations in parentheses categorize these motivations into four thematic groups: agriculture (A), conservation (C), livelihoods (L), and climate change (CC). Panel (b) indicates the number of initiatives for which the respondent selected at least one "very important" motivation in each group.

3.2. Motivations

Stakeholders were motivated to establish and participate in ILIs both to address current and pending threats and to collaborate around identified opportunities. Respondents identified a mean of six (SE = 0.3) "very important" objectives, four (SE = 0.3) "important" objectives, and two (SE = 0.2) "moderately important" objectives per initiative. Conservation-related motivations were, on average, twice as likely to be considered very important as those related to agricultural production, livelihood improvement, or climate change concerns (Fig. 3). Ninety-three initiatives reported at least one conservation-related objective as very important. Conserving biodiversity and reducing natural resource degradation were the most frequently identified as very important, by 78% and 73% of initiatives, respectively. In addition to the 15 choices of potential motivations listed in the questionnaire, respondents wrote in additional motivations including the strengthening social networks, preserving local culture and traditions, creating new incentives for conservation, and reaching new markets (local, national or international) for organic and sustainably produced agricultural products.

3.3. Participants and stakeholders

Most of the initiatives engaged multiple sectors in landscape management, with respondents reporting a mean of four (SE = 0.2) sectors involved in each initiative (Fig. 4). However, 8% reported the involvement of only one sector. The most commonly involved sector (in 89% of initiatives) was "natural resources, conservation and environment" (characterized in the survey as a single sector). This was closely followed by the agriculture sector (75% of initiatives). The forestry, tourism, and education sectors were also each involved in more than 40% of surveyed initiatives (Fig. 4).

Respondents reported a mean of 11 (SE = 0.4) different stakeholder groups, out of 21 pre-defined questionnaire choices, participating in the design and/or implementation of each initiative. The most frequently involved groups were farmer or producer organizations (in 86% of initiatives), local government leaders (82%), and local non-governmental organizations (NGOs) (78%). At least one international organization (e.g., international conservation or agricultural NGOs, foreign universities or research organizations, and foreign donors) was involved in 87% of initiatives. Stakeholder groups less commonly reported included private

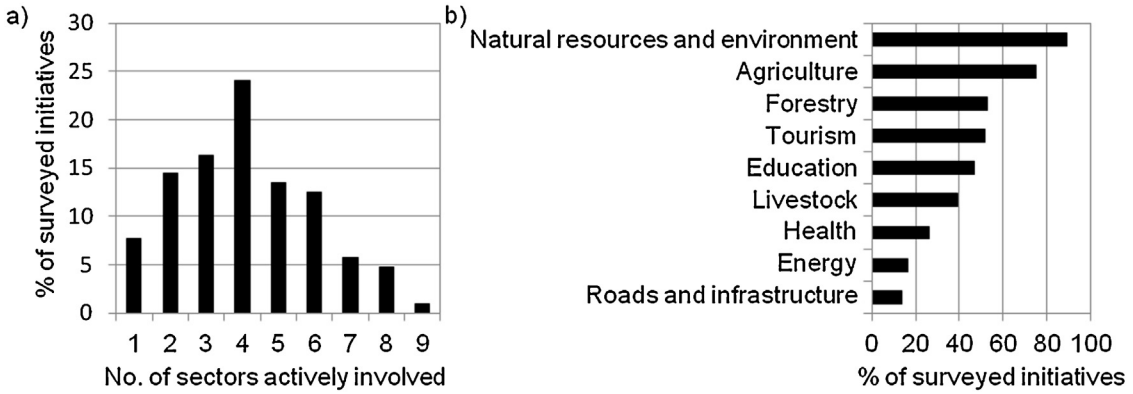

Fig. 4. Number (a) and identity (b) of the sectors involved in the surveyed landscape initiatives.

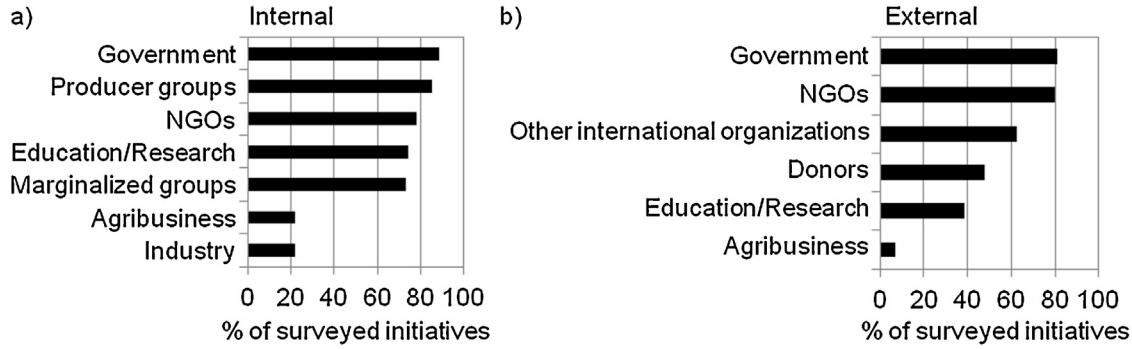

Fig. 5. Proportion of initiatives that included at least one stakeholder group from each of the stated categories, which are denoted as either internal to the landscape (i.e., local individuals, organizations, or institutions) or external to the landscape (i.e., regional, national, or international government entities, companies, or civil society groups).

sector interests including local agribusiness (22%), logging and forest industries (20%), landless people (18%), foreign agribusiness (7%), and mining and extraction industries (7%). On average, the number of participating stakeholder groups internal to the landscape was reported to be greater than the number of participating external stakeholder groups (paired t-test, $p < 0.001$), and in each category government stakeholders were the most commonly represented (Fig. 5). An average of only three stakeholders groups per initiative participated in both the design and the implementation of the initiative, suggesting that different stakeholders played different roles in the initiative, and that there may have been limited continuity from design to implementation.

3.4. Investments, activities, and governance structures

The majority of initiatives (75%) reported core investments in all four domains. The investment index for institutional planning and coordination was significantly higher than that for the other three domains (ANOVA, $F_3 = 3.978$, $p = 0.008$). This domain also included the two most frequently reported investments: strengthening capacity for conducting integrated management (71% of initiatives) and providing technical assistance for integrated landscape management (68% of initiatives). All but one of the activities in this domain was reported by more than half of respondents. Investments least commonly reported were those associated with conventional crop intensification (6%) and irrigation (15%), and those associated with poverty alleviation efforts focused on hunger, malnutrition, and human health (each reported in about 30% of initiatives) (Fig. 6).

On average, respondents reported a significantly higher number of core investments (those considered part of the initiative; mean core investment index = 50, SE = 2.1) than associated investments (those undertaken by others in the landscape; mean associated investment index = 22, SE = 1.6) (paired t-test, $p < 0.001$). However, we were unable to confirm the degree to which this result may reflect perception bias (i.e., seeing the landscape through the lens of the initiative), or respondents' incomplete knowledge of other landscape investments. The two domains with the lowest proportion of core investments—agriculture and livelihoods—were reported to have the highest proportion of associated investments (Fig. 7).

3.5. ILI outcomes

Overall, initiatives were generally reported to have the largest relative number of core outcomes in the domains where they made the largest relative number of investments. The outcome index for the institutional planning and coordination domain was significantly higher than that of any other domain (ANOVA, $F_3 = 15.23$, $p < 0.001$) (Fig. 7). For instance, 80% of initiatives reported achieving improved coordination among stakeholders, 72% reported that local communities gained capacity to manage their natural resources, 65% reported that local communities became more empowered to participate in decision-making, and 64% reported that traditional knowledge about agriculture and natural resources had been preserved or used. Planning and coordination was the only domain in which all possible outcomes given as choices on the questionnaire were reported by more than half of the surveyed initiatives (Fig. 6).

In the agriculture domain, outcomes related to improving the sustainability of agriculture (e.g., protecting agrobiodiversity [57%] and reducing environmental impacts [54%]) were more commonly reported than those related to increased productivity (37%), increased profitability (36%), or increased land area under agriculture (14%). In the conservation domain, 63% of initiatives reported overall improvements in biodiversity protection; 50% reported improved protection of rare, threatened, or endangered species; and 48% reported increased habitat connectivity. Improvements in water quality, conservation of ecosystem services benefitting agriculture, and conservation of other ecosystem services were each reported in about 40% of initiatives. In the livelihoods domain, 50% of initiatives reported increased cash income for low-income residents while 54% reported increases in non-cash measures of human wellbeing. Forty percent reported improved food security while 28% reported a reduction in human vulnerability. Beyond the 22 pre-defined outcome choices included in the close-ended portion of the survey, respondents identified additional core outcomes related to improved perception and valuation of natural resources, improved infrastructure, and empowerment of local stakeholders.

Overall, respondents reported relatively few associated outcomes (i.e., outcomes resulting from activities outside the scope of the landscape initiative). To the extent that such outcomes were reported, they tended to be concentrated in areas that were less commonly foci of the initiatives themselves, such as agricultural expansion and increased access to health services (Fig. 6). When interpreting results on ILI outcomes, it is important to recall that this information is based on respondent self-reporting. The evidential basis for such self-reports undoubtedly varies in quality and rigor, and in some cases may be based primarily on perception.

3.6. Most and least successful aspects

We asked respondents to indicate what they saw to be the most and least successful aspects of their landscape initiative. Responses tended to emphasize the human and institutional aspects of landscape management. Among the most successful aspects, 31% of respondents reported increased capacity for understanding and implementing integrated landscape management.

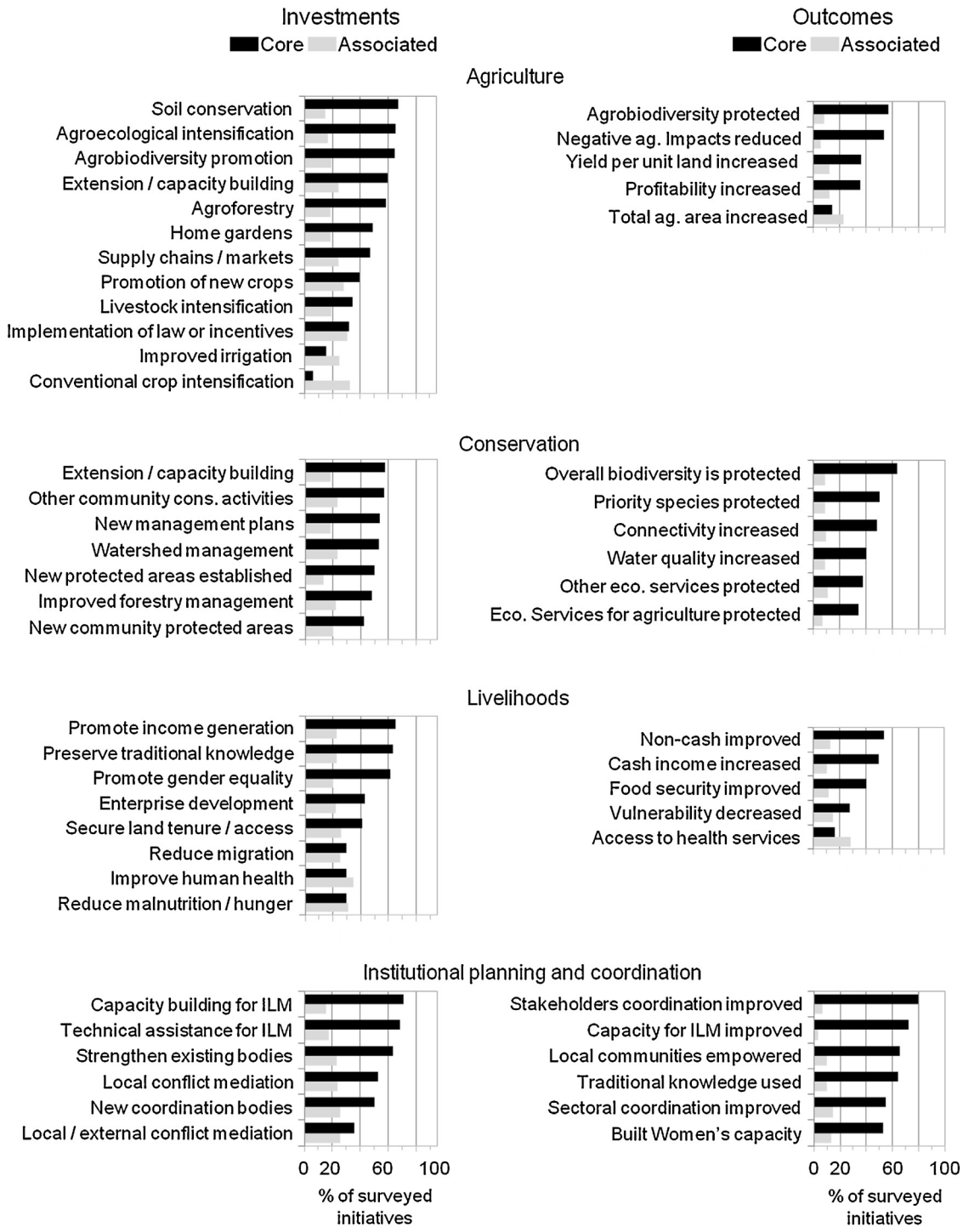

Fig. 6. Proportion of the surveyed initiatives that were reported to include each of 33 investments and activities (left panels) and to achieve each of 22 outcomes (right panels). "Core" refers to investments that were part of the landscape initiative itself and to outcomes attributable to the initiative. "Associated" signifies investments undertaken by other organizations in the landscape and other outcomes occurring in the landscape but not attributable to the initiative. Abbreviations used in the figure: ag. = agriculture; cons. = conservation; eco. = ecosystem; ILM = integrated landscape management.

Thirty percent reported improvements in natural resource management through the formation of new protected areas, improved agroforestry and forestry management, and the protection of threatened species. Improved agricultural and agroforestry practices were mentioned by 26% of respondents, many of whom noted that these improvements resulted from strong farmer engagement, farmer-to-farmer communication, strengthening of farmer organizations, and engagement of farmers in participatory research at pilot sites where the benefits of environmentally friendly practices could be directly observed. Other important successes included the empowerment of local leaders (mentioned by 19% of respondents) and the ability of communities to self-organize for change (18% of respondents).

Thirty eight respondents recognized integrated landscape management to be a long-term endeavor requiring constant support (e.g., human, monetary, technological, and infrastructural), which they noted was difficult to maintain. The least successful aspects of the ILIs (often stated by respondents in the form of key challenges)

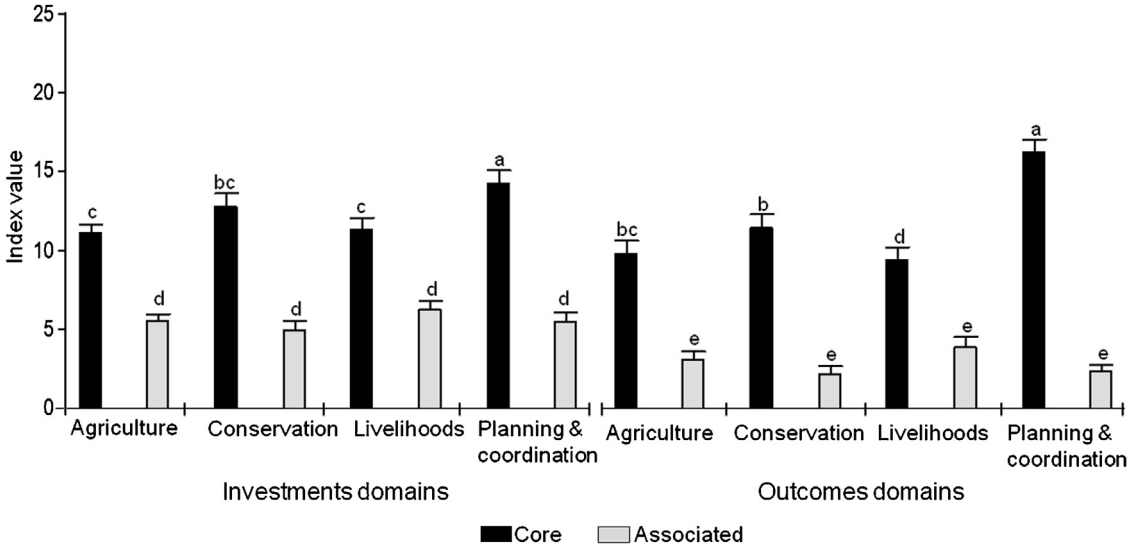

Fig. 7. Mean and standard error of the core and associated investment and outcome index values across the four domains of landscape activity (agriculture, conservation, livelihoods, and institutional planning and coordination). See the narrative for further explanation of the investment and outcome indices. Different letters above the bars indicate significant differences among the mean index values for each domain for investments and outcomes (LSD Fisher test, $\alpha = 0.05$).

were commonly associated with limitations in stakeholder participation (34% of respondents) and funding (20% of respondents). Fourteen percent of respondents reported poor integration, inconsistency or counterproductive laws or policies as a major challenge to meeting their initiative's objectives. Although local, sub-national and national government agencies were frequently involved in the initiatives as stakeholders, several respondents indicated that support from government entities was shallow and insufficient (14% of respondents). Finally, respondents reported difficulties establishing value chains for sustainable agriculture or non-timber forest products (10% of respondents) and getting the private sector involved (8% of respondents).

3.7. *Relationships among ILI characteristics*

Overall, initiatives that respondents characterized as more "multi-objective" (i.e., those reporting more motivations as "very important") had both higher investment index ($r = 0.4$, $p < 0.001$) and higher outcome index ($r = 0.4$, $p < 0.001$) scores. In other words, initiatives with a greater number and diversity of objectives also reported higher numbers of investments and outcomes across all domains than those with lower numbers of objectives. Investment index scores and outcome index scores were also positively and significantly correlated ($r = 0.59$, $p < 0.001$).

Duration of the initiatives was positively correlated with total outcome index scores ($r = 0.3$, $p < 0.003$) and more strongly correlated with outcome index scores in the conservation domain ($r = 0.4$, $p < 0.001$), suggesting that more outcomes might be progressively achieved over time, especially in the conservation domain. Initiative duration was also positively correlated with the number of sectors involved ($r = 0.3$, $p = 0.005$).

The number of stakeholder groups involved in the initiatives was positively correlated with both investment index ($r = 0.5$, $p < 0.001$) and outcome index ($r = 0.2$, $p = 0.024$). The number of sectors involved in the ILIs was also positively correlated with investment index and outcome index scores ($r = 0.4$, $p < 0.001$ and $r = 0.3$, $p = 0.005$, respectively). Higher outcome index scores were associated with the participation of women's groups ($\chi^2 = 0.023$) and local farmer's organizations ($\chi^2 = 0.028$) but not with other specific segments of local communities such as indigenous people or landless people. The participation of the private sector—the least frequently involved set of stakeholder groups—was not significantly associated with higher outcome index scores. Other investments in institutional planning and coordination that we expected might support positive outcomes—including the strengthening of existing landscape coordination bodies, creation of new landscape coordination bodies, and efforts to mediate conflict among stakeholders—were not associated with higher outcome index scores.

4. Discussion and conclusions

This study provides the first broad characterization of integrated landscape management in the LAC region and, as such, is informative for understanding the current state of this field, the challenges and potential benefits of applying such an approach, and the needs for additional research. The size and diversity of the survey sample suggests that integrated landscape management is being applied across the region to address a variety of challenges in a wide range of contexts. Furthermore, data on the starting date of the surveyed initiatives (Fig. 2) suggests that uptake of integrated landscape approaches within the LAC region has accelerated in the past decade. This trend is consistent with recent shifts in parts of the region from early territorial development paradigms focused on economic and social priorities (Bebbington et al., 2008; Schejtman & Berdegué, 2008) to current approaches that integrate conservation strategies with economic and human development plans (ERAS, 2008; SECAC, 2012). The proliferation of ILIs may also reflect the evolving interests and priorities of international donors and NGOs, who were present as stakeholders in 87% of the surveyed initiatives.

Because it was designed as a foundational region-wide characterization of ILIs, this study prioritized breadth and data comparability over in-depth analysis of individual ILIs. This design presents a few caveats for interpretation of the results. First, reliance on the Internet and practitioner networks to identify initiatives may bias the sample toward those that have published information or are associated with external organizations, and may underrepresent grassroots-led initiatives that lack these features. Second, all data are based on self-reporting by initiative participants. Thus, the accuracy of any factual information reported may be limited by the respondent's knowledge, while results related

to more subjective themes (e.g., ILI motivations and stakeholder participation) may reflect respondents' deliberate or unintentional bias. Third, results are based on the perspectives of only one representative of each ILI, who may not be aware of all aspects of the initiative, or who may be inclined to portray the initiative in a positive (or negative) light. Fourth, results related to investments and outcomes identify only whether or not a particular activity or outcome occurred, not the level of effort or resources allocated to each investment or the magnitude and reach of each outcome. Finally, reported outcomes may not have been evaluated relative to a baseline or counterfactual scenario; thus, reporting of an outcome signifies that change occurred in the landscape, but not necessarily that this change was mainly attributable to the initiative. Despite these caveats, the results provide a rich portrait of the practice of integrated landscape management in the LAC region.

4.1. ILIs as a vehicle for advancing landscape multifunctionality

At the most general level, the results suggest that ILIs are not only pursuing landscape multifunctionality (as indicated by diverse objectives and investments spanning several sectors) and but also achieving it to some degree (as indicated by outcomes in at least three of the four domains for most initiatives). Furthermore, the data support the hypothesis that landscape initiatives that pursue a wider range of objectives and invest across several domains yield a broader range of reported outcomes than those that focus on fewer objectives. This finding suggests that deliberate efforts to pursue landscape multifunctionality in the LAC region are bearing fruit, at least in the eyes of initiative participants. What the data do not reveal is whether these initiatives are achieving landscape multifunctionality in a way that is simply additive (i.e., by amalgamating multiple investments under a single umbrella), or whether the initiative is serving to coordinate and integrate investments in a way that generates new synergies that multiply benefits on the ground.

To gain additional insight into the ability of ILIs to catalyze new synergies for landscape multifunctionality, it is instructive to compare the motivations and roles of the agriculture sector in the surveyed ILIs to those of the conservation sector. Conservation motivations were the most commonly cited "very important" drivers of ILIs, while motivations related to increased food production and crop and livestock productivity lagging behind in overall frequency and reported importance. The implication is that, in at least a subset of the initiatives, stakeholders that have conservation objectives foremost in mind are choosing to invest more broadly across multiple domains. This pattern may reflect the recent shift of major conservation organizations toward prioritizing conservation strategies that also support economic development and human wellbeing (Doak, Bakker, Goldstein, & Hale, 2013). In the wake of disappointing experience with integrated conservation and development projects in the 1990s, conservationists have now adopted new ways of integrating conservation and human development, including payments for ecosystem services and ILIs (Balvanera et al., 2012; Milder, Buck, DeClerck, & Scherr, 2012). Concurrently, research has elucidated the conservation value of—and conservation friendly management options for—Neotropical production landscapes to protect native species, habitat corridors, and ecosystem services in fragmented regions (e.g., DeClerck et al., 2010; Harvey et al., 2008; Porter-Bolland et al., 2012). These factors appear to create a comfortable fit for conservation stakeholders to participate in multi-objective projects that include potentially conservation-friendly economic activities such as diversified agriculture, agroforestry, and ecotourism.

Similarly, ILI participation from the agriculture sector generally emphasized agroecological approaches (Altieri, 1995) that conserve and use agricultural biodiversity, and foster local ecosystem functions (e.g., soil fertility, water conservation, and pest control), to support productivity. On the other hand, investments in conventional crop intensification and irrigation—core components of Green Revolution agriculture—were rarely reported to be part of the ILIs. Relatedly, small-scale farmers and producer groups, who are most likely to apply agroecological practices (Altieri & Toledo, 2011), were much more commonly involved as ILI stakeholders than agribusiness. These results suggest that many ILIs are focusing on the alignment among ecologically-based agriculture, resource-based livelihoods, and ecosystem conservation. While far from easy, such alignment in some sense represents the "low-hanging fruit" of integrated landscape management. More challenging—and apparently less common—is to pursue alignment among large-scale agriculture, other commercial interests, ecosystem conservation, and local livelihoods. Whereas conservation stakeholders apparently already have strong incentives to work across sectors to protect the environment and manage common-pool resources, this is less true of the full range of stakeholders principally interested in maximizing agricultural yields and economic returns, for whom it will be critical to identify the right incentives and entry points for constructive participation in ILIs.

4.2. The role of institutional development and multi-stakeholder processes

At its core, integrated landscape management is composed of human and institutional processes and systems for governing rural landscapes. Consistent with this observation, institutional planning and coordination emerged as the most important of the four domains for both ILI investments and outcomes—suggesting that many initiatives consider such functions to be a critical foundation for multi-stakeholder landscape governance. As highlighted by the open-ended responses on the most and least successful aspects of ILIs, many respondents considered improved stakeholder coordination and human and institutional capacity for multi-objective planning and decision-making to be successes in their own right.

However, these human and institutional outcomes can take years to achieve and there is no guarantee that they will ultimately translate into greater multifunctionality on the ground. Indeed, compared to landscape planning and coordination outcomes, tangible outcomes in the agriculture, conservation, and livelihood domains were each reported in a smaller percentage of initiatives (although most initiatives registered at least a few outcomes in each domain). These results imply that the road from institutional investments to on-the-ground results at a landscape scale may be a long one. Accordingly, the governments, donors, and community stakeholders who invest or participate in such efforts should understand the need for ongoing support (in the form of funding, technical backstopping, and/or other human resources) that allows for flexible and non-linear adaptive management approaches. Similarly, monitoring programs and indicators for ILIs should track both "slow" and "fast" variables related to each of the four domains to assess not only biophysical and socioeconomic results at each stage of an initiative, but also the human and institutional capacities that may support long-term sustainable management and enable appropriate responses to future challenges (Walker, Carpenter, Rockstrom, Crépin, & Peterson, 2012).

The results also suggest that ILIs can provide a constructive platform to convene stakeholders in a way that brings a broad set of perspectives and interests to address landscape management challenges. The surveyed initiatives were reported to involve a large number and diversity of stakeholders in design and implementation, including both internal stakeholders from the landscape itself and external stakeholders from the public, private, and civil society sectors. This finding suggests that most ILIs cannot be considered as strictly bottom-up or top-down efforts, but, rather, commonly

involve an interplay between both sets of stakeholders in which stakeholders roles may shift over time.

Prior research has indicated that multi-objective land and resource governance may promote the engagement of diverse stakeholders at multiple scales by raising questions or framing challenges that cannot be addressed through the expertise or perspective of any one group (Berkes, 2009; Southern, Lovett, O'Riordan, & Watkinson, 2011) and facilitating relationships that foster engagement (Höppner, Frick, & Buchecker, 2007). This dynamic appeared to be at play in many of the surveyed ILIs, where the set of participating stakeholders extended far beyond the convening body. Nonetheless, the frequent absence of commercial interests, as well as the superficial nature of government participation in some cases, raises concern that powerful stakeholders are not being fully incorporated into ILIs. Efforts of political and economic elites to circumvent participatory and democratic governance processes are common and well-documented (e.g., Cornwall, 2008; Platteau & Abraham, 2002), and should be recognized as a particular challenge for ILIs given the emphasis that they place on fostering multi-stakeholder processes that are both technically sound and politically legitimate.

4.3. Future research directions

As noted above, this study provides a foundational characterization of the practice of integrated landscape management in the LAC region, but was not designed to independently evaluate or attribute the impacts of ILIs in quantitative terms. Further research is therefore warranted to deepen the understanding of landscape approaches and their relative effectiveness. We suggest that such work be conducted at two levels: (1) in-depth case studies of individual ILIs, and (2) comparative studies and meta-analyses of larger sets of initiatives.

At the level of individual ILIs, rigorous evidence of effectiveness will require systematically collecting quantitative data on ecological, social, economic, and agricultural outcomes of ILIs and evaluating the relationships among these outcomes to document the degree to which the desired synergies and complementarities are being achieved. Such research must be designed to disentangle the multiple interacting consequences of a landscape management initiative from exogenous factors and change trajectories not attributable to the initiative. Landscape management interventions are not necessarily amenable to experimental approaches, but counterfactual scenarios can nevertheless be established or modeled to infer the net effects of landscape initiatives. In addition to quantitative outcome monitoring, qualitative methods will be important for understanding the perspectives and roles of different stakeholders in each landscape and for delving more deeply into the institutional and policy factors that support or undermine effective integrated landscape management.

While case studies can be informative and provide rigorous evidence about ILIs in specific contexts, policy recommendations and investment decisions related to integrated landscape management may be better informed if they are based on evidence from a range of contexts. For this reason, comparative studies and meta-analyses should also be considered as a critical part of the research agenda on ILIs. At present, such analyses are probably not possible, as there has been little or no comparability in monitoring approaches or research methods that have sought to document and quantify ILIs outcomes. However, as the practice of integrated landscape management expands over time, meta-analyses may become more feasible if a major portion of ILIs conduct credible monitoring, and particularly if such monitoring adheres to some basic common parameters to facilitate data comparability. Several frameworks for multi-scalar, multifunctional, long term monitoring of agricultural landscapes have recently been proposed (e.g., Sachs et al., 2010; Vital Signs, 2013), and could serve as useful starting points to improve the comparability of data on ILIs to support future meta-analyses.

Taken together, research on integrated landscape management at these two levels will assist ILI practitioners, investors, and policymakers in conducting and supporting more effective landscape approaches by: (1) clarifying the causal relationships between ILI investments and outcomes under different institutional and landscape configurations; (2) highlighting mechanisms, tools, methodologies, approaches or strategies that tend to support better outcomes across multiple domains of multifunctionality; (3) suggesting how policy frameworks can more effectively support ILIs and landscape multifunctionality; and (4) identifying feasible and efficient strategies for supporting landscape initiatives such that they can sustain themselves indefinitely.

Acknowledgments

We thank all of the survey respondents for taking time to share their experiences with integrated landscape management. Diana Vega and Camila Medeiros provided excellent research assistance. We also thank Alexandra Judd of the Iberoamerican Model Forest Network for helping to contact with ILI practitioners from Model Forests within LAC. We gratefully acknowledge financial support from the Gordon and Betty Moore Foundation and the CGIAR Research Program on Water, Land and Ecosystems. We thank three anonymous reviewers for their valuable comments to improve the manuscript.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at http://dx.doi.org/10.1016/j.landurbplan.2014.05.001.

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