



From *territorio* to *Pacha*: The epistemology of land system science in Latin America

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Abstract. Land system science (LSS) has emerged as a central discipline at the intersection of global environmental change and sustainability research, yet its core vocabulary, publication networks, and conceptual frameworks remain largely anchored in the English language and associated Western scientific traditions. This creates particular challenges in Latin America, where decades of academic, governmental, and Indigenous and local knowledge on land-related processes have developed through distinct terminological and epistemological traditions that do not map directly onto LSS concepts. We conducted a multilingual survey of 156 land systems actors across Latin America, spanning academic, governmental, non-governmental, and community-based organizations, to characterize how the field is understood, translated, and operationalized across the region. We found that engagement with land systems topics exceeds identification with the LSS term itself, suggesting that the Latin American land systems community is larger than those identifying with LSS. Conceptual frameworks used in the region are pluralistic, with social-ecological systems, territorial studies, landscape ecology, and political ecology all sharing questions that LSS addresses under a single label. A majority of respondents supported developing a shared Spanish and Portuguese equivalent for LSS, with a clear preference for terms rooted in *territorio* over biophysical alternatives, reflecting deeper ontological commitments to land as a socially constructed and politically inhabited space. Drawing on these preferences, we propose *Ciencias de sistemas territoriales* (Spanish) and *Ciências de sistemas territoriais* (Portuguese) as working translations of land systems science for the Latin American context. Inclusion of Indigenous and local knowledge into research remains shallow and epistemologically stratified, concentrated among researchers with critical or transdisciplinary orientations rather than fixed within the whole field. Taken together, these findings call for deeper engagement among the broader community of LSS actors in terminological dialogue and knowledge co-production that would allow Latin American, Indigenous, and relational traditions to shape the foundations of land system science globally.

Resumen

La ciencia de sistemas territoriales (land system science, LSS) ha emergido como una disciplina central en la intersección entre el cambio ambiental global y la investigación en sostenibilidad; sin embargo, su vocabulario central, sus redes de publicación y sus marcos conceptuales permanecen en gran medida anclados en el idioma inglés y en las tradiciones científicas occidentales asociadas. Esto genera desafíos particulares en América Latina, donde décadas de conocimiento académico, gubernamental e indígena y local sobre procesos relacionados con la tierra se han desarrollado a través de tradiciones terminológicas y epistemológicas propias que no se corresponden directamente con los conceptos de LSS. Realizamos una encuesta multilingüe a 156 actores de sistemas territoriales en América Latina, abarcando organizaciones académicas, gubernamentales, no gubernamentales y comunitarias, para caracterizar cómo se comprende, traduce y operacionaliza el campo en la región. Encontramos que el involucramiento con los temas de sistemas territoriales supera la identificación con el término LSS en sí mismo, lo que sugiere que la comunidad latinoamericana de sistemas territoriales es más amplia que quienes se identifican con LSS. Los marcos conceptuales utilizados en la región son pluralistas: los sistemas socioecológicos, los estudios territoriales, la ecología del paisaje y la ecología política comparten preguntas que LSS aborda bajo una sola etiqueta. La mayoría de los encuestados apoyó el desarrollo de un término equivalente en español y portugués para LSS, con una clara preferencia por términos enraizados en territorio sobre alternativas biofísicas, lo que refleja compromisos ontológicos más profundos con la tierra como espacio socialmente construido y políticamente habitado. A partir de estas preferencias, proponemos Ciencias de sistemas territoriales (español) y Ciências de sistemas territoriais (portugués) como traducciones de trabajo de land system science para el contexto latinoamericano. La inclusión del conocimiento indígena y local en la investigación sigue siendo superficial y epistemológicamente estratificada, concentrada entre investigadores con orientaciones críticas o transdisciplinarias, en lugar de estar consolidada en el campo en su conjunto. En conjunto, estos hallazgos demandan un mayor compromiso entre la amplia comunidad de actores de sistemas territoriales con el diálogo terminológico y la coproducción de conocimiento, que permita a las tradiciones latinoamericanas, indígenas y relacionales contribuir a moldear los fundamentos de la ciencia de sistemas territoriales a nivel global.



Resumo A ciência dos sistemas territoriais (*land system science*, LSS) emergiu como uma disciplina central na interseção entre as mudanças ambientais globais e a pesquisa em sustentabilidade; no entanto, seu vocabulário central, suas redes de publicação e seus marcos conceituais permanecem amplamente ancorados na língua inglesa e nas tradições científicas ocidentais associadas. Isso gera desafios particulares na América Latina, onde décadas de conhecimento acadêmico, governamental e indígena e local sobre processos relacionados à terra se desenvolveram por meio de tradições terminológicas e epistemológicas próprias que não se correspondem diretamente com os conceitos da LSS. Realizamos uma pesquisa multilíngue com 156 atores de sistemas territoriais na América Latina, abrangendo organizações acadêmicas, governamentais, não governamentais e comunitárias, para caracterizar como o campo é compreendido, traduzido e operacionalizado na região. Constatamos que o envolvimento com os temas de sistemas territoriais supera a identificação com o próprio termo LSS, o que sugere que a comunidade latino-americana de sistemas territoriais é mais ampla do que aquela que se identifica com a LSS. Os marcos conceituais utilizados na região são pluralistas: os sistemas socioecológicos, os estudos territoriais, a ecologia da paisagem e a ecologia política compartilham questões que a LSS aborda sob um único rótulo. A maioria dos respondentes apoiou o desenvolvimento de um termo equivalente em espanhol e português para a LSS, com clara preferência por termos enraizados em *território* em detrimento de alternativas biofísicas, refletindo compromissos ontológicos mais profundos com a terra como espaço socialmente construído e politicamente habitado. Com base nessas preferências, propomos *Ciencias de sistemas territoriales* (espanhol) e *Ciências de sistemas territoriais* (português) como traduções de trabalho de *land system science* para o contexto latino-americano. A inclusão do conhecimento indígena e local na pesquisa permanece superficial e epistemologicamente estratificada, concentrada entre pesquisadores com orientações críticas ou transdisciplinares, em vez de estar consolidada em todo o campo. Em conjunto, esses achados demandam um maior compromisso entre a ampla comunidade de atores de sistemas territoriais no diálogo terminológico e a coprodução de conhecimento, que permita às tradições latino-americanas, indígenas e relacionais contribuir para moldar os fundamentos da ciência dos sistemas territoriais em nível global.

Full versions of this manuscript in Spanish and Portuguese are available in Supplements 4 and 5, respectively (Note to editor and reviewers: Translation of the final, accepted version will be available as supplements).

1 Introduction

Scientific disciplines are built on shared language. The terms researchers use to frame problems, search literature, and communicate findings are not neutral, they shape research themes, approaches, inclusion of participants and knowledge. When a complex discipline's core vocabulary is anchored in a single language and cultural tradition, it risks systematically excluding diverse perspectives (Anticoli et al., 2025, Amano et al. 2021). This tension between main-stream terminology and conceptual inclusivity is particularly important in fields that aspire to global societal relevance (Amano et al., 2021), and land system science is no exception.

Land system science (LSS) has emerged as a prominent integrative discipline at the intersection of global environmental change and sustainability science (Estoque et al., 2026). Land systems encompass all processes and activities related to human land use and their social-ecological outcomes (Verburg et al., 2013). Over the past two decades, the field has developed a rich body of conceptual frameworks and analytical tools, establishing itself as a central pillar of global change research. Yet, as with other fields of science and technology, its dominant vocabulary, publication venues, and institutional networks remain largely anchored in the English language and associated Western scientific traditions (Canagarajah, 2002).

This linguistic and epistemological hegemony has concrete consequences in Latin America, a region of global significance for land system dynamics. Academic, governmental, and Indigenous and local knowledge (ILK, hereafter (McElwee et al., 2020)) on land-related processes in the region has been developed over time, expressed through a diverse array of terms, frameworks, and concepts that do not translate directly into English. One effort to bridge this gap was made by Boillat et al. (2017), who addressed how the LSS concept applies to Latin America, and



proposed "social-ecological land systems" (SELS) as a framework designed to bridge local realities with regional processes, and to acknowledge both social and environmental dimensions of these diverse contexts simultaneously. They also called for more complex analytical frameworks that acknowledge stakeholder perceptions, livelihood diversification, and landscape values that shift across time and space. The SELS framework has since been adopted in subsequent regional work (Montti et al., 2026; Zarbá et al., 2022; Trumper et al. (In press), yet both SELS and the broader LSS concept remain unevenly recognized across the disciplines and institutions that engage with land-related questions in Latin America, where a diversity of conceptual frameworks already address what LSS describes, often under different names and from distinct epistemological traditions.

A further complication is semantic ambiguity (Gurukkal, 2026): in Portuguese and Spanish in Latin America, the word *terra* or *tierra* carries the meaning of both Earth and land, a distinction that English (and by extension, LSS) treats as fundamental, separating Earth System Science from LSS as distinct but nested fields. This blurring of boundaries makes a regional consensus translation of "land system science" difficult, and means that professionals working within ecology, sociology, geography, agronomy, and Indigenous sciences may be addressing the same land system dynamics from different conceptual starting points, unaware of similar insights being generated across disciplines and language communities. Further, a substantial share of land-related work in Latin America is likely published in languages other than English and disseminated through regional platforms such as Redalyc and SciELO, as well as books, reports and policy documents (Anticoli et al., 2025). In line with decolonial approaches, which question Western thinking hegemony in science and stress the need for recognizing a plurality of worldviews and knowledge systems (e.g., Radcliffe, 2017), it is crucial to take into consideration non-English perspectives in LSS.

Understanding and mapping this conceptual diversity goes beyond translating concepts. Developing a shared terminological foundation can consolidate and make visible regionally produced and diverse knowledge, while facilitating a dialogue between academia and decision-makers. In this sense, this study aims to build an instrument that enables comparison and collaboration across Latin America's disciplinary and linguistic LSS communities. At the same time, it opens a pathway for Latin American concepts and policy and practice insights, including those rooted in Indigenous and local knowledge, to enter and enrich the English-dominant LSS literature.

We adopted a participatory survey-based approach in order to capture how actors working on land-related questions in Latin America understand, translate, and operationalize LSS. We use the term 'land systems actors' broadly to refer to professionals spanning academic, governmental, NGO, private sector, and community-based organizations who produce, apply, or mediate knowledge related to land use, land cover change, and territorial dynamics. Our research questions are:

- To what extent do land actors in Latin America identify with LSS as a concept?
- What level of support exists for a shared Spanish and Portuguese equivalent term of "land system science"?
- To what degree and at which stages of the research process do land systems actors incorporate Indigenous and local knowledge (ILK)?
- What concepts related to land systems are common in Spanish, Portuguese, and Indigenous languages, and to what extent do they find equivalents in the English-language literature?

2 Methods

2.1 Study design and rationale

We conducted an online survey targeting land systems actors across Latin America to characterize the conceptual and epistemological landscape of the field in the region. We aimed to capture the diversity of terminology, methodological practices, and knowledge integration strategies across heterogeneous institutional and geographic



135 contexts not easily accessible through literature review alone. A keyword-driven literature search would systematically miss research that does not use our search terms, and would exclude actors whose knowledge is not captured in academic publications.

2.2 Survey instrument

140 The survey was developed in three parallel language versions (Spanish, Portuguese, and English) by bilingual team members to maximize accessibility across the region's primary scientific languages and reduce linguistic barriers to participation. The survey included closed-ended items (multiple-choice, Likert-scale, and percentage-allocation questions) alongside open-ended text responses (Supplement 1). Core thematic domains included: (1) respondent profile and institutional affiliation; (2) familiarity with and adoption of the term LSS and its regional equivalents; (3) predominant methodological approaches and scales of analysis; (4) integration of ILK; (5) epistemological orientations; (6) language use in academic publishing; and (7) perspectives on terminology standardization. The survey included 31 questions and was administered via Qualtrics (Provo, UT). To avoid priming respondents who
 145 might be unfamiliar with the term, the survey did not explicitly mention "land systems science" in its introduction. Instead, participants were presented with a functional description of the field, encompassing the study of land use and its social-ecological drivers and outcomes, and asked about their own terminology and practices. This design choice aimed to capture actual conceptual diversity rather than anchoring responses to a specific disciplinary label. The study received Institutional Review Board approval from the University of Nevada, Reno (ID: 2412055-2).
 150 Informed, revocable consent was obtained electronically prior to survey access. All questions were optional and no personally identifying information was collected, ensuring anonymity.

2.3 Participant recruitment

155 Participants were recruited over a four-week period (February-March 2026) through direct and snowball sampling strategies. Initial recruitment targeted actors identified through the Global Land Programme and direct invitations to networks working in issues related to land systems (e.g. FLACSO, Prisma). The authors made an effort to recruit a variety of professionals including contacts in academia, NGOs and government agencies. Recruitment materials were distributed via direct email invitations and professional social media platforms (X/Bluesky, LinkedIn), and respondents were encouraged to share the survey within their professional networks. Eligible participants were professionals aged 18 or older currently engaged in research or practice related to land systems, land use, land cover
 160 change, territorial management, sustainability, or related fields, with work focusing on or including Latin American contexts.

2.4 Data analysis

165 Quantitative data were analyzed in R (R Core Team, 2026). Descriptive statistics such as frequencies, percentages, and cross-tabulations were computed for all categorical variables, and means were calculated for continuous variables. Open-ended responses to questions about search terminology, terms used with local communities, terms lacking adequate translation, and local concepts approximating land systems were coded and grouped to seven themes: (1) Technical/Biophysical, capturing terms related to land cover, land use change, remote sensing, and biophysical classification; (2) Social-ecological systems, encompassing social-ecological systems frameworks, ecosystem services, and coupled human-environment terminology; (3) Territorial/Relational, covering concepts
 170 centered on territory, landscape, governance, and place-based relationships; (4) Political/Critical, reflecting vocabulary associated with political ecology, power, conflict, agrarian reform, and environmental justice; (5) Indigenous/Cosmological, capturing terms rooted in Indigenous ontologies and cosmologies; (6) Agroecological/Productive, encompassing farming systems, smallholder, and agroecological vocabulary; and (7) Sustainability/Policy, covering sustainability science, conservation, management, and policy-oriented terminology.
 175 Coding was performed by the first co-author only to maintain coherency and through keyword matching across



Spanish, Portuguese, and English terms within each category. Where a response matched multiple categories, a priority ordering was applied as follows: Indigenous/Cosmological > Political/Critical > Territorial/Relational > Socio-ecological systems > Agroecological/Productive > Sustainability/Policy > Technical/Biophysical.

2.5 Researcher positionality

- 180 We acknowledge that the research team approached this work largely from Global North institutions, with English as a predominant language of our professional work. While most team members were born and trained in Latin America, are native Spanish or Portuguese speakers, and all have extensive experience conducting research in and about the region, our conceptual framing inevitably reflects perspectives shaped by Anglo-centric land systems literature that we sought to minimize. The research team members come from diverse disciplinary backgrounds, ranging from biology to geography, and anthropology. Beyond the team's academic work, several of its members also have experience in the non-for-profit sector or in international organizations in the fields of sustainable development, conservation, or land management in Latin America.

3 Results

3.1 Sample and regional classification

- 190 A total of 156 responses were obtained across the three language-versions (Spanish n=86, Portuguese n=21 and English n=49). After merging responses, respondents were grouped into six geographic regions, based on where they are currently based, for comparative analysis: Southern South America (South S, n=29), comprising Argentina (n=21), Chile (n=4), and Paraguay (n=4); Brazil (n=15); Northern South America (South N, n=19), comprising Colombia (n=7), Peru (n=6), Ecuador (n=4), Bolivia (n=1), and Venezuela (n=1); Mexico and Central America (MX-Central, n=21), comprising Mexico (n=17), Costa Rica (n=2), and Guatemala (n=2); North America (North, n=20), comprising the United States (n=18) and Canada (n=2); and Europe (n=22), comprising respondents from other European countries not listed as named options in the survey (n=20) and Spain (n=2) (map in Supplement 2). Of the 156 respondents, 30 did not provide a country of residence and were therefore not assigned to a regional group but their responses to other questions were considered.

200 3.2 Characterization of survey respondents

- Latin American-based respondents comprised approximately 66.7% of the sample. Participants were dominated by senior actors: 55% of respondents reported more than 10 years of professional experience, with this proportion particularly high in South S (69%), South N (84%), and MX-Central (71%). 71% of respondents held a doctoral degree, ranging from 62% in Europe to 80% in both the North and Brazil groups. The majority of respondents were affiliated with universities or research institutes (65%), followed by 10% NGO and 5% Government and Private 2.6%. Disciplinary backgrounds were diverse, with Geography selected 37% of the time, Ecology/Biology 35%, Environmental Sciences 32.2%, Social Science (22%). Less represented were Urban/Territorial Planning (7%) Forestry (6%) and Indigenous or local science (3%). About half of respondents indicated working at landscape/watershed levels (49%), region/biome (42%) and national scales (35%). Fewer respondents indicated working at municipality (30.8%), plot (25%) or translational scales (22%). Related to scales, 49% of respondents reported working primarily within a single country, 29% selected multiple countries within a subregion, 18% globally, and 3% across all Latin America. Spanish (46%) or Portuguese (13%) was the native language of the majority of respondents, with English (12%) and other languages (German, French, Italian, Nepali, Chinese, 12%) being the least represented. Respondents chose English (71%) as a language they use in literature they use for reference, 36% Spanish, 21% Portuguese and 31% other. A similar trend occurred for the language in which respondents disseminate their work: 72% in English, 43% Spanish, 33% Portuguese, 15% Indigenous languages/dialects and 30% other.



3.3 Engagement with land system science as a concept

3.3.1 Familiarity with the term "land system science"

Self-reported familiarity with the term LSS varied across regions, disciplines, and career stages (Fig. 1). Overall, respondents in the North and Europe groups reported the highest familiarity, with mean scores close to 4 ("very familiar") on a 1–5 scale (Fig. 1a). In contrast, respondents from MX-Central and South S reported lower familiarity, with mean values closer to 3 ("somewhat familiar"). Respondents with more than 20 years of professional experience reported higher familiarity scores than those with fewer than 10 years (Fig. 1b), though relatedness scores were similarly high across all experience categories with exception to people with 0-5 years who indicated the least relatedness. Familiarity patterns also differed by discipline (Fig. 1c): agronomy, geography, and data/remote sensing respondents reported the highest familiarity scores, while political science/policy and forestry respondents reported the lowest, with mean scores near the "somewhat familiar" category. By institutional affiliation (Fig. 1d), private sector respondents reported the highest familiarity, followed by university/research affiliates. Across all groups, work relatedness to LSS scores (i.e., the extent to which respondents' current work relates to land systems) consistently met or exceeded familiarity scores, suggesting that researchers are engaged with land systems topics even when they do not identify with the term itself. This was more pronounced with government/public respondents who showed the widest spread between familiarity and relatedness scores.

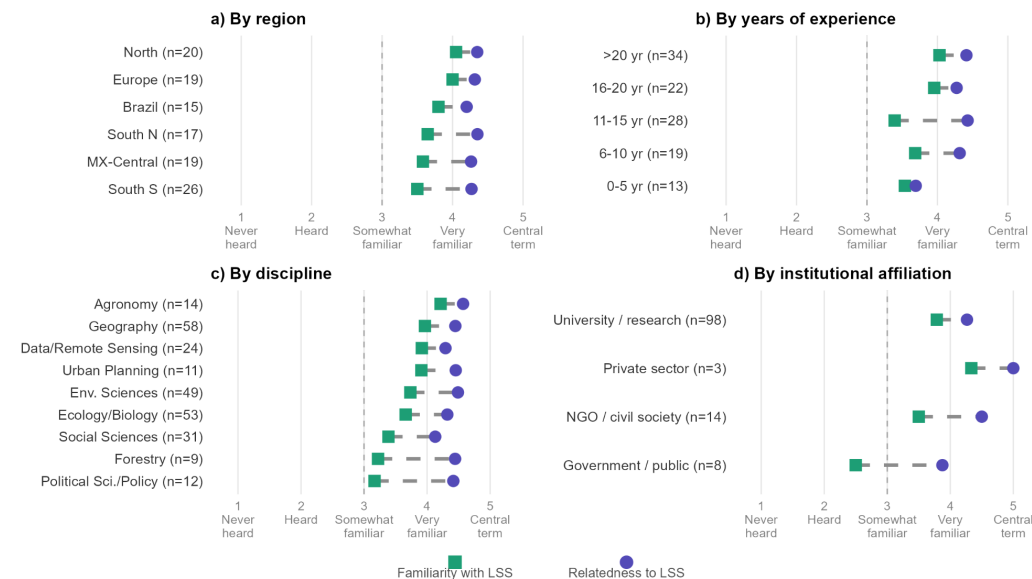


Figure 1: Familiarity with the term land systems science (LSS) and relatedness of current work to LSS among survey respondents

3.3.2 How the LSS concept is operationalized in English

Regarding English-language search terms related to LSS (Fig. 2a), social-ecological systems was the most widely used option across all regions (71% across all respondents, with regional variation of 60-79%), followed by land use science (63%, variation 52–87%), land system science (51%, variation 33-60%). Political ecology was chosen by 33% of respondents with a wide regional variation (10% in South S and 52% in MX-Central). Respondents used the land systems concept professionally in multiple ways (Fig. 2b). The most common use across regions was as a study



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object or unit of analysis, selected by 52% of respondents (regional variation 38–64%). Use as an analytical framework was also prevalent, particularly in the North (65%), Europe (45%) and MX-Central (43%), while it was less common in South N (37%) and Brazil (33%). Communication tool and interdisciplinary bridge were the next most frequently selected uses, each chosen by roughly 33–24% of respondents across regions.

a) Disciplinary fields and search terms used in English

	Overall (%)	South S (%)	South N (%)	MX-Central (%)	North (%)	Europe (%)	Brazil (%)
Social-ecological systems (n=90)	71	72	79	67	70	77	60
Land use science (n=80)	63	59	68	52	60	64	87
Land system science (n=64)	51	34	58	57	45	59	60
Landscape ecology (n=58)	46	55	37	57	45	27	53
Sustainability science (n=55)	44	41	37	57	45	50	27
Human-env. systems (CHANS) (n=45)	36	31	37	38	55	18	40
Political ecology (n=42)	33	10	42	52	45	32	27
Land change science (n=39)	31	17	37	29	45	27	40
Earth system science (n=22)	17	7	5	29	25	23	20
Ethnoecology / ethnobiology (n=20)	16	14	21	14	20	9	20
Don't search in English (n=0)	0	0	0	0	0	0	0

b) How 'land system science' concept is used professionally

	Overall (%)	South S (%)	South N (%)	MX-Central (%)	North (%)	Europe (%)	Brazil (%)
Study object / unit (n=65)	52	38	58	48	55	64	53
Analytical framework (n=55)	44	38	37	43	65	45	33
Communication tool (n=42)	33	24	47	29	40	32	33
Interdisciplinary bridge (n=30)	24	17	11	38	20	27	33
Teaching concept (n=28)	22	24	21	29	30	18	7
Rarely / never use it (n=28)	21	24	32	14	15	14	27
Policy / planning concept (n=24)	19	14	5	24	35	18	20
Mapping / spatial unit (n=20)	16	7	5	29	25	18	13
Data classification system (n=20)	16	17	5	14	20	18	20
Research agenda (n=19)	15	17	5	14	20	23	7
Modeling framework (n=17)	13	7	11	14	25	9	20
Other (n=3)	2	3	0	5	0	5	0

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Figure 2: Percentage of respondents within each region selecting each option for (a) disciplinary fields and search terms used when locating English-language literature and (b) uses of the concept of land system science in professional practice.

3.4 Support for a shared LSS terminology

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Attitudes toward a consensus term showed that 64% of participants see advantageous to have a Spanish or Portuguese equivalent term of LSS (intermediate 25%, very much 23% and complete support 26%) (Fig. 3a). The main perceived benefits for a consensus term in Spanish or Portuguese are facilitating trans- and interdisciplinary collaboration (47% of respondents), better recognizing local concepts (44%), improving academic communication (40%) and avoiding confusion with other fields (37%). At a slightly smaller rate, increased visibility of the field (34%), facilitating collaboration between LA countries (32%) and improving impact on public policy (32%) also were seen as benefits for a consensus term. Other respondents indicated no interest in creating a consensus term, choosing no practical need for consensus (13%), that terms should adapt to context (11%), and that it is difficult to achieve consensus (9%). Preferred translations for LSS showed fragmentation across the sample (Fig. 3b). *Ciencias de estudios territoriales* in Spanish or *Ciências de estudos territoriais* in Portuguese (27%), *Estudios de sistemas territoriales* in Spanish or *Estudos de sistemas territoriais* in Portuguese (26%), and *Ciencias de sistemas terrestres* in Spanish or *Ciências de sistemas terrestres* in Portuguese (21%) emerged as the most preferred options for respondents.

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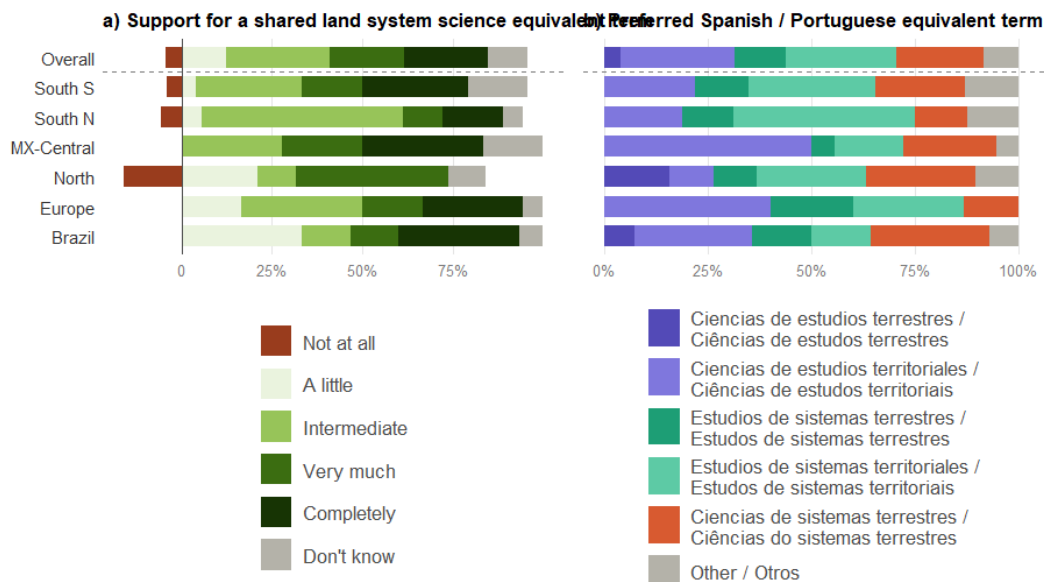


Figure 3: Terminological preferences among survey respondents by geographic region. (a) Support for developing a shared Spanish/Portuguese equivalent term for LSS, displayed as a diverging bar chart from opposition (left) to support (right). (b) Preferred Spanish/Portuguese translation of “land systems science”.

3.5 Indigenous and local knowledge

Inclusion of ILK into land systems research varied by the knowledge approach of the participants (Fig. 4a). Respondents reporting using critical/decolonial/environmental justice and transdisciplinary/co-production approaches reported the highest levels of ILK incorporation in their work (>50% reported substantial or full incorporation of ILK). In contrast, respondents working with explanatory/positivist (research traditions grounded in quantitative measurement, hypothesis testing, and reproducibility) and systemic/modeling approaches (that represent land-society interactions through formal computational or conceptual models) showed the inverse pattern, with the majority reporting limited or no incorporation of ILK. Interpretive/qualitative respondents (those using context-dependent methods such as interviews, ethnography, or case studies that prioritize meaning and experience) reported more integration of ILK than the positivist or modeling groups but less than the critical or transdisciplinary groups.

The phases in which ILK was incorporated in the respondents professional work also varied by region (Fig. 4b). Analysis and interpretation was the most commonly reported phase of ILK engagement across all regions, cited by 51% of respondents (regional variation 32–70%). Validation/review (43%) and co-writing/co-production (41%) were the next most frequent. Incorporation at the problem framing (40%) and data collection stages (30%) was less common, though still reported by 20–65% of respondents depending on region. Dissemination (overall 29%) showed notable variation, from 9% in Europe to 38% in MX-Central (Fig. 4b).

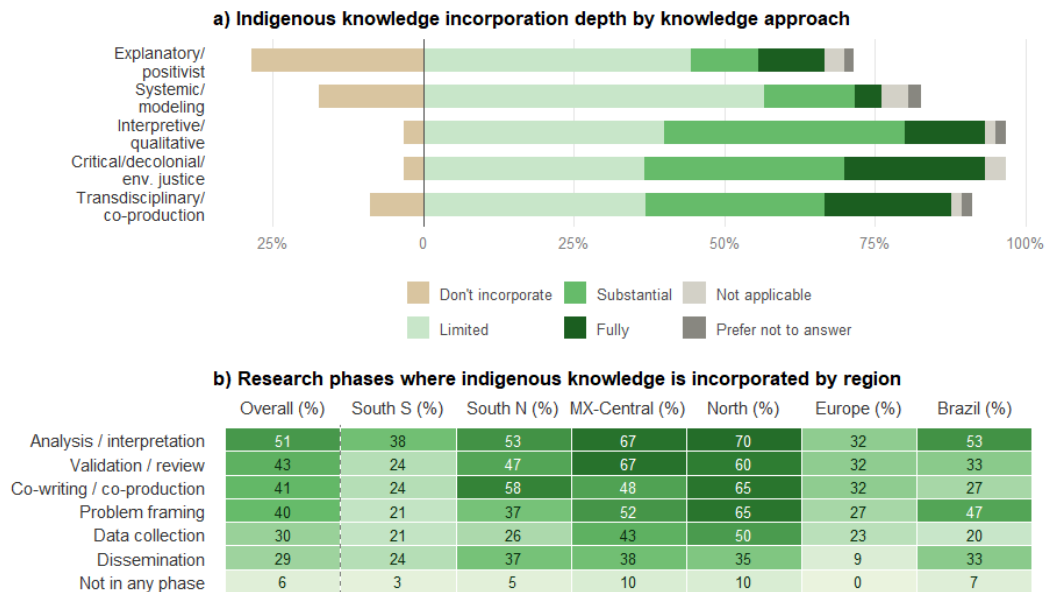


Figure 4: Incorporation of Indigenous, Afro-descendant, and campesino knowledge (ILK) by (a) research approach, showing the degree of incorporation and (b) research phase and region.

3.6 Epistemological orientations

Analysis of open-ended responses revealed consistent patterns in the LSS-related vocabulary used by the respondents, with notable variation across questions and regions. Where terms appear in Spanish, Portuguese, or Indigenous languages, we provide English translations in brackets; however, many of these concepts carry meanings that exceed their English equivalents. Search terms used in Spanish and Portuguese in relation to the professional activity of respondents (Supplement 3, Q20) were primarily around Territorial/Relational terms (28%, e.g., *territorio* [territory], *paisaje* [landscape], *cuenca* [watershed], *gobernanza* [governance]) and Technical/Biophysical concepts (25%, e.g., *cambio de uso* [land use change], *teledetección* [remote sensing], *uso da terra* [land use], *cobertura* [land cover]). Social-ecological systems vocabulary was the third most common orientation (14%, e.g., *sistemas socio-ecológicos* [social-ecological systems], *servicios ecosistémicos* [ecosystem services], *nexo* [nexus]), followed by Sustainability/Policy terms (10%, e.g., *manejo* [management], *conservación* [conservation], *políticas públicas* [public policy]). Indigenous/Cosmological terms were less frequent in literature searches (8%, e.g., *biocultural* [biocultural], *plan de vida* [life plan], *Buen vivir* [good living/living well]), and Political/Critical vocabulary was the least represented (2%, e.g., *ecología política* [political ecology], *conflicto* [conflict], *reforma agraria* [agrarian reform]). Regional variation was notable: Brazil was dominated by Technical/Biophysical terms (40%), while MX-Central showed the strongest Territorial/Relational orientation (33.3%) (Supplement 3).

Among the 70 respondents that shared terms used with local and Indigenous communities (Supplement 3, Q24), Territorial/Relational vocabulary was dominant (47%, e.g., *territorio* [territory], *ejido* [communal landholding], *comunidad* [community], *tenencia* [land tenure]), nearly four times more common than the next categories: Technical/Biophysical and Indigenous/Cosmological, each at 13% (e.g., *uso del suelo* [land use], *deforestación* [deforestation], *cosmovisión* [worldview/cosmology], *conocimiento ecológico tradicional* [traditional ecological knowledge], *reciprocidad* [reciprocity]). Sustainability/Policy terms accounted for 6% (e.g., *manejo* [management],



315 *conservación* [conservation], *restauración* [restoration]), while social-ecological systems vocabulary was rarely reported in community engagement contexts (3%). Europe had the highest non-response rate for this question (73%), consistent with limited direct community engagement among Europe-based respondents.

Only 36% of respondents shared terms from other languages lacking adequate translation into English or vice versa (Supplement 3, Q25). Among those who responded, Indigenous/Cosmological and Territorial/Relational concepts
 320 had the highest share of untranslatable terms (22% each, e.g., *Mapu* [Mapuche relational earth and territory], *Sumak Kawsay* [Quechua concept of good living], *cosmovisión* [worldview/cosmology], *Ñuke Mapu* [Mapuche mother earth]; *ejido* [communal landholding], *milpa* [Mesoamerican crop system], *territorio* [territory]). Social-ecological systems terminology represented 15% of responses, with several respondents noting that English terms such as *land system* and *ecosystem services* are themselves difficult to translate into Spanish, Portuguese, or Indigenous
 325 languages. Agroecological/Productive terms were reported by 9% of respondents (e.g., *roça* [Brazilian shifting cultivation practice], *capoeira* [secondary vegetation following shifting cultivation], *campesino* [farmer]). North America-based respondents reported Indigenous/Cosmological translation gaps most frequently (15%), followed by South N (11%) and MX-Central (9%).

About 38% of respondents indicated ILK concepts approximating land systems (Supplement 3, Q26).
 330 Indigenous/Cosmological concepts were the most frequently cited (31%, e.g., *Mapu* [Mapuche relational earth and territory], *Pacha* [Andean concept of space-time as a living whole], *Tekoha* [Guaraní place of communal life and practice], *comunalidad* [concept of communal existence and governance], *reciprocidad* [reciprocity]), followed closely by Territorial/Relational terms (25%, e.g., *territorio* [territory], *resguardo* [legally recognized collective Indigenous territory in Colombia], *ejido* [communal landholding], *comunidad* [community]). Social-ecological
 335 systems vocabulary was cited by 8% of respondents, while Technical/Biophysical terms accounted for only 4%. South N had the highest proportion of Indigenous/Cosmological responses (22%), followed by South S (17%), while Brazil showed no Indigenous/Cosmological responses for this question.

4 Discussion

340 This study offers a systematic assessment of how LSS is understood, translated, and operationalized across Latin America. Our findings revealed that respondents are substantively engaged with land systems topics but unevenly identified with the field's English-language terminology, epistemologically diverse in ways that reflect distinct regional traditions. We discuss these findings in relation to each research question before reflecting on their broader implications for the development of a more inclusive Latin American LSS.

4.1 Identification with land systems science is high in practice but lower in familiarity

345 A central and somewhat conflicting finding is that work relatedness to LSS consistently exceeded familiarity with the term itself across all regions, disciplines, and career stages. Respondents who mentioned low or no familiarity to the term LSS were conducting work that was precisely related to it: land use change, social-ecological dynamics, territorial governance, and human-nature interactions. This decoupling of practice from terminology reflects two related considerations. On one hand, it suggests that the LSS community in Latin America is larger than formal
 350 terminology and networks (such as the Global Land Programme, GLP), with significant intellectual and practical contributions occurring under different conceptual labels and communities that never encountered the LSS label. On the other hand, it points to a structural disconnect: actors working within regional traditions may not identify with LSS not because their work is unrelated, but because the concept circulates primarily through English-language networks and conceptual frameworks that do not resonate with the linguistic and epistemological traditions through
 355 which much of this work is conducted. This is compounded by the relative novelty of LSS as a discipline which is still permeating different communities. Notably, since our sample was drawn largely from GLP-connected networks



already skewed toward LSS familiarity, this gap is likely even larger in the broader population of land systems actors across the region.

360 The variation in familiarity by region, with North America and Europe-based respondents reporting higher familiarity than MX-Central and South S, likely reflects different exposure to English-language literature and networks rather than differences in the work conducted. Given that familiarity increased with years of experience, we consider that senior actors show stronger identification with the term since they might have built careers in closer contact with international networks, while early and middle-career actors may be engaging with land systems topics through regional concepts without a LSS label. Likewise, while 72% of respondents indicated >10 years of professional experience, only 44% indicated work in land systems, which can indicate that many professionals gravitate (or associate) later in their careers to LSS. This has direct consequences for field-building efforts, suggesting that outreach and capacity development initiatives should focus not on introducing LSS as a new subject but on connecting existing regional expertise to international networks under a shared, though not necessarily uniform, conceptual umbrella.

370 The disciplinary pattern is also revealing. Higher familiarity with LSS among actors associated with agronomy, geography, and remote sensing, compared to those with social science, political science and forestry backgrounds, reflects that LSS as a concept has been more deeply rooted in disciplines with biophysical and spatial traditions. The relatively low identification among political scientists and policy actors is of interest given the strong political ecology tradition in Latin America (Leff, 2015; Toledo and Barrera-Bassols, 2017), a cross-disciplinary field that
 375 deals with many of the same questions as LSS, but from a different epistemological starting point. Bridging this gap represents both a challenge and an opportunity for the field.

4.2 Fragmentation and pluralism in conceptual frameworks

The finding that social-ecological systems was the most widely used English-language framework across all regions (more so than LSS itself) raises important questions about conceptual boundaries and field identity. Social-ecological systems thinking, rooted in resilience and commons literature (Folke et al., 2010; Meadows, 2008;
 380 Ostrom, 1990, 2009), shares similarities with LSS (Verburg et al., 2013) but emphasizes different analytical units, governance mechanisms, and theoretical commitments. Its dominance in Latin America likely reflects the strong influence of resilience and commons literature (Folke, 2006) as well as the framework's explicit attention to institutional dynamics that resonate with the region's history of resource conflict and collective land management
 385 (Lorenzen et al., 2022).

The co-occurrence of multiple frameworks and LSS concepts, such as social-ecological systems, landscape ecology, sustainability science, land use science, and political ecology, within individual respondents' reported vocabularies suggests that Latin American actors are operating as pluralists rather than exclusive adherents of a single framework. This pluralism may reflect that respondents either have a genuine flexibility, and thus indicating that LSS emerged
 390 as a highly interdisciplinary field, or that there is an absence of a unified regional identity within the land systems community. However, the high use of English-language literature (71% of respondents reporting English as their primary reference language despite only 12% being native English speakers) shows a dependency or dominance of work published in this language, potentially favoring one particular cultural point-of-view over others (Alves and Pozzebon, 2013) and preventing non-English speakers to actively participate in the scientific process (Márquez and
 395 Porras, 2020). This situation has been documented in other areas of global environmental science, noticing for example, that synthesizing work in multiple languages adds local, context-dependent evidence to improve assessments (Amano et al., 2021; Amano and Berdejo-Espinola, 2025).

Some frameworks showed clear regional preferences. Political ecology in particular was cited by 10% of South S respondents but 52% in MX-Central. This framework's regional distribution could respond to established differences



400 in Latin American academic traditions: Mexico and Central America have tradition of critical agrarian and political ecology scholarship (Toledo and Barrera-Bassols, 2017), while the Southern Cone showed stronger orientation toward technical-biophysical and systems ecology frameworks. The framework LSS showed smaller regional variation than political ecology, suggesting a more neutral concept that serves as a “conceptual umbrella” that could help attract more actors across the spectrum of LSS work.

405 4.3 Broad support for regional LSS terminology and a proposed translation rooted in *territorio*

The majority of respondents expressed support to some degree for developing a shared Spanish or Portuguese equivalent of LSS, choosing a range of benefits including facilitating transdisciplinary collaboration, better recognizing local concepts, and improving academic communication. This broad support indicates that respondents show difficulty when conducting work across linguistic and disciplinary boundaries in Spanish or Portuguese, 410 suggesting that a regional term resonates better to their work compared to the English term. This distinction situates the terminological debate within a broader question of epistemic independence, whether Latin American land systems scholarship should adapt Global North frameworks or develop its own conceptual vocabulary grounded in regional epistemological traditions (Oliveira and Mendes Pinto, 2024). At the same time, the dominance of English in academic publishing, contrasts with the reality that most policy debates and community-level discussions occur in 415 local and national languages (Montgomery, 2004).

We observed a fragmentation of preferred translations of LSS, with *Ciencias de estudios territoriales/Ciências de estudos territoriais* and *Estudios de sistemas territoriales/Estudos de sistemas territoriais*, representing the majority of votes. The first trend identified is that there was a preference for *ciencia/ciência* [science] over *estudio/estudo* [study] which might resonate better with the original term “science”. The second trend is that *territorial* was 420 preferred over *terrestre* across regions, with exception to respondents from Brazil, who showed almost equal preferences between these two concepts. Drawing on these two trends, we propose *Ciencias de sistemas territoriales* (Spanish) and *Ciências de sistemas territoriais* (Portuguese) as working translations of LSS for the Latin American context.

This preference for the concept of *territorio* is not merely semantic. The choice between *territorial* and *terrestre* has 425 different ontological roots: *terrestre* positions land primarily as a biophysical substrate, aligning closely with the Earth system and land cover traditions from which LSS historically emerged (Verburg et al., 2013), while *territorial* evokes land as a socially constructed, politically related, and inhabited space, a framing with deep roots in Latin American scholarship (Benedetti, 2011; Porto-Gonçalves, 2006). This resonates with a broader tradition of critical thought across Latin America, where research and social movements have historically been intertwined, producing 430 intellectual traditions that are more explicitly political and place-based than the comparatively less politicized conceptual traditions of the Global North (Halvorsen, 2019; López Sandoval et al., 2017; Rosset et al., 2022). A third framing, however, remains largely at the periphery of this terminological debate: relational and Indigenous understanding of *land* (e.g., *Pacha* [Andean space-time as living whole], *Mapu* [Mapuche relational earth]) do not treat land as a physical substrate or even as a territory in the political sense, but as a living web of relationships 435 between human communities, non-human beings, and place (de la Cadena, 2015; Escobar, 2008). These framings exceed both *terrestre* and *territorial* in their ontological commitments, and are increasingly recognized in global assessments such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) and the Global Environmental Outlook (United Nations Environment Programme, 2025).

While in smaller proportion than benefits, some respondents were skeptical of terminological standardization, 440 indicating that a consensus term may exclude Indigenous and local approaches, that terms should adapt to context, and that consensus may be unachievable. These are not just objections to terminological change but epistemological critiques that point to a tension between a field aspiring to international networks and the heterogeneity of knowledge practices on the ground of plurality that characterizes the region's environmental scholarship



445 (Montgomery, 2004). LSS could thus learn from this plurality: the territorial experience of Latin America, grounded in decades of scholarship on land governance, Indigenous rights, and relational ontologies, offers conceptual resources that could enrich the field globally rather than simply being accommodated within it (Quiroga Manrique and Caretta, 2026). Higher ambivalence in Brazil may reflect the established theoretical weight of *território* in Portuguese, while lower perceived need for a regional LSS term in the North region could reflect greater familiarity with LSS and thus less urgency for an equivalent term.

450 4.4 Indigenous and local knowledge inclusion remains shallow

The strong association between epistemological orientation and ILK incorporation depth is another substantive finding. The limited ILK incorporation among explanatory/positivist respondents, comprising the majority orientation in several regions, indicates that is not a common practice. In addition, it shows that disciplines who are more engaged with ILK (e.g. anthropology, ethnobiology) do not work much on topics related to land systems in the region. Thus, there is much room for further engagement between these disciplinary fields, who have the potential to contribute to each other with complementary concepts and tools. This echoes broader critiques of sustainability science regarding the gap between rhetorical commitment to knowledge co-production and its actual implementation in research design and analysis (Norström et al., 2020; Tengö et al., 2017).

460 The pattern of ILK incorporation by research phase is also notable. The concentration of ILK use in analysis and interpretation, rather than in problem framing and data collection, suggests that where IKL is incorporated, it tends to function as interpretive context or validation material rather than as a constitutive input into research design. Genuine co-production, in which knowledge holders participate in defining research questions, collecting data, and shaping the ontological and epistemological framing of the research itself, remains uncommon across all regions, suggesting that the field is still far from using decolonial approaches. We also noted high non-response and non-incorporation rates in South S, combined with low dissemination of ILK-integrated findings in Europe. These patterns may partly reflect a sampling limitation where we missed actors actively engaged with Mapuche (Chile) or Guaraní (Paraguay) communities. Beyond sampling, these patterns may reflect a disciplinary composition effect, where respondents in these regions were drawn from positivist and systems-modeling traditions where ILK engagement is less common. However, they may equally reflect a genuine structural gap: the persistence of disciplinary and institutional arrangements that systematically exclude ILK from professional practices (Bohensky et al., 2013; Tengö et al., 2017).

4.5 Conceptual diversity and the limits of translation

The open-ended response analysis reveals a conceptual landscape that is both richer and more epistemologically varied than the English-language land systems literature would suggest. The convergence on *territorio* as the most widely cited approximation for land systems is particularly noteworthy. As several respondents emphasized, *territorio* in Latin American usage, especially as understood by Indigenous peoples, carries meanings that exceed the English territory in important ways: it encompasses dynamism, relational connection between people and place, governance, cosmological dimensions, and a fundamentally different ontological relationship between human communities and the land they inhabit (Benedetti, 2011; Porto-Gonçalves, 2006; Quiroga Manrique and Caretta, 2026). The concept of *territorio* is also used by Indigenous movements in the fights for their rights, to refer to their "life space" as a holistic concept (Escobar, 2008). Concepts shared by respondents such as *Mapu* (Mapuche relational earth), *Pacha* (Andean space-time as living whole), *Tekoha* (Guaraní place of communal life), *resguardo* (Colombian collective Indigenous territory), and *comunalidad* (Zapotec communal existence and governance) similarly encode systemic relationships between people, land, and non-human actors that approximate what LSS seeks to describe analytically, but from within relational rather than analytical ontologies. Another interesting pattern is that respondents did not include Political/Critical vocabulary in community engagement contexts, despite it being used in literature search terms (Supplement 3). This contrast raises a question about how respondents



approach scholarship and community-facing research practice: respondents might use political ecology as a study framework but then engages communities using different terms, adopting territorial and relational vocabulary rather than political language.

4.6 Limitations

This study provides an exploratory characterization of how LSS is understood and practiced across Latin America rather than a statistically representative survey of the field. The sample size ($n=156$), while geographically and disciplinarily diverse, prevents formal hypothesis testing and limits the generalization of regional and disciplinary comparisons. We also acknowledge that respondents in the North America and Europe groups may include actors originally from Latin America, whose responses could reflect familiarity with both regional and international LSS networks, introducing an additional source of bias in regional comparisons. Nonetheless, the consistency of patterns across diverse respondent groups suggests these trends are meaningful. Recruitment through the authors' professional networks also likely introduced a selection bias toward actors already familiar with formal land systems communities, potentially underrepresenting government, private sector, and community-based practitioners. Future work would benefit from larger, stratified sampling targeting underrepresented sectors and regions that could contribute to the dialog we started with this work.

5 Conclusion

This study offers a systematic assessment of how LSS is understood, translated, and operationalized across Latin America. Three findings stand out. First, the Latin American community of actors working on LSS topics is larger than networks already using LSS as a familiar umbrella, reflecting a conceptual pluralism in which actors engage with land related topics under diverse but related concepts. Second, the terminological landscape is pluralistic, reflecting distinct epistemological traditions that have developed independently of, and in some cases prior to, the English-language LSS literature. The preference for *territorio* over land-based framings such as *terrestre*, the richness of the reported ILK concepts, and the regional variation in framework use, carry social and political connotations often absent in English-language LSS. Third, ILK integration remains shallow and unevenly distributed, concentrated among actors who already have transdisciplinary orientations rather than embedded in the LSS field as a whole.

Together, these findings suggest that supporting LSS in Latin America is not primarily a matter of diffusing the concept from established networks, but of creating the conditions for genuine conceptual exchange. One in which *territorio*, *Pacha*, *comunalidad*, and the political ecology tradition are recognized as intellectual contributions to the field rather than local variants of it. As a starting point for this exchange, we propose *Ciencias de sistemas territoriales* (Spanish) and *Ciências de sistemas territoriais* (Portuguese) as working translations of LSS that reflect both the scientific ambition of the field and the epistemological traditions through which land is understood and governed across the region. This terminological debate points to something deeper than translation: an invitation for LSS to engage with Latin American, Indigenous, and other non-Western knowledge traditions that contain conceptual resources that could reshape the field's own analytical foundations.

Author contributions

All authors contributed to the conceptualization, methodology, study design, data collection, formal analysis and interpretation of results, and writing – review & editing. (Redacted) coordinated the project and prepared the original draft of the manuscript with contributions from all co-authors.

Competing interests

At least one of the (co-)authors is a member of the editorial board of Land Systems



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