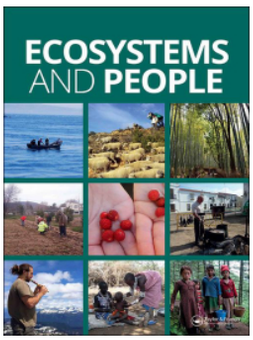

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A regional PECS node built from place-based social-ecological sustainability research in Latin America and the Caribbean

Rafael Calderón-Contreras [a], Patricia Balvanera [b,c], Micaela Trimble[d], Alfonso Langle-Flores [e], Esteban Jobbágy [d,f], Manuel Maass Moreno[b], Jorge Marcone[d,g], Néstor Mazzeo[d,h], Minerva M. Muñoz Anaya[d], Iván A. Ortiz-Rodríguez [b,i], Maria Perevochtchikova[j], Sophie Avila-Foucat[k], Martha Bonilla-Moheno[l], Laurie Beth Clark[d,m], Miguel Equihua [n], Bárbara Ayala-Orozco [b], Isabel Bueno[o], Loni Hensler[p], Juana Claudia Leyva Aguilera[o], Miguel Martínez Ramos[q], Juliana Merçon[r], M. Azahara Mesa-Jurado [s], Henrik Österblom[c,n], Raul Pacheco-Vega[t], Bonifacio Pérez Alcántara[u], Octavio Pérez-Maqueo[l], Luciana Porter-Bolland [v], Sandra Quijas[d], Laura Elisa Quiroz Rosas[a], Eduardo Rios Patron[w], Juan C. Rocha-Gordo[d,n,x], Iskra Alejandra Rojo Negrete[a], Luz Piedad Romero-Duque[p], Julieta A. Rosell [o], Marten Scheffer[d,q], Luis-Bernardo Vázquez[y], Mariana Villada Canela[z] and Mónica Velázquez[z]

[a]Departamento de Ciencias Sociales, Universidad Autónoma Metropolitana Cuajimalpa, Mexico; [b]Instituto de Investigaciones en Ecosistemas y Universidad Nacional Autónoma de México, Morelia, Mexico; [c]Unidad Académica de Estudios Territoriales, Universidad Nacional Autónoma de México, Oaxaca, Mexico; [d]South American Institute for Resilience and Sustainability Studies (SARAS), Bella Vista, Uruguay; [e]Centro Universitario de la Costa, Universidad de Guadalajara, Puerto Vallarta, México; [f]Instituto de Matemática Aplicada de San Luis (IMASL), Universidad Nacional de San Luis, San Luis, Argentina; [g]Rutgers University, New Jersey, NJ, USA; [h]Eastern Regional University Centre (CURE), Maldonado, Uruguay; [i]Classe di Scienze, Scuola Normale Superiore, Florence, Italy; [j]El Colegio de México A.C., México; [k]Instituto de Investigaciones Económicas, Universidad Nacional Autónoma de México, Mexico; [l]Red de Ambiente y Instituto de Ecología, A.C. ., Xalapa, Mexico; [m]University of Wisconsin-Madison, Madison, WI, USA; [n]Stockholm Resilience Center (SRC), Stockholm, Sweden; [o]Laboratorio Nacional de Ciencias de la Sostenibilidad, Instituto de Ecología, Universidad Nacional Autónoma de México, Mexico; [p]Universidad de Ciencias Aplicadas y Ambientales Bogotá Colombia; [q]Wageningen University, Wageningen, The Netherlands; [r]Instituto de Investigaciones en Educación, Universidad Veracruzana, Xalapa, México; [s]El Colegio de la Frontera Sur, Laboratorio Transdisciplinario para la Sustentabilidad (LATSU), Villahermosa, Mexico; [t]Facultad Latinoamericana de Ciencias Sociales (FLACSO) México, Toluca, Mexico; [u]Facultad de Geografía de la Universidad Autónoma del Estado de México, México; [v]Instituto de Ecología, A.C, Red de Ecología Funcional, Xalapa, Mexico; [w]Instituto de Investigaciones Económicas y Empresariales de la Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Mexico; [x]Future Earth, Stockholm, Sweden; [y]El Colegio de la Frontera Sur, Grupo de Investigación en Sistemas Socioecológicos Urbanos, Chiapas, México; [z]Instituto de Investigaciones Oceanológicas, Universidad Autónoma de Baja California, Ensenada; [z]Facultad Latinoamericana de Ciencias Sociales (FLACSO) Sede México, Laboratorio de Métodos, Ciudad de México, México

ABSTRACT

Sustainability requires a combination of meaningful co-production of locally relevant solutions, synthesis of insights gained across regions, and increased cooperation between science, policy and practice. The Programme for Ecosystem Change and Society (PECS) has been coordinating Place-Based Social-Ecological Sustainability Research (PBSESR) across the globe and emphasizes the need for regional scientific nodes from diverse biocultural regions to inform sustainability science and action. In this paper, we assess the strengths of the PBSESR communities in Latin America and the Caribbean (LAC). We provide an overview of PBSESR literature associated with this region and highlight the achievements of two prominent regional networks: The Social-Ecological Systems and Sustainability Research Network from Mexico (SocioEcoS) and the South American Institute for Resilience and Sustainability Studies from Uruguay (SARAS Institute). Finally, we identify the potential in these nodes to constitute a regional PECS node in Latin America and discuss the capacity needed to ensure such function. The results of the literature review show that while still loosely interconnected across the region, networks play key roles in connecting otherwise cloistered teams and we illustrate how the SocioEcoS network (focusing on transdisciplinary co-production of knowledge towards sustainability) and the SARAS Institute (focusing on innovative approaches for looking at complex social-ecological problems, rooted in slow science and arts) operate as key connectors in the region. We conclude that these organizations combined can embody a Latin American node for PECS, and would thereby not only contribute to regional but also global capacities to advance the sustainability agenda.

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1. Introduction

The importance of sustainability and the intertwined aspects of people and nature have become increasingly evident in the face of the COVID-19 pandemic. Resilience is critical for the capacity to face similar future disturbances in social-ecological systems based

CONTACT Rafael Calderón-Contreras rcalderon@cua.uam.mx
Supplemental data for this article can be accessed here.

on novelty and innovation (Chapin et al. 2009). Given the heterogeneity in social and ecological conditions across the planet, the co-construction of sustainable pathways at any particular point on Earth is paramount. Such pathways require a deep understanding of the long-term drivers of unsustainable outcomes and the potential for positive transformation, as well as meaningful and trustful collaborations with a wide range of stakeholders (Fischer, Gardner, Bennet et al. 2015; Balvanera et al. 2017c; Norström et al. 2020). Global sustainability can be built from insights gained at each specific site, through cross-site thematic syntheses to identify lessons learned that are locally, regionally or globally relevant (Maass and Equihua 2015; Norström et al. 2017; Balvanera et al. 2017b).

The Programme for Ecosystem Change and Society (PECS) has been coordinating Place-Based Social-Ecological Sustainability Research (PBSESR) across the globe for 10 years now (Norström et al. 2020). Based initially at the Stockholm Resilience Centre, and drawing from conceptual legacies initiated by the Resilience Alliance since 1999, and from insights gained during the Millennium Ecosystem Assessment (Carpenter et al. 2009), PECS is a core project within the Future Earth program and has grown into a diverse global and yet locally grounded network (www.pecs-science.org). Today the coordination is shared between the Centre for Sustainability Transitions at Stellenbosch University in South Africa, Leuphana University of Luneberg in Germany, and the McGill University in Canada. Further in-depth insights emerging from multiple regions of the world have been considered critical for understanding the diversity of contexts that shape social-ecological dynamics around the world (Bennett, Solan, Biggs et al. 2016). To do so, the PECS scientific committee identified in 2017 the need to foster the development of regional PECS nodes beyond the first network based in South Africa.

Latin America and the Caribbean (LAC) provides a unique opportunity to enrich the contributions of PECS towards understanding the diverse challenges to achieving global stewardship. Its large biocultural diversity, colonial legacies, historical political turbulence, rapid degradation due to commodity exports, strong power imbalances, and inequities in gains and burdens from social-ecological systems provide distinctive insights on how to address these challenges in the shaping of more sustainable pathways (Ortega Uribe et al. 2014; Balvanera et al. 2020). The second open science conference of PECS (PECS-II) in Oaxaca, Mexico (Balvanera et al. 2017c), made visible the richness of the PBSESR in the region, the prominence of regional networks, and the potential contribution of the social-ecological aspects the region offers to inform global sustainability.

In this paper, we describe the state and contributions of the PBSESR community across LAC and identify suitable institutions to support the development of a regional PECS node. To do so, we provide an overview of PBSESR literature associated with the region. We then identify key connectors across scientific institutions in the region and highlight the achievements of two of the main actors: the Social-Ecological Systems and Sustainability Research Network from Mexico (SocioEcoS network – https://www.redsocioecos.org/) and the South American Institute for Resilience and Sustainability Studies from Uruguay (SARAS Institute – https://saras-institute.org/). Although strong research groups are dealing with the pressing sustainability issues from the region from within Latin America and beyond (See Rocha et al. 2020), there are two main features at the core of these two collaborative networks that are worth analysing given their potential for informing global sustainability issues: 1) their collective effort to mobilise toward long-standing Latin American- and empirically-based collaborative research, and 2) their respective focus on transdisciplinary and politically-driven approaches (SocioEcoS), and their innovative and exciting focus on arts and their potential to tackle sustainability issues (SARAS).

2. Systematic review of Place-Based Social-Ecological sustainability research in Latin America

A systematic literature review allowed us to assess the characteristics of the diverse papers from multiple institutions that explicitly address integrated social-ecological systems (Figure S1), have a focus on solutions and transformation-oriented research, and emphasize the local context of the study sites assessed (see supplementary materials for methods used). This review follows the PRISMA protocol (Preferred Reporting Items for Systematic Review and Meta-Analyses) (Moher et al. 2009; Booth et al. 2016), which was applied to Scopus. A total of 1939 papers were identified from which 570 met the criteria for place-based SES research. A comprehensive analysis of the 570 PBSESR selected publications were performed following the SALSA Framework (Higgins and Green 2006): i) Time analysis of publications, ii) Semantic network analysis, iii) Association analysis, and iv) Co-authorship network analysis. This systematic search review also follows previous integrative synthesis efforts that reflect the importance of the region for PBSESR (Place-Based Social-Ecological Sustainability Research) (Perevochtchikova et al. 2019; Balvanera et al. 2020).

Our analysis shows that PBSESR is on the rise in LAC (Figure S2). We found that the rate of growth in the number of publications was 20% between 2004–2019. Papers were published in the journals Ecology and Society, Ocean and Coastal Management,

Ecological Economics, Journal of Environmental Management and Ecological Indicators. The institutions playing a major role in the region (considering the affiliation of authors) include the Universidad Nacional Autónoma de México (Mexico), Pontificia Universidad Católica de Chile (Chile) Instituto de Ecología (Mexico), University of California (USA), University of British Columbia (Canada), Wageningen University (Netherlands), University of Florida (USA), Indiana University (USA) and Stanford University (USA). Study sites were distributed across LA, but most of them were located in Brazil, Mexico, Argentina, Colombia and Chile (Figure 2a). A total of 2,263 authors contributed to this body of research, and 94.7% of the papers were multi-authored. Although we do not disregard publications in Spanish and Portuguese, this paper explores those publications with the largest potential for informing global sustainability issues by bringing local insights to the global arenas. Most of this research is published in English.

PBSESR in LAC tends to illustrate a wide agenda of pressing sustainability issues (See Figure S3). Seven major thematic groups were identified (See Figure 1). *Environmental management* (50%) includes publications referring to environmental management, sustainability, social-ecological systems, environmental impact, agricultural impact, governance, fisheries, and marine protected areas. *Community sustainable development* (18%) includes topics such as social perceptions, social participation, sustainable development, community knowledge, community resilience, local economy and indigenous knowledge. *Ecosystem services* (13%) refers to studies about ecosystem services, land cover, payments for ecosystem services, and values. *Biodiversity conservation* (8%) encompasses issues of conservation and restoration of species, forest and landscapes. *Land cover change and climate change* (5%) refers to publications related to climate change, scenarios, risks, costs, social processes and long-term effects. *Amazon* (4%) includes publications from the Brazilian Amazon and *Water river management* (2%) refers to basin and river management, water quality and soil.

PBSESR is carried out by different institutions across LAC; however, associations between the country of affiliation, research sites and topics showed some regional differences. Issues of environmental management and ecosystem services were largely addressed by authors in Brazil, Mexico and USA, in study sites within Brazil (especially in the Sao Paulo area) and Chiapas, Mexico (Figure 2a). Some research topics were more prevalent for some countries compared to others; for instance, Argentina showed more prominent research directed to decision-making, Brazil in participatory approaches, Chile in local participation, Colombia in social perceptions, and Mexico in sustainability. The co-authorship network between countries (Figure 2b) displayed the

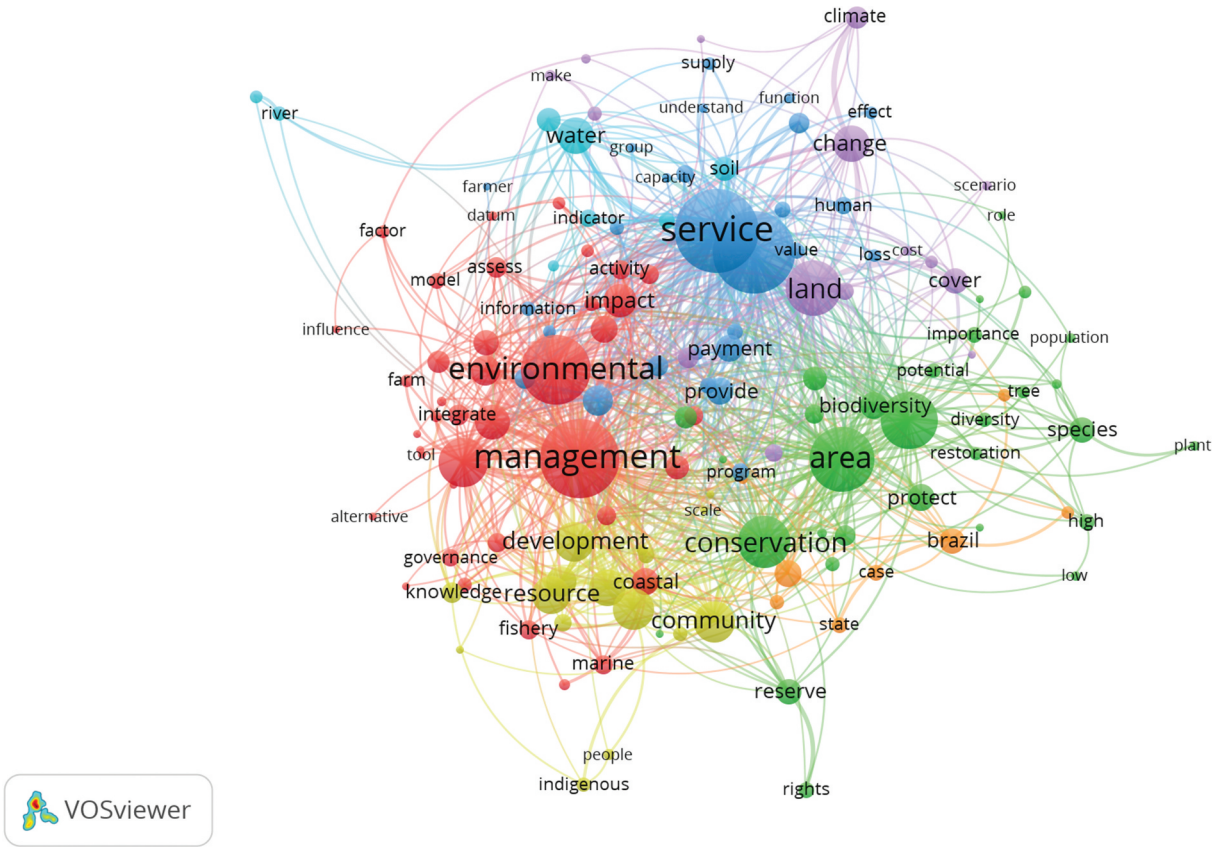

Figure 1. Semantic networkanalysis.

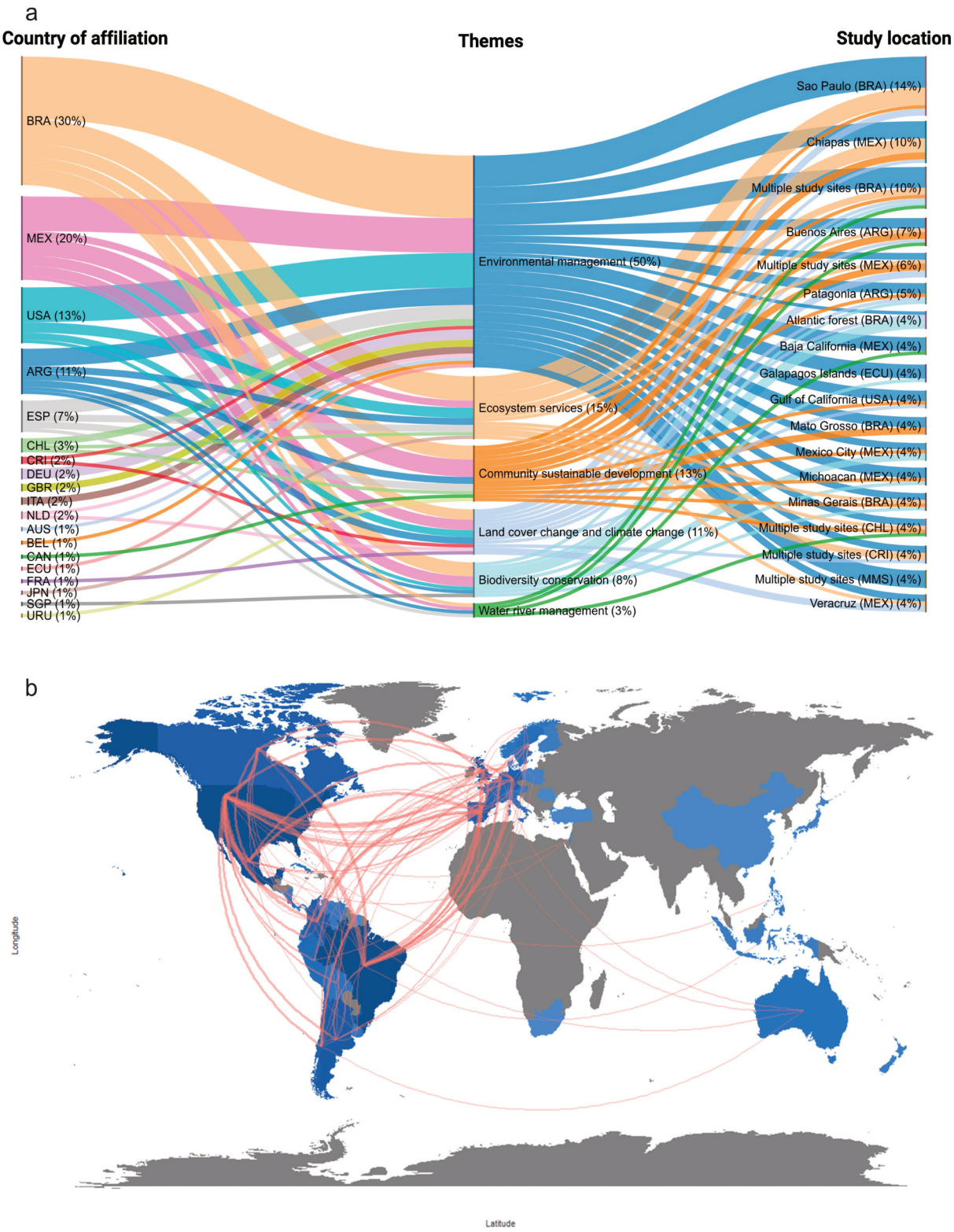

Figure 2. Place-based social-ecological sustainability research in Latin America.

prevalence of cross-collaboration between authors in LAC and countries outside the region, predominantly the USA and several European countries. The sample analysis shows that Mexico and Brazil concentrate the majority of public funding for PBSER (Figure S4).

Gaps and opportunities for PBSER can be identified from these analyses. The body of literature focuses on a few specific topics that have traditionally impacted public policy such as environmental management, biodiversity conservation, and ecosystem services (Figure 1); however, these PBSER topics and places in LAC can contribute sound literature to and relevant examples for global sustainability and social-ecological transformations (Bennet et al.). International research programmes such as PECS, have made strong efforts to enhance these traditional

research themes by encouraging novel frameworks based on transdiscipline and arts (Scheffer and Mazzeo 2019), and by providing the means for local research groups to link to international organizations for better research collaborations. International collaborations across regions (i.e. between Europe and LAC, or between North America and LAC) are more notorious than collaborations within the region (Figure 2). Strengthening regional research networks in LAC may foster south-south exchanges, including capacity building and opening new collaboration opportunities.

PBSESR in LAC is loosely interconnected, although a few authors and networks play a key role in bringing together otherwise cloistered teams (Figure 3). Among the 978 authors and 8,826 connections, we found 98 tight co-authorship clusters that were isolated from one another. On average, each author was connected to 9 others, however, eight authors (from Mexico, Sweden, Chile, USA, and France) extended co-authorship connections with more than 30 authors (see Table S3). Yet, several networks and research programs or institutions have created bridges among these clusters: the SocioEcoS network (yellow in Figure 3, is prevalent in 9 clusters), PECS (blue in Figure 3, 6 clusters), SARAS Institute (green in Figure 3, 4 clusters) and the Stockholm Resilience Centre (SRC) and the Resilience Alliance (RA) (red in Figure 3, clusters 3). These results show the need for finding ways for strengthening local and regional collaborations within the region, without leaving aside the importance of the international platforms provided by specific research groups, organizations and programmes. That is the case of PECS, whose potential for creating, sustaining and promoting new PBSER agendas based

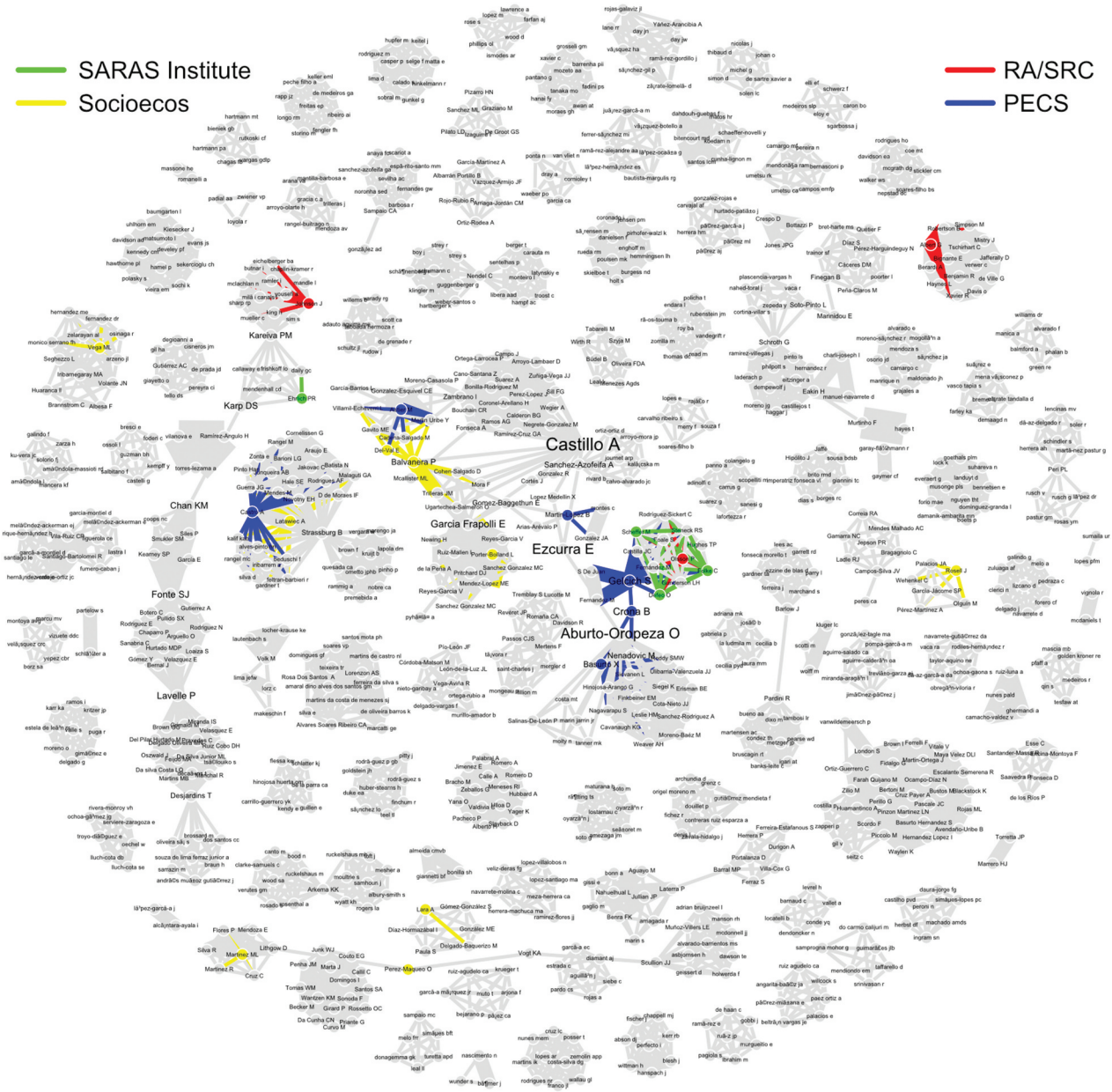

Figure 3. Coauthorship network for PBSESR in LAC.

on the existing local efforts and reliant on the key connecting institutions can reduce fragmentation and foster collaboration.

In summary, there is a thriving community carrying out PBSESR in LAC. However, there is a need for bridging closely the different research clusters that may remain scattered in disconnected groups or organizations. Figure 3 shows the impact of four PBSER networks reflected in Latin American literature. In this case, we used the colors to indicate the authors' membership to these four networks and their role as bridges (hubs) in maintaining connectivity in the large network of co-authors on PESBR (see Ahn et al 2011; Burt and Merluzzi 2014). Hence, the scope of Figure 3 encompasses a wide array of co-authorship relations that given the large number of nodes in the network (979 authors), it is possible that we have captured other collaboration networks by default, as shown by the numerous tight clusters (in grey color). More research is needed to better illustrate the role of smaller networks working on PBSER in Latin America, whose reach may be difficult to detect by the analysis presented here. Nevertheless, the following sections highlight the role of networks, programs and institutions such as SocioEcoS, and the SARAS Institute for creating such clusters of research groups based on transdisciplinary approaches and the potential relevance of the humanities and arts. The results also show that these networks have proven successful by connecting LAC authors with those in Europe and the USA, especially through the role of PECS and the Stockholm Resilience Centre (SRC). The following sections characterize these LAC networks.

3. The SocioEcoS network

Following a long-standing tradition of participatory place-based research carried out in Latin America, Mexico has represented a prime example of collaborative and interdisciplinary solution-oriented sustainability research. Interdisciplinary exploration of the interlinkages between ecosystems and people on issues such as traditional agricultural systems, ecosystem services or social-ecological resilience has thrived since the 1950s, as depicted in the above literature review (Martínez et al. 2006; Balvanera et al. 2011, 2017a; Cruz-León and Cervantes-Herrera 2015). Based on those collaborative efforts and following the need to address complex, multiscale, nationwide priority problems, the National Council for Science and Technology (CONACYT, 2017) launched the Thematic Networks Program in 2012. It was aimed at fostering the development of networks that would encompass a wide range of disciplines, institutions, and regions of the country. Under this programme, the SocioEcoS network was created in 2014 to build upon long-standing collaboration efforts relevant to sustainability (Figure 4). It was conceived as a space for dynamic, horizontal and creative interactions between scientists, government, and civil society organizations.

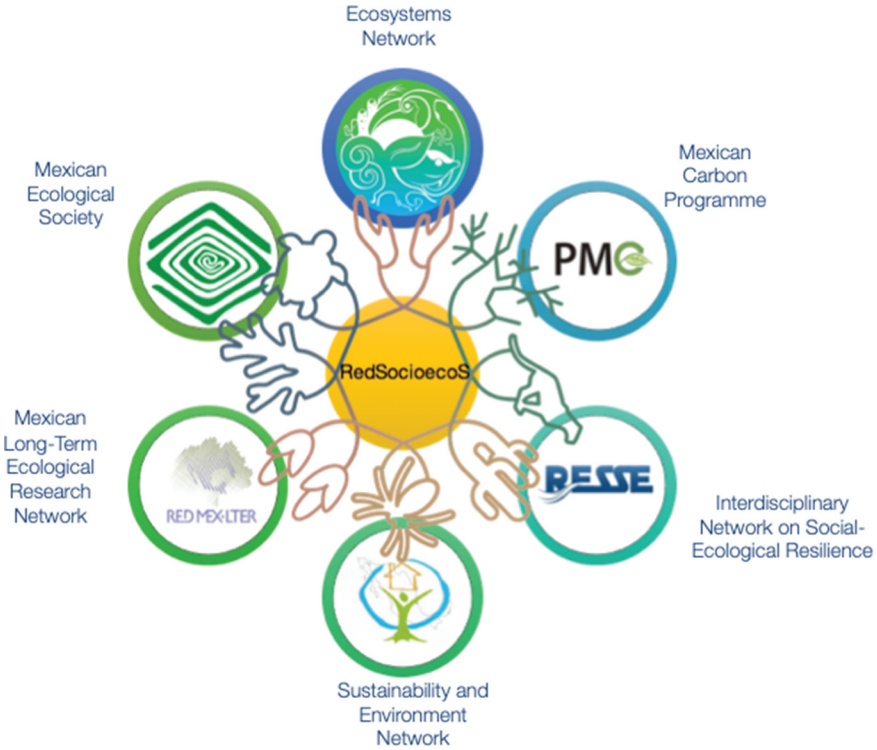

Figure 4. Structure of the SocioEcoS network.

The objectives of the SocioEcoS Network are: i) to generate knowledge and information necessary for the construction of sustainable development alternatives, understanding their implications for the diverse social-ecological systems found in the country, ii) to design solutions to human problems without compromising the functioning and biodiversity of natural systems, and iii) to integrate the necessary knowledge for the forecast, design and construction of various future scenarios for social-ecological systems. SocioEcoS is structured around operative (management, liaison, internal communication) and thematic (ecosystems integrity, long-term research, the incidence in public policy, transdisciplinarity, capacity building, international collaborations and knowledge syntheses) nodes. The thematic nodes provide a means for assessing the actual functioning and impact of the network, and for classifying most of the products.

The key to the operation of SocioEcoS is to foster interaction among its members. A strong online platform supports communication with a wide audience as well as with members (www.redsocioecos.org). SocioEcoS was designed from its very beginning as a multi-actor transdisciplinary academic network. The three types of membership (academics, students and members of civil organizations) can be found in the designed Geographic Information System embedded in the website, identifying even further details such as the case studies and main research projects involved. The website also includes a repository of all the products of the network, all of which are publicly available. It also includes a live repository of all the environmental regulations and laws for easy consultation updated weekly (https://normatecambiental.org/).

Collaboration within and across countries in Latin America is often hampered by the lack of research funding, which in turn produces fragmentation and isolation among research networks. There is little opportunity for national or international networks to grow if there are not serious research funding commitments. In fact, funding available to SocioEcoS from CONACYT dropped dramatically in 2016 and was eliminated in late 2018 due to a change in national policies, limiting the possibility to undertake face-to-face activities. However, the formulation of new projects and online activities is still very dynamic. Such funding restrictions have reduced the number of activities and participants and the density of interactions among its members has decreased slightly (Figure 5). Connecting to large international research programs such as PECS could open new funding opportunities for this dynamic network.

One of the strengths of Socioecos has been the transdisciplinary co-production of knowledge in the search for solutions towards sustainability. The transdisciplinary node organised a series of workshops across Mexico, in which transdisciplinary teams carrying out sustainability projects exchanged experiences and discussed good practices regarding natural resource management and conservation (Merçon et al. 2019). These discussions led to the identification of obstacles and opportunities for place-based multi-stakeholder collaboration, specifically those that are unique to the Global South and are poorly discussed in the current sustainability literature (Ayala-Orozco et al. 2018). Recognizing the need for producing materials for the general public on multi-stakeholder collaboration, the transdisciplinarity node generated an edited book to share successful Mexican experiences on this kind of collaboration (Merçon et al. 2018), a manual with general guidelines (Alatorre et al. 2016), and an edited book on transdisciplinary processes (Merçon forthcoming). These materials have reached different networks in LA. From those efforts, a series of books and

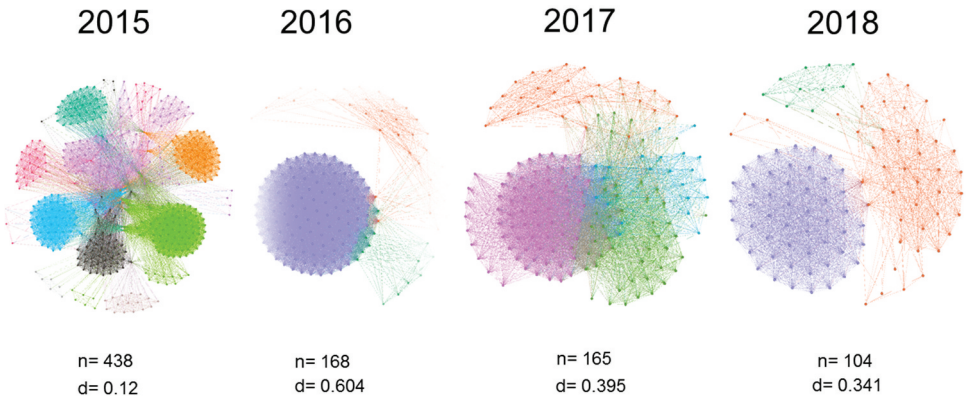

Figure 5. Temporal variation of members attendance to events. The figure shows the density of the connections (d) provided by the events organized by the network during each year, where n is the number of nodes in the network. Density ranges between 0 where there are no connections between any of the nodes and 1 where every node is connected to all other nodes in the network. High density contributes to the strengthening of trust between individuals and groups, which encourages collaboration.

manuals were made available on SocioEcoS web page (https://www.redsocioecos.org/libros). A thematic book (Calderón-Contreras 2017) and a series of webinars (https://www.redsocioecos.org/webinars) emerged from these workshops.

A strong community of practice emerged from these different activities, including students and academics at a range of career stages and a wide diversity of stakeholders. Novel research projects emerged from SocioEcoS. For example, a 'National Observatory for Socioecosystem Sustainability' is being designed by a common effort of multiple national research networks, including SocioecoS, Mex-LTER, and the networks of 'Biocultural Patrimony' and 'Integrate Basin Manag ement'. ONSSES, as it is known by its acronym in Spanish (**O**bservatorio **N**acional para la **S**ustentabilidad **S**ocio**E**co**S**istémica), is conceived as a transdisciplinary network of local learning communities, scattered throughout Mexico. I-Gamma (http://i-gamma.net/) is a platform focused on promoting sustainability by maintaining the integrity and functionality of ecosystems. To this end, it relies on the analysis of large amounts of environmental data (Big environmental data), and automated learning techniques (such as deep learning, Bayesian networks and semantic analysis).

SocioEcoS has played a key role in international cooperation across LA. One of the most relevant international activities was SocioEcoS participation in the Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES), specifically the Americas Assessment, where Mexico was the country with the highest participation and SocioEcoS was the main source of revisions. Furthermore, the international cooperation network organized several international workshops and conferences. In 2017 SocioEcoS was a key organizer of the Fifth Conference of Ecosystem Services in the Tropics (CISEN-V – https://www.cisenv.org/) and the Second Open Conference of the Programme of Ecosystem Change and Society (PECS-II – https://www.pecsii.org/), with 350 participants each from all five continents. In the context of PECS-II, for instance, SocioEcoS collaborated with a wide range of institutions to organize a workshop on the plural valuation of nature and on the contributions of biocultural diversity to social-ecological resilience (Merçon et al. 2019b; Jacobs et al. 2020). Given the lack of current funding, the future of SocioEcoS lies on the strength of its community of practice and on its capacity to contribute to science-based policy-making aimed at positive social-ecological transformations across LAC.

4. SARAS institute

The South American Institute for Resilience and Sustainability Studies (SARAS) is a place in South America for weaving networks to help the region realize sustainable and resilient futures (Scheffer and Mazzeo 2019). Located in Uruguay, it was conceived and created in 2006. It is an interdisciplinary research institute aimed at contributing substantially to the production of knowledge and capacity building in processes and mechanisms that determine the sustainability of ecosystem services, the key to determining human wellbeing.

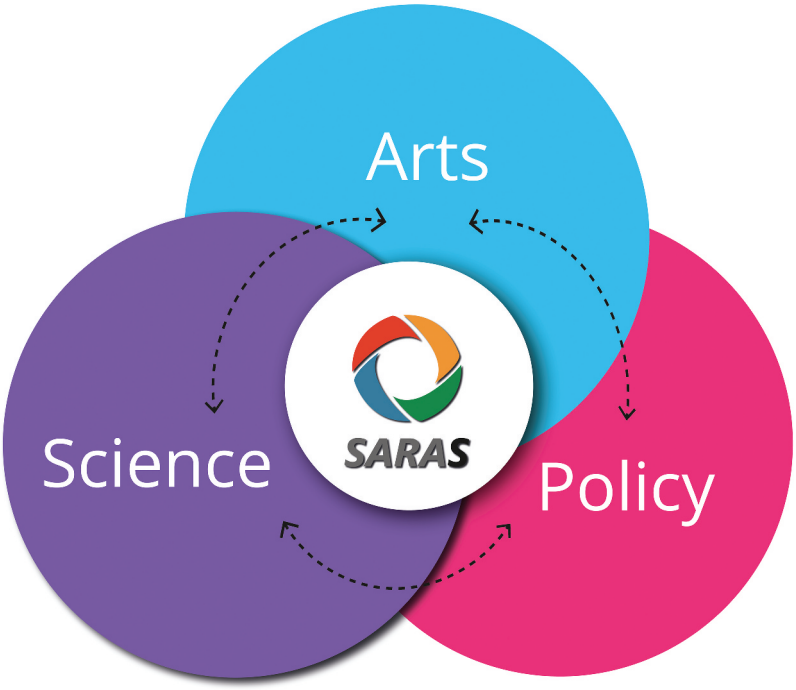

Figure 6. The South American Institute for Resilience and Sustainability Studies (SARAS).

SARAS is based on an understanding that there is a need for slow science, the collaboration between artists and scientists, and links to policy (Figure 6). Slow science allows the mind to find peace and think deeply and SARAS makes space for informal walks, unplanned connections, unstructured time slots, mind wandering and risk-taking explorations (Scheffer 2014; Scheffer et al. 2015; Paasche and Österblom 2019). These ideas go hand in hand with the incorporation of the arts in collaboration with scientific approaches (from different disciplinary domains) to sustainability, resilience, and transformation (Scheffer 2014; Scheffer et al. 2015; Paasche and Österblom 2019). The integration between arts and sciences is generating novel ways of looking at complex problems in nature and society.

SARAS aims at collaborating in the development of theoretical frameworks related to the structure and dynamics of complex adaptive systems (especially social-ecological systems), applying these to real-world problems, co-creating or co-producing knowledge and solutions from the perspective of LA. The conceptual foundations of SARAS are complex systems, social-ecological systems and resilience thinking (Berkes et al. 2003; Folke 2006; Biggs et al. 2015), as well as transdisciplinary place-based social-ecological sustainability research (e.g. Lang et al. 2012; Balvanera et al. 2017). SARAS networks and meetings have been organized around specific topics, problems and/or systems, involving researchers from various disciplines, areas of expertise, and countries.

SARAS activities have led to a diverse range of products, including interdisciplinary research projects, graduate courses and annual conferences/workshops. The cycle of annual conferences has been focusing on relevant topics to LA, including issues such as sustainable coastal fisheries, water management, or food systems, critical transitions, collaborations between art and science for sustainability, and education for uncertainty. These activities have been key for building networks among professionals in Latin America. Publications include special issues in the journal Ecology and Society on art and science for sustainability, and sustainable pathways for LA, a book on the integrated management of Laguna del Sauce lake nearby SARAS, as well as an anthology of

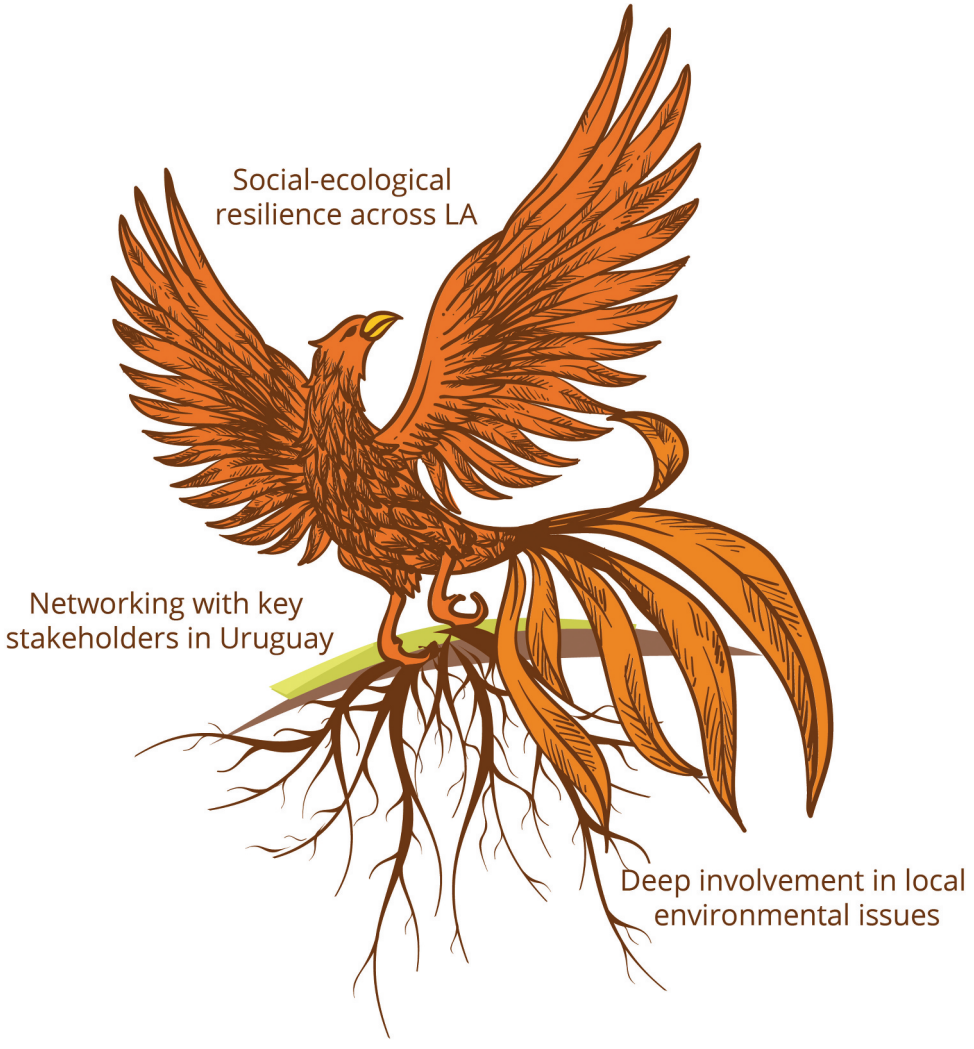

Figure 7. The roots and wings of the South American Institute for Resilience and Sustainability Studies (SARAS).

poems. Webinars have been key at building capacities across LA.

SARAS is a leading institute in resilience, fostering strategic connectivity within Uruguay and developing deep roots into local environmental issues (Figure 7). SARAS has been fostering international collaborations through several means, such as the UNITWIN Network on Climate Change and Decision Making, or the GovernAgua research project on adaptive and anticipatory water governance in six watersheds in South America. A course organized in 2018, in collaboration with the Stockholm Resilience Centre and PECS, promoted the creation of The Social-ecological Co-creation Network for Latin America (RESACA), a network or networks of LAC young scholars and artists to respond to the regional social-ecological challenges. SARAS activities and events have taken place mostly in Uruguay, to facilitate the interactions with Uruguayan policymakers and non-governmental actors and with society at large, through annual public events.

5. A regional LAC node for PECS

Multiple international policy documents advocate for capacity building in science, policy and practice as a key mechanism for advancing sustainability and equity challenges. We argue that a long-term investment in scientific capacity represents a key priority for building such capacity. Although important efforts have been made in the region for strengthening PBSER within specific countries and across the region, it is important to find ways of creating long-lasting ties between PBSESR in Latin America and other regions in the world. One way of doing this is by relying on the experience of international programmes with the potential to create long-lasting scientific collaborations. That is the case of the PECS programme, that has supported the creation of strong collaborations, for instance, between Southern African researchers and groups with a global forum with a common PBSESR interest (Balvanera et al. 2017).

Setting up a LAC node for PECS in collaboration with RedSocioecos and SARAS creates novel opportunities for individuals and institutions to learn about and engage in sustainability challenges. PECS has been an important connector internationally and is supporting scientific research, co-production of knowledge, teaching and training to academics and practitioners, and is supporting change towards sustainability. We argue that the time is ripe for the creation of a LAC node for PECS, in order to strengthen the regional capacity of Latin American science and practice and thereby also increase the diversity of perspectives featured in the sustainability science discourse. Our assessment is that SocioEcoS and SARAS Institute represent strategic partners for this purpose, with networks and ability to connect with additional organizations in the region. PBSER is on the rise, focusing on regionally relevant sustainability issues, relying on strong institutions. SocioEcoS and SARAS have played key roles in connecting teams of researchers across LA, leading creative and relevant collaborative projects, developing the science-policy interface from local to regional scales, producing a wide range of products targeted at multiple audiences and building capacities for transdisciplinary sustainability research and collaboration within and beyond Latin America. Placed geographically near the two extremes of the LAC region, SocioEcoS from Mexico and SARAS from Uruguay, have complementary strengths while converging towards similar visions, making them a suitable team to operationalize an LAC node for PECS.

With an emphasis on social-ecological systems, the focus on the co-design of solutions, the adaptation of studies to the local context, the long-term, frequent and meaningful engagement with local stakeholders have shown to be key elements for the successful PBSER developed by both networks and their teams across LAC (Balvanera et al. 2017c). Such engagement has contributed to novel and radically different social and organizational processes that lead to new forms of creative knowledge production in environmental sciences. PBSESR in Latin America is often characterized by meaningful relations with local stakeholders based on common rituals, solidarity, emotional bonding and stronger ties beyond academia (Parker and Hackett 2012). We envision that under the frame of a PECS LAC node, it would be possible to organise a series of joint and periodic events bringing together civil society organizations, local producers, artists and government institutions to co-design environmental alternatives and policy-driven solutions. Examples of these activities may be the series of virtual conferences on sustainable food systems organised by SARAS with an important participation of SocioEcoS members (https://saboreandosostenibilidad.net/).

Based on the analysis presented in this paper, SocioEcoS and SARAS have excelled at conceptual and methodological tools to strengthen the science-policy interface and can provide new insights to the PECS community. In particular, SocioEcoS has explored in depth the obstacles and opportunities for transdisciplinary collaborations across types of knowledge and practices and provided a wide range of products, including academic papers, manuals, and webinars. SARAS has excelled at exploring the complexities and the opportunities of the collaborations between artists and scientists, contributing academic papers, poetry, and networks of engaged youth. Both networks have inspired policy design from local to regional scales in LAC. Combining these experiences in joint seminars, expositions and periodic meetings

could inform global policy recommendations while supporting a vibrant research, practitioner and student community interested in the most pressing regional sustainability issues.

The LAC node for PECS will be deeply rooted in local and regional aspects of sustainability. The colonial legacies represent a critically important perspective and we envision that South-South collaboration between the PECS node in Latin America and Southern Africa will add important perspectives on a decolonizing approach. Organising periodic meetings between the different PECS nodes directed to wide academic and practitioner audiences may spread the visions of the links between people and nature that are unique to LAC, such as those grounded in the *Buen Vivir*. It will be grounded on conceptual frameworks (See Leff 2003) and methodological tools (See Colmenares 2011) developed by the thriving research community of the region, illustrative for other regions of the world. Such activities could address key social-ecological issues relevant to LAC, and how they are interconnected to global dynamics. For instance, colonial legacies are still visible today in strong power inequities among those who benefit from nature and those who bear the burdens of its degradation (Laterra et al. 2019). Neocolonialism has reproduced these inequities and interdependencies into agricultural development, biodiversity and tourism policies worldwide (See Cáceres et al. 2016.). Insecurity, corruption and illegality (e.g. from drug dealing with trafficking with wildlife) have had an increasing role in negatively influencing governance capacity and is accelerating environmental degradation (e.g. Grau and Aide 2008).

Narrowly conceived development and conservation policies, such as payments for ecosystem services designed with limited understanding of regional needs and contexts, have multiple undesirable consequences, such as the commodification of the visions of and relations with nature (Burgos et al 2007; Balvanera et al 2017; Balvanera et al. 2020). Multiple voices are driving novel bottom-up processes to bring to the table the voices that have been historically been shut down and to rescue the rich biocultural diversity of the region that is critical for social-ecological sustainability (https://www.redsocioecos.org/libros). A joint research agenda encouraged by a LAC PECS node could provide novel mechanisms to address the most pressing sustainability challenges while fostering new opportunities for funding. The often-disconnected research agendas in the LAC region make it difficult to apply for common funding sources; however, a shared research agenda could improve the possibilities of finding the much-needed alternative funding sources and opportunities.

Latin America has become one of the prime regions for place-based sustainability research (Balvanera et al. 2017b). We argue, however, that substantial added value could be achieved through increased regional collaboration. A regional PECS node, with associated funding and capacity to share insights and learning across the region, would represent an important mechanism for advancing the capacity to engage in sustainability science and action in the region and beyond. Although there is a need to expand the scope of the analysis presented here by adding research published in Spanish and Portuguese, the results of this paper show that there is a high fragmentation of PBSESR publications in the region, evidence of the struggles research networks find themselves in to create long-standing and ground-breaking collaborations. However, and with the focus of identifying key features for the creation of the LAC regional PECS node, the collaboration emerging between SocioEcoS and SARAS is demonstrating a vibrant potential for overcoming these shortcuts. Besides the activities suggested here as the practical ways for implementing a regional PECS node, a shared agenda for publications, student and stakeholders' mobility and common outreach strategies, could enhance upon the already existing collaborations between SARAS and SocioEcoS. May this paper also be an invitation for individuals, small and medium-sized research networks and other non-academic groups interested in PBSESR in LAC to join efforts and collaborations towards a LAC PECS node.

6. Conclusions

A unique opportunity for the creation of a Latin American node for PECS stems from the strengths of the social-ecological research in the region, and those of two networks: SocioEcoS and SARAS Institute. We found an increasingly robust research community focused on place-based, in-depth, search for more sustainable pathways, with the potential to benefit the region and the international community engaged in sustainability challenges and solutions. The two networks are complementary and have excelled at connecting teams across LAC, and beyond, developing tools to strengthen the science-policy interface, and providing unique insights from the region.

As shown in the literature review this paper is based on, PBSESR networks in LAC face fragmentation and collaboration problems that may be related to the lack of long-term funding commitments. Although scattered, research networks in LAC provide exciting opportunities for government bodies and funding institutions alike to provide the support needed for improving the outreach of PBSESR in the

region. Although this paper is based on mainly PBSER published in English, we have found that adopting the results of the research projects must be published and disseminated in local languages, and with local authorities and potential funders. A LAC node for PECS may provide the means by which funding opportunities may be made more accessible to research individuals and interested networks from the region. Participating in the regional node of PECS may also address the opportunity of linking other research networks with long-standing backgrounds dealing with similar issues, both within the region and globally.

The LAC PECS node, together with the other regional PECS nodes, will contribute in unique and complementary ways to the sustainable stewardship of social-ecological systems across the planet. By combining co-production of locally relevant knowledge with regional and global syntheses, this new node will contribute unique insights that can be mainstreamed into the global sustainability agenda through regional and global science-policy interfaces such as IPBES. Overcoming the obstacles of collaborative PBSESR research requires a joint effort for participating in the vibrant networking effort outlined by SocioEcoS and SARAS. As this paper shows, fragmented and underfunded research networks require inputs and energy from other researchers and institutions interested in sustainability and place-based issues. A regional LAC PECS node may provide the means by which other interested parties could join efforts towards a more policy-driven and meaningful collaboration. As stated in the last Advisory Board Meeting in the headquarters of SARAS Institute, the potential creation of a LAC PECS node was paralleled to mixing mezcal with Tannat. May this paper be also an invitation to try a new and exciting mix of research efforts aiming at renewing the efforts towards a ground-breaking and more meaningful sustainability and social-ecological research.

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ORCID

Rafael Calderón-Contreras http://orcid.org/0000-0001-8709-4502
Patricia Balvanera http://orcid.org/0000-0001-6408-6876
Alfonso Langle-Flores http://orcid.org/0000-0003-2585-8049
Esteban Jobbágy http://orcid.org/0000-0002-4214-6011
Iván A. Ortiz-Rodríguez http://orcid.org/0000-0003-1296-9049
Miguel Equihua http://orcid.org/0000-0001-5306-7397
Bárbara Ayala-Orozco http://orcid.org/0000-0002-9371-3151
M. Azahara Mesa-Jurado http://orcid.org/0000-0003-4571-7251
Luciana Porter-Bolland http://orcid.org/0000-0001-8586-3267
Julieta A. Rosell http://orcid.org/0000-0001-5741-8027

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