REVISTA CHILENA DE HISTORIA NATURAL

SUPPLEMENTARY MATERIAL

ANDERSON et al. (2010) Revista Chilena de Historia Natural 83: 1-11.

Introduction
Building a Chilean Network for Long-Term Socio-Ecological Research: Advances, perspectives and relevance

Introducción
Construyendo una Red Chilena para Estudios Socio-Ecológicos a Largo Plazo: Avances, enfoques y relevancia

CHRISTOPHER B. ANDERSON[1, 2, *], RICARDO ROZZI[1, 2, 3], JUAN J. ARMESTO[2, 4] & JULIO R. GUTIÉRREZ[1, 5]

[1] Sub-Antarctic Biocultural Conservation Program, Universidad de Magallanes and University of North Texas, Puerto Williams, Chile & Denton, Texas, USA
[2] Institute of Ecology and Biodiversity, Casilla 653, Santiago, Chile
[3] Department of Philosophy and Religion Studies, University of North Texas, Denton, Texas, USA
[4] Center for Advanced Studies in Ecology and Biodiversity, Departamento de Ecología, Pontificia Universidad Católica de Chile, Santiago, Chile
[5] Departamento de Biología y Centro de Estudios Avanzados en Zonas Áridas, Universidad de La Serena, La Serena, Chile
*Autor correspondiente: christopher.anderson@alumni.unc.edu

ABSTRACT

Since their formal inception in 1980, long-term ecological research (LTER) programs have served as a successful organizing framework to create research agendas and funding mechanisms that allow scientists to address meaningful ecological phenomena at the scales they occur. In its 30 years of existence, LTER has expanded its geographic range (currently the International LTER network has more than 40 country members with sites on every continent) and disciplinary foci (principally encompassing the natural and social sciences and leading some to call for a name change to long-term socio-ecological research – LTSER). Nonetheless, the temperate and subantarctic biomes of southern South America have lacked formalized long-term research sites and networks. Yet, at the same time, numerous uncoordinated long-term research efforts exist in both Chile and Argentina, and in 2008, the Institute of Ecology and Biodiversity launched Chile's first concerted effort to link three existing sites (Fray Jorge Forest National Park – 33° S, Senda Darwin Biological Station – 43° S, and Omora Ethnobotanical Park – 55° S). Here, we present a special feature of the Revista Chilena de Historia Natural, dedicated to LTSER, with the aim of 1) providing a synthesis of some of the most emblematic cases of long-term socio-ecological research in Chile; 2) demonstrating the value of these efforts for the integration of research, education and social outcomes, such as decision making; and 3) offering the perspective of a broad array of participants involved in these initiatives, including graduate students and associated programs from Ibero-America and North America. It is our hope that these compiled works will contribute to the consolidation of the LTSER approach in southern South America both within the academic community and also to better link academia and society.

Key words: LTER, LTSER, South America, subantarctic, temperate.

RESUMEN

Desde su inicio formal en 1980, los programas de investigación ecológica a largo plazo (LTER por su sigla en inglés) han servido como un exitoso marco organizacional para crear agendas de investigación y mecanismos de financiamiento que permiten a los científicos abordar fenómenos ecológicos significativos a las escalas en que ellos ocurren. En sus 30 años de existencia, LTER ha expandido su rango geográfico (actualmente la red Internacional de LTER tiene más de 40 países miembros con sitios de estudios en cada uno de los continentes) y focos disciplinarios (principalmente abarcando las ciencias naturales y sociales, llevando a algunos a pedir un cambio de nombre a estudios de investigación socioecológica de largo plazo – LTSER por su sigla en inglés). No obstante, los biomas templados y subantárticos del sur de Sudamérica han carecido de sitios y redes formales de investigación a largo plazo. Sin embargo, numerosos esfuerzos de investigación a largo plazo han existido en Chile y Argentina sin coordinación entre sí. Particularmente, en 2008, el Instituto de Ecología y Biodiversidad puso en marcha el primer esfuerzo sistemático para articular tres sitios existentes (Parque Nacional Fray

Jorge – 33° S, Estación Biológica Senda Darwin – 43° S, y Parque Etnobotánico Omora – 55° S). Aquí presentamos un número especial de la Revista Chilena de Historia Natural, dedicado a LTSER, con el objetivo de 1) dar una síntesis de algunos de los casos más emblemáticos casos de investigación socioecológica a largo plazo en Chile; 2) demostrar el valor de estos esfuerzos para la integración de la investigación y educación con resultados y procesos sociales, tales como aquellos relacionados con la toma de decisiones; y 3) ofrecer la perspectiva de una amplia gama de participantes involucrados en estas iniciativas, incluyendo a estudiantes de postgrado y programas asociados desde Iberoamérica y Norte América. Es nuestro deseo que estos trabajos compilados contribuyan a la consolidación de la aproximación de LTSER en el sur de Sudamérica dentro de la comunidad académica y también para una mayor integración entre la academia y la sociedad.

Palabras clave: LTER, LTSER, subantártico, Sudamérica, templado.

BACKGROUND TO LTER AND LTSER

The term long-term ecological research (LTER) was coined by the homonymous United States National Science Foundation (US NSF) program established in 1980. This first LTER network formalized various decades of work by ecologists showed the need to institutionalize a long-term research network and funding mechanism. This innovative research platform allowed them to encompass the large temporal and geographic scales at which many ecological phenomena, which are not possible to address based a collection of discreet, short-term projects (Callahan 1984, Franklin et al. 1990). Since its initial conceptualization and creation, the LTER program has grown both geographically and thematically. During the first two decades, the LTER program evolved from five sites with an annual budget of $ 1.2 M into a network comprising 24 ecologically diverse sites with an annual direct budget of $ 17.8 M (fiscal year 2002), involving over a thousand scientists and students that generated approximately $ 44 M in LTER-related research in the extended network (NSF 2002). Thematically, the first LTER decade focused on long-term data collection and analysis in five core areas of research: primary production, nutrient flux, trophic structures, disturbances, and organic matter accumulation and decomposition. During the second decade, the LTER program broadened its approach, including anthropogenic influences on ecological systems. This adaptation of the research agenda followed the advice of the first ten-year review of LTER by NSF, which emphasized the need of addressing large-scale and cross-site ecological patterns and processes (NSF 2002). Consequently, during 1990-2000 LTER program promoted interdisciplinary, interagency and international scientific collaborations, and more than forty nations now have associated International LTER (ILTER) programs.

In the last decade, LTER's purview has explicitly stated its attempt to articulate relevant disciplines beyond ecology, within academia (e.g., anthropology, sociology, environmental history, etc.; see Redman et al. 1998) and also go beyond the Ivory Tower by integrating research efforts with societal concerns (e.g., education, outreach, policy making; see Hobbie et al. 2003). Today, various efforts such as the National Ecological Observatory Network (NEON) in the U.S. are at the vanguard of incorporating new advanced technologies, such as remote sensor arrays for continuous records of physical and biological variables and other networking and monitoring methods, to create an even finer scale resolution of our understanding of fundamental ecosystem processes at continental scales (Keller et al. 2008).

During its three decades of existence, the LTER program has transformed from a former focus on natural, often protected areas, to an integrated perspective that includes cities, rural/agricultural landscapes and other social factors as part of coupled human-nature systems. This broader perspective on ecological phenomena has led for calls to adopt the name long-term socio-ecological research – LTSER, with a focus on socio-economic variables (Haberl et al. 2006). As a result, concerted efforts are advancing to create conceptual models of socio-ecological systems. Recently, for example, the US LTER put forward the Integrated Science for Society and the Environment (ISSE) framework that combines social and ecological dimensions of ecosystems via a focus on the understanding of thresholds and feedback loops between human perceptions and behavior, ecosystem structure and function, and the provision of ecosystem goods and services (Collins et al. 2007). Additionally, the International LTER Network (ILTER) is carrying out a pilot project that (véase Maass et al. 2010) attempts to apply this framework in as many national and regional networks as possible to test its utility across biomes and political boundaries (Bougeron et al. unpublished data). Nonetheless, to date, approaches to implement LTSER are centered largely on the integration of natural and social sciences, particularly economics (but see Swanson et al. 2008 for a case of integration of scientists and creative writers).

As Costanza et al. (1997) stated "ecosystems services are not fully 'captured' in commercial markets, or adequately quantified in terms comparable with economic services and manufacture capital;" therefore there is a critical need for a monetary valuation. However, economic values and methodologies do not address all social and cultural dimensions; therefore, there is still a persisting and significant need to more fully account for the multiple facets of culture, incorporating humanistic studies and philosophical methodologies to encompass the broad arrays of values

and practices that constitute cultures into long-term ecosystem research for the conservation of biological and cultural diversity (Rozzi et al. 2008).

At the time of this writing, formalized LTER programs have been adopted by approximately 40 country-based networks, which are members of the International Long-Term Ecological Research network (ILTER). Within the ILTER's coverage, however, we find a conspicuous lack of consolidated research programs and sites in only one latitudinal range – the area between 40-60° S – which corresponds to the temperate/subantarctic biome, shared between Argentina and Chile in southern South America. At the same time, this ecoregion exhibits singular attributes that make it globally relevant for long-term socio-ecological research vis-à-vis global change research, including its main components. For example, across this latitudinal extension we find displayed a stark gradient of relevant variables for ecosystem experiments, including temperature, photo period, precipitation, disturbance regime, anthropogenic impact, ozone exposures, highly variable topography and species assemblages that display outstanding degrees of endemism (Lawford et al. 1996). In addition, the southern tip of South America hosts the world's southernmost ethnic groups and language families; two of the Fuegian languages (Kaweshkar and Yahgan) are endangered, having less than ten fluent speakers (Rozzi et al. 2006). The area is also the home to the Southern Hemisphere's most extensive temperate forests (Armesto et al. 1996), temperate peatlands (Arroyo et al. 2006) and ice fields (outside of Antarctica). Finally, this is also one of the few land areas in the world that has not experienced significant atmospheric pollution, such as nitrogen deposition, making it valuable as a global reference for pre-industrial biogeochemical cycles (Galloway et al. 2004, Armesto et al. 2009). With regard to climate change, the austral region of South America is expected to face contrasting trends in temperature and rainfall from mid to high latitudes (CONAMA 2006), and has unique and detailed millennial records of biotic and climatic changes across topographic and latitudinal gradients that are critical to understanding global patterns of climate variability (Latorre et al. 2007). Therefore, the lack of established long-term research sites in this area, which could be connected as well to national and international efforts, is of concern not only for the development of high-level and predictive environmental science in Chile and Argentina, but indeed filling this gap is relevant for our understanding of Earth system processes and the responses of human society to expected changes in climate and ecosystem services. Yet, achieving a new emphasis on coordinated LTSER in southern South America will require overcoming significant obstacles regarding infrastructure, coordination, networking, personnel and financing, which are still underway (Anderson et al. 2008).

PRESENTATION OF THE SPECIAL FEATURE

This special feature of the Revista Chilena de Historia Natural, dedicated to LTSER, makes an attempt to progress on the early calls (Armesto 1990, 1995) to formalize a national strategy for long-term ecological research in Chile, which could integrate Chilean science and an understudied continental area of the southern hemisphere to major international initiatives to understanding Earth systems, such as ILTER, NEON, GLEON (http://www.ilternet.edu, http://www.neoninc.org, http://www.gleonrcn.org), among others. Towards this goal, we present here a collection of papers that are largely the result of the workshop entitled "Confronting global change with a network of long-term socio-ecological research sites in the south of the Americas," which was organized at the remote southern end of the Americas, in the Magellanic Region of Chile in June 2008. Funded by the Millennium Scientific Initiative's Formal Network Program (MIDEPLAN, IMC P05-002) and the Basal Financing Program (CONICYT, PFB-23) as well as the Hispanic Global Initiative of the University of North Texas, this gathering had as its core mission to launch Chile's first nascent, coordinated effort to link three LTSER sites, under the coordination of the Millennium Institute of Ecology and Biodiversity (http://www.ieb-chile.cl) and in the process, bring together relevant researchers connected to long-term research in Chilean and complementary experiences of nascent and advanced networks from Spain, Mexico, USA and Argentina.

To complement these proceedings, the organizers invited contributions from various other major long-term research initiatives in Chile from a variety of ecosystem types, as well as partner programs in other parts of Ibero-America to enrich the international dialogue. While this collection is not an exhaustive list of all long-term research efforts in Chile, which have been started independently by various academic centers and private field sites, it is our hope that throughout this work, it is possible to call for the integration of such efforts within the nascent Chilean LTSER-network and reflect upon and debate the following objectives that were articulated during the inauguration of the LTSER effort in Chile in Puerto Williams in June 2008:

(1) Gain social, academic and political agreement for the LTSER approach. The formal inauguration of the nascent Chilean Long-Term Socio-Ecological Research Network allowed participants in the first three Chilean LTSER sites and their collaborators to present their research agendas to regional, national and international authorities and demonstrate their ability to support practical and theoretical work for advancing both academic concerns and the integration of science and society in critical areas of the country.

(2) Utilize the LTSER concept to effectively establish long-term international collaborations. For logistic and funding reasons, the initial network has begun with three research sites in Chile (Fig. 1): Fray Jorge Forest National Park (33° S), Senda Darwin Biological Station

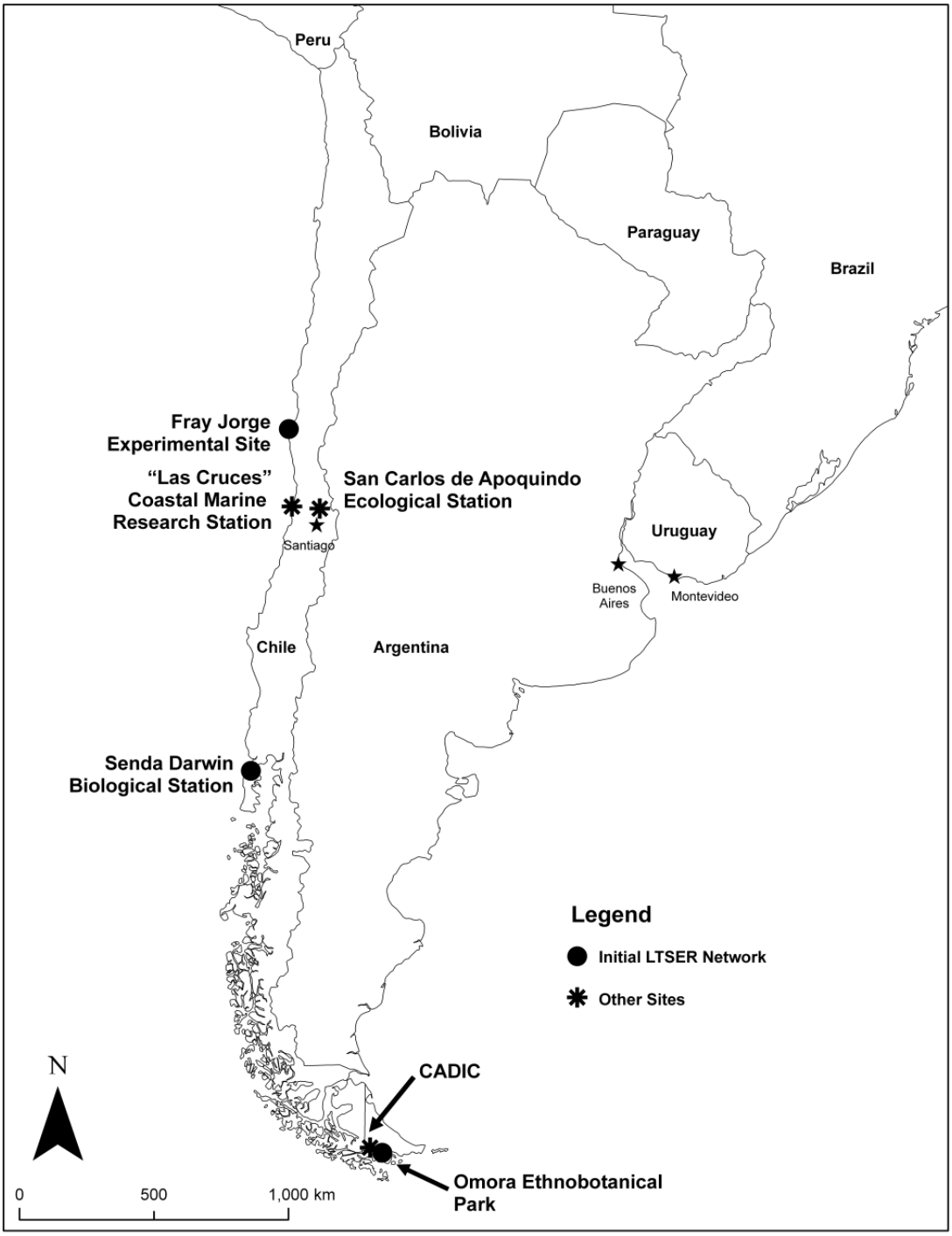

Fig. 1: The initial Chilean Long-Term Socio-Ecological Research Network (LTSER), coordinated by the Institute of Ecology and Biodiversity, includes three preliminary sites (solid circles) that span the latitudinal range of forests in Chile. Complementary programs (denoted with crosses) were invited to contribute to this special edition to enrich to dialogue on LTSER in Chile and Latin America and demonstrate its potential growth in the future stages. (Map elaborated in UNT Center for Spatial Analysis & Mapping, P. Palacios).

La primera Red Chilena de Sitios de Estudios Socio-Ecológicos a Largo Plazo (LTSER), coordinada por el Instituto de Ecología y Biodiversidad, incluye tres sitios preliminares (círculos sólidos) que abarcan el ámbito de distribución latitudinal de los bosques en Chile. Programas complementarios (indicados con cruces) fueron invitados para contribuir a esta edición especial y enriquecer el diálogo de LTSER en Chile y América Latina, a la vez que demostrar su potencial de crecimiento en etapas futuras. (Mapa elaborado en el UNT Center for Spatial Analysis & Mapping, P. Palacios).

(43° S) and Omora Ethnobotanical Park (55° S). These sites have preliminary, but formal ties with three international networks: the International Long-Term Ecological Research Network (ILTER), the Ibero-American Biosphere Reserve Network (Ibero-MaB), and the Center for Embedded Network Sensing at the University of California Los Angeles (CENS-UCLA).

(3) Help institutionalize LTSER as a transdisciplinary research paradigm. The agenda promoted by the network intends to strengthen the groundwork and design of interdisciplinary and inter-instituional approach. As such, the network is working in the creation of education programs and international field courses, which integrate ecological sciences, environmental philosophy and other approaches to understanding the natural world to generate applicable and novel solutions to interrelated social and environmental issues. Furthermore, this network builds upon and extends existing relationships of individual sites that go beyond academia and include the public and private sector.

The workshop in 2008 brought together more than twenty-five scientists from five countries throughout the Americas, as well as Spain, and convened more than twenty-five authorities from the local, regional, national and international levels, including the inaugural event in Puerto Williams (Fig. 2), Chile that was presided over by the Regional Intendenta Eugenia Mancilla (Fig. 3). Furthermore, the scientific meeting was organized so as to coincide with an international field course, entitled Tracing Darwin's Path (http://www.chile.unt.edu/projects/tdp/tdp-index.html), one of three field courses to be held annually by the LTSER-Chile network (http://www.ieb-chile.cl/ltser/curso_campo.php). From this initial effort, a subsequent dialogue has been initiated with ILTER, US LTER, and other relevant national and international partners in the analysis of global change impacts on ecosystems.

Now, this Special Feature is intended to aid in the progress of the communication and better refinement of this strategy by both scientists and science

Fig. 2: The inauguration of the first LTSER-Chile Network at the Omora Ethnobotanical Park in June 2008 (from left to right – 1st row: Julio Gutiérrez (ULS-IEB), Phil Rundel (UCLA-USA), Comandant Francisco Abrego (Chilean Navy), Sergio Guevara (Ibero-MaB), Andrés Mansilla (UMAG-IEB), Dinah Arnett (US Embassy in Chile), Ricardo Díaz-Delgado (CSIC-Spain), Francisco Squeo (ULS-IEB), Graciela Alcina (Tierra del Fuego, Argentina); 2nd row: Kelli Moses (OSARA-UNT), James Kennedy (UNT-USA), Aurora Gaxiola (IEB), Juan Armesto (PUC-IEB), Yanet Medina (UMAG-IEB), Mary Kalin (UCh-IEB), Robert Frodeman (UNT), Eduard Mueller (UCI-Costa Rica), Bron Taylor (UF-USA), Alejandro Rojo-Vivot (AVINA-Patagonia); 3rd row: Cristián Guerrero (Omora), Manuel Maass (UNAM-México), Eric Graham (UCLA-USA), Adrian Schiavini (CADIC-Argentina), Ricardo Rozzi (UNT-UMAG-IEB), General Luis Ili (Chilean Air Force), Guillermo Martínez Pastur (CADIC-Argentina), Christopher Anderson (UMAG-IEB-UNT). Not pictured: Carolina Henríquez (IEB), J. Britt Holbrook (UNT-USA), Ione Hunt Von Herbing (UNT-USA), Francisca Massardo (UMAG-IEB), Rodrigo Vásquez (UCh-IEB).

La inauguración de la primera Red LTSER-Chile en el Parque Etnobotánico Omora durante junio de 2008 (de izquierda a derecha– 1er plano: Julio Gutiérrez (ULS-IEB), Phil Rundel (UCLA-USA), Comandante Francisco Abrego (Armada de Chile), Sergio Guevara (Ibero-MaB), Andrés Mansilla (UMAG-IEB), Dinah Arnett (Embajada de EE.UU. en Chile), Ricardo Díaz-Delgado (CSIC-España), Francisco Squeo (ULS-IEB), Graciela Alcina (Tierra del Fuego, Argentina); 2° plano: Kelli Moses (OSARA-UNT), James Kennedy (UNT-USA), Aurora Gaxiola (IEB), Juan Armesto (PUC-IEB), Yanet Medina (UMAG-IEB), Mary Kalin (UCh-IEB), Robert Frodeman (UNT-USA), Eduard Mueller (UCI-Costa Rica), Bron Taylor (UF-USA), Alejandro Rojo-Vivot (AVINA-Patagonia); 3er plano: Cristián Guerrero (Omora), Manuel Maass (UNAM-México), Eric Graham (UCLA-USA), Adrian Schiavini (CADIC-Argentina), Ricardo Rozzi (UNT-UMAG-IEB), General Luis Ili (Fuerza Aérea de Chile), Guillermo Martínez Pastur (CADIC-Argentina), Christopher Anderson (UMAG-IEB-UNT). No se encuentran en la foto: Carolina Henríquez (IEB), J. Britt Holbrook (UNT-USA), Ione Hunt Von Herbing (UNT-USA), Francisca Massardo (UMAG-IEB), Rodrigo Vásquez (UCh-IEB).

administrators. We set out through the special feature to: (a) summarize several of the most significant long-term ecological research initiatives operating in Chile; (b) demonstrate the value of such efforts for research, education and decision-making; and (c) offer insights and perspectives from a range of actors, including graduate students and partner programs in other regions of Ibero-America to guide the process of LTSER establishment in Chile, and also stimulate the training of a new cadre of professionals able to work at the interface of science and society to address the future challenges of resource management and conservation in a changing world (Pielke et al. 2007). This will require an understanding the coupled changes of anthropogenic and natural ecosystems. A long-term perspective is needed to anticipate and model global change scenarios that will enhance uncertainty of socio-economic development, especially for countries, such us Chile, which rely largely on the increased exploitation of natural capital. Consequently, the documents provided herein are intended to be a resource not only to the academic community in Chile, but also to inform policy and decision makers involved in the role of science and research in the social development and well-being of Chile.

ORGANIZATION OF THIS SPECIAL FEATURE

For clearer communication of these objectives, we have divided this Special Feature into the following sections.

I. The international relevance of Chile's preliminary steps toward LTSER

Prologue: Dr. Terry Parr currently serves as the Chair of the International Long-Term Ecological Research's (ILTER) Executive Committee and in this capacity coordinates the more than 40 member networks. He is also chair of ALTER-Net, a long-term biodiversity and ecosystem research network with twenty-two European partners in seventeen countries, and serves in various capacities with the ESFRI/European LifeWatch Program and the global Diversitas initiative. In the prologue to this Special Feature, he relates his understanding of the global long-term research context and its relationship to the nascent efforts happening in Chile and the Southern Cone.

II. Integrating of research, education and decision-making

Estevez and colleagues are a group of graduate students from two regional Chilean universities (University of La Serena and University of Magallanes) and one U.S. university (University of North Texas). They offer a critical analysis of the existing graduate-level conservation programs in Chilean universities and present their vision for the direction that interdisciplinary educational initiatives should take to create a cadre of students that are capable of undertaking research in integrated socio-ecological dimensions of the human-nature system.

Rozzi and colleagues build upon the first ten years of experience at the Omora Ethnobotanical Park conducting biocultural research, education and conservation in Cape Horn at the southern end of the Americas. This article presents a methodology consisting of a cycle with four interrelating steps: (1) ecological and philosophical research, (2) metaphorical communication, (3) field environmental philosophy and ecologically guided educational and ecotourism activities, and (4) in situ conservation. This "biocultural" approach has been developed with the graduate programs in conservation, philosophy and ecology that conduct field activities at the Omora Park, particularly the master's of science program at the University of Magallanes in collaboration with the Institute of Ecology and Biodiversity (IEB) and the University of North Texas (UNT).

III. Major LT(S)ER efforts in Chile

Gutiérrez and colleagues represent one of the most significant long-term research sites and teams not only in Chile or South America, but the entire Southern Hemisphere. Their project deploys an extensive experimental system that includes sixteen 0.56 ha vertebrate exclosure plots. Taken together, this approach and the team's long-term commitment have been able to detect long-term patterns in community dynamics of this arid ecosystem, such as the relationship of El Niño events on plant and subsequently small mammal dynamics.

Pavez and colleagues use data from one of Chile's most intensively studied research sites at San Carlos de Apoquindo Ecological Station to demonstrate the use of long-term datasets to detect changes in such subtle ecological relationships as tropic interactions and the role of land use in changing them. These otherwise "invisible" community dynamics would otherwise go unperceived without such datasets.

Carmona and colleagues report on long-term research on forest and moorland ecosystems, set primarily at Senda Darwin Biological Station, Chiloé Island. These studies have multiple objectives, from understanding the demography and dynamics of populations of key species of birds, mammals and plants, to restoring threatened species, and conducting long-term field experiments on climate change effects on forest ecosystem processes and tree growth. Results from these studies are the used to improve the management, conservation of biodiversity, and human well-being in the surrounding rural landscape.

Navarrete and colleagues enrich this dialogue by presenting the case of the Marine Research Station at Las Cruces, where a small experimental exclosure of fishing in 1982 has grown into one of the most intensively studied areas for marine-coastal ecology in southern South America. Likewise, the long-term involvement of this station and the researchers in the

area has allowed their work to be applied directly to fisheries and natural resource management.

IV. Insights from partner programs from Ibero-America

Martínez-Pastur and colleagues synthesize forty years of experimental forestry plots that are distributed throughout southern Patagonia. Their work in effect "rediscovers" and highlights a previously unappreciated long-term research platform and resource that have been underutilized to date, but also illustrates the key need for Chilean and Argentine scientists to dialogue and communicate about their joint ecosystems in a more effective manner.

Maass and colleagues use a comparative approach; they present the case of the creation of Mexico and Spain's long-term research programs. Subsequently, the expand their discussion by using the example of the ISSE ecosystem services framework promoted by ILTER to show the utility in two separate cultural, political and economic contexts of the LTSER model to address complex and relevant ecological and social questions.

To conclude, Franklin & Swanson review the strategies and contribution of long-term research in North American forest ecosystems, and how these initiatives have influenced decision making that has affected conservation, as well as sustainable forestry practices. These insights are extrapolated to the broader meaning of LTER and LTSER agendas, and how they can help inform the emerging efforts in the temperate-subantarctic ecosystems of southern South America.

In summary, this Special Feature of the Revista Chilena de Historia Natural synthesizes a significant step in an ongoing process to conduct better and more relevant research on the socio-ecological ecosystems of the temperate and subantarctic ecoregions of southern South America. The success of implementing LTSER in Chile requires long-term commitments of funding, infrastructure and institutional support, but most importantly such initiatives require a shared vision of dedicated individuals to overcome the obstacles to not only establishing permanent research sites (Strayer et al. 1986), but also undertaking the task of establishing a long-term working relationship between academics and the local communities and broader society that surrounds and is influenced by such programs

Fig. 3: Regional Intendenta Ms. Eugenia Mancilla visits the Omora Ethnobotanical Park with school children from Puerto Williams as part of the inauguration of the Chilean Long-Term Socio-Ecological Research Network, coordinated by the Institute of Ecology and Biodiversity (IEB), in June 2008.

La intendenta de la Región de Magallanes y Antártica Chilena Sra. Eugenia Mancilla durante su visita al Parque Etnobotánico Omora con alumnos del liceo de Puerto Williams, en la inauguración de la Red Chilena de Sitios de Estudios Socio-Ecológicos a Largo Plazo, coordinada por el Instituto de Ecología y Biodiversidad (IEB), en junio 2008.

(Anderson et al. 2008). It is our hope that this volume aids in strengthening the LTSER effort in Chile and the Southern Cone, which should help to link the Chilean research community with international LTSER efforts. This collaboration is essential to confront the large social and ecological challenges we face at the regional and global levels in the 21st century.

ACKNOWLEDGMENTS

The guest editorial board would like to thank Dr. Patricio Camus for his assistance and collaboration in preparing this Special Feature. We sincerely thank all government and administrative authorities, researchers, and graduate students who participated in the "Confronting Global Change with a Network of Socio-Ecological Research Sites in the South of the Americas" workshop with thoughtful and generous comments, which helped to launch the Chilean LTSER initiative. Institutional support has been provided by the University of Magallanes, the Institute of Ecology and Biodiversity, and the University of North Texas, as well as the Millennium Scientific Initiative (MIDEPLAN) thru a Formal Networking Project to R. Rozzi, J. Armesto and C.B. Anderson and Grant P05-002 and the Basal Financing Program (CONICYT) Grant PFB-23. We acknowledge the valuable input of the reviewers to the manuscripts of this volume, and the constructive comments by Alexandria Poole (UNT) to this introduction. Translations into Spanish were assisted by Ph.D. students funded to work at the Omora Park via the Sub-Antarctic Biocultural Conservation Program's International Research Experience for Students Grant (US National Science Foundation OISE: 0854350), including Christopher Cheleuitte (Texas A&M University), Deborah Viera (University of North Texas) and Alejandro Valenzuela (Buenos Aires University) with the collaboration of Dr. Silvina Ippi (University of Chile) and Jaime Ojeda (University of Magallanes). Translations were reviewed subsequently by Drs. Guillermo Martinez Pastur (CADIC-CONICET), Vanessa Lencinas (CADIC-CONICET), Martin Carmona (IEB) and Juan Luis Celis (IEB).

LITERATURE CITED

ARMESTO JJ (1990) Estudio a largo plazo: Una prioridad para la investigación ecológica de hoy. Revista Chilena de Historia Natural 63: 7-9.

ARMESTO JJ (1995) Fundamentos y necesidades para un programa de estudios de largo plazo de ecología en Chile. Revista Chilena de Historia Natural 68: 5-11.

ARMESTO JJ, C VILLAGRAN & MTK ARROYO (eds) (1996) Ecología de los bosques nativos de Chile, Editorial Universitaria, Santiago, Chile.

ARMESTO JJ, C SMITH-RAMÍREZ, MR CARMONA, JL CELIS-DIEZ, IA DIAZ et al. (2009) Old-growth temperate rainforests of South America: Conservation, plant-animal interactions, and baseline biogeochemical processes. In: Wirth C (ed) Old-growth forests Vol. 207: 367-390. Springer-Verlag, Berlin.

ARROYO MTK, P PLISCOFF, M MIHOC & M ARROYO-KALIN (2005) The Magellanic moorland. In: Fraser LH & PA Keddy (eds) The world's largest wetlands: Ecology and conservation: 424-445. Cambridge University Press, Cambridge, UK.

CALLAHAN JT (1984) Long-term ecological research. BioScience 34: 363-367.

COLLINS SL, SM SWINTON, CW ANDERSON, TL GRAGSON, NB GRIMM et al. (2007) Integrated science for society and environment: A strategic research initiative. Albuquerque, Long-Term Ecological Research Network, Publication No. 23. (online) URL: http://www.lternet.edu.

COSTANZA R, R D'ARGE, R DE GROOT, S FARBER, M GRASSO et al. (1997) The value of the world's ecosystem services and natural capital. Nature 387: 253-260.

CONAMA (2006) Estudio de la variabilidad climática en Chile para el siglo XXI. Informe final. Corporación Nacional del Medio Ambiente, Santiago, Chile.

FRANKLIN JF, CS BLEDSOE & JT CALLAHAN (1990) Contributions of the long-term ecological research program. BioScience 40: 509-523.

GALLOWAY JN, FJ DENTENER, DG CAPONE, EW BOYER, RW HOWARTH et al. (2004) Nitrogen cycles: Past, present, and future. Biogeochemistry 70: 153-226.

HABERL H, V WINIWARTER, K ANDERSSON, RU AYRES, C BOONE et al. (2006) From LTER to LTSER: Conceptualizing the socioeconomic dimension of long-term socioecological research. Ecology and Society 11: 13.

HOBBIE JE, SR CARPENTER, NB GRIMM, JR GOSZ & TR SEASTEDT (2003) The US Long-Term Ecological Research Program. BioScience 53: 21-32.

KELLER M, DS SCHIMEL, WW HARGROVE & FM HOFFMAN (2008) A continental strategy for the National Ecological Observatory Network. Frontiers in Ecology and the Environment 6: 282-284.

LATORRE C, PI MORENO, G VARGAS, A MALDONADO, R VILLA-MARTINEZ et al. (2007) Late Quaternary environments and palaeoclimate. In: Moreno T & W Gibbons (eds) The geology of Chile: 309-328. The Geological Society, London, UK.

LAWFORD RG, PB ALABACK & E FUENTES (eds) (1996) High latitude rainforests and associated ecosystems of the west coast of the Americas: Climate, hydrology, ecology and conservation. Springer-Verlag, New York.

MAASS M, R DÍAZ-DELGADO, P BALVANERA, A CASTILLO & A MARTÍNEZ-YRÍZAR (2010) Redes de Investigación Ecológica y Socio-Ecológica a Largo Plazo (LTER y LTSER) en Iberoamérica: Los casos de México y España. Revista Chilena de Historia Natural 83: 171-184.

NSF (2002) Long-Term Ecological Research Program Twenty-Year Review National Science Foundation.

(online) URL: http://intranet.lternet.edu/archives/documents/reports/20_yr_review/ (accedido Enero 27, 2010).

PIELKE JR R, G PRINS, S RAYNER & D SAREWITZ (2007) Lifting the taboo on adaptation. Nature 445: 597-598.

REDMAN CL, JM GROVE & LH KUBY (2004) Integrating social science into the long-term ecological research (LTER) network: Social dimensions of ecological change and ecological dimension of social change. Ecosystems 7: 161-171.

ROZZI R, F MASSARDO, J SILANDER JR, CB ANDERSON & A MARIN (2003) Conservación biocultural y ética ambiental en el extremo austral de América: Oportunidades y dificultades para el bienestar ecosocial. In: Figueroa E & J Simonetti (eds) Biodiversidad y Globalización: 51-85. Editorial Universitaria, Santiago, Chile.

ROZZI R, F MASSARDO, A BERGHÖFER, C ANDERSON, A MANSILLA et al. (2006) La Reserva de Biosfera Cabo de Hornos. Programa MaB-UNESCO. Ediciones Universidad de Magallanes, Punta Arenas.

ROZZI R, J ARMESTO & R FRODEMAN (2008) Integrating ecological sciences and environmental ethics into biocultural conservation in South American temperate subantarctic ecosystems. Environmental Ethics 30: 229-234.

STRAYER DL, JS GLITZENSTEIN, C JONES, J KOLASA, GE LIKENS, M MCDONNEL, GG PARKER & STA PICKETT (1986) Long-term ecological studies: An illustrated account of their design, operation and importance to ecology. Occassional Publication of the Institute of Ecosystem Studies. Millbrook, New York.

SWANSON FJ, C GOODRICH & KD MOORE (2008) Bridging boundaries: Scientists, creative writers, and the long view of the forest. Frontiers in Ecology and the Environment 6: 499-504.