

We present a summary of the activities and results of a face-to-face workshop aimed to discuss strategies for the consolidation of an incipient network of Andean socio-ecological monitoring, ROSA (Red de Observatorios Socio-Ambientales de los Andes).

1) Objectives

The specific objectives of the workshop were 1) reunite different experiences of socio-ecological monitoring through the Andes and identify potential nodal monitoring sites to structure the network, 2) discuss the operational structure and functioning of ROSA and 3) identify priority lines of research addressing socio-ecological challenges.

2) Activities

The workshop was held in Yerba Buena, Tucumán, Argentina, from May 15th to 20th, 2023. Twenty-eight participants from different countries with research lines or interests in the Andes attended the workshop (Table 1). All the Andean countries and Brazil were represented by at least one researcher involved in montane monitoring (Peruvian researcher participated remotely). Stakeholders of local administration (provincial and municipal governments) and of the main environmental NGO of the region (Fundación Pro Yungas) also attended the workshops and presented their activities and information demands. Participants from Germany, the UK and the European Space Agency also participated in the workshop.

The workshop consisted of two and a half days of presentations and discussions in the Howard Johnson Hotel, Yerba Buena, and a three-day trip recognizing the socio-environmental features in an elevational gradient (including the urban area of Yerba Buena and the surrounding montane ranges of San Javier and Calchaquí valley, Table 2).

To achieve the objectives of the workshop, in the discussion sessions we carried out the following activities (not in chronological order):

- Presentation of the network and the objectives of the workshop and a brief introduction of each participant.
- Fourteen participants presented their interests related to Andean socio-ecological monitoring and at least one monitoring site per country was described (all the presentations are in this [folder](#)).
- Discussion of a preliminary zonification of Andean Socio-ecological Land Systems following the methodology used by Zarbá and coworkers (2022).
- Proposal, discussion, and preliminary selection of potential observatories that could be part of ROSA (Table 3),
- Discussion of the operational structure of ROSA on the basis of a previously shared document. The main issues discussed were the leading question of the network, data handling, the governmental structure of ROSA, and the funding strategy.
- Identification of potential collaborative publications and discussion on the next steps of ROSA.

3) Results, products, and discussion

3.1) Objective 1: existing monitoring experiences

The workshop enabled the networking of different monitoring efforts along the Andes. They all presented a brief overview of their work and monitoring sites. The monitoring sites presented cover every Andean country, yet to analyze their socio-ecological representativeness we need to develop a consensual and validated zonification of Andean socio-ecological land systems. In the workshop we discussed the accuracy and usefulness of a preliminary map of Socio-ecological land systems developed specific for the Andes (SELSA). Participants were concerned about some specific regions not being captured as distinct systems by this zonification (eg. the Chilean Metropolitan area, Colombian intermountain valleys), thus we agreed on the need of a new version of this map and proposed additional layers of information and a higher spatial resolution, which may probably allow the identification of these regions.

Participants agreed on the need of identifying nodal monitoring sites that can be complemented with additional local monitoring information. A thorough discussion about the criteria to include a monitoring nodal site concluded that they should:

- be representative of a larger region (e.g. of a geographic system or a developing scenario). It is important to be aware of some current biases on site locations (e.g. studying only attractive sites) could lead to a lack of representativeness
- be available and present good baseline information
- present the possibility of informing socio-environmental policies through the collaboration with different governmental or planning organizations. Thus, third-order administrative units (e.g. municipalities in Argentina) could constitute the spatial monitoring entity.
- have the commitment of a group or institution to provide continuity and objectiveness in the analysis, avoiding moral valuations or prejudices (e.g. rating biodiverse systems over biosimple systems)

The assessment of these criteria, the map of socio-ecological land systems and the availability of monitoring systems permitted identifying 6 node sites with their responsible: Santiago, Chile (Petra Wallen and Patricia Breuer); Yerba Buena-Tafí, Tucumán (IER team); Tiquipaya, Cochabamba, Bolivia (Wanderley Ferreira); Tupicocha, Peru (Vivien Bonnesoeur); Loja, Ecuador (Tatiana Ojeda); Chocó andino, Ecuador (Francisco Cuesta and Luis Daniel Llambí); Merida, Venezuela (Luis Daniel Llambí). The Humboldt Institute is still to be consulted if Los Nevados, Colombia could be the 7th node (led by Ana Belen Hurtado).

3.2) Objective 2: The architecture of ROSA

Ideally, ROSA may function as an "ecosystem" or community of existing monitoring sites that build knowledge in a bottom-up structure. Thus, in the first stages, independent sites should go on with data gathering but making some efforts to coordinate data collection to ease collaborative analyses. Since data through time fuels every monitoring system it is important to describe different sources of data.

Usually monitoring efforts do not take into account their historical background, an aspect that should be incorporated to achieve a more thorough understanding of socio-ecological systems. Most of the proposed nodal sites currently focus on biophysical traits, although they gather key other information to interpret their context. They may be quite idiosyncratic and limited in scope and in cover; in some cases, their representativeness could be restrained. However, the study of some biophysical

processes is, sometimes, monitored under strict protocols that have shown useful to ease integrated analyses. Social data is more difficult to standardize for different reasons.

We discussed additional data sources to complement the field data collection. It would be helpful to include social information from governmental sources. However, it needs revising and adapting for our purposes, sometimes this data is difficult to find or access, they have different methodologies across countries, and their spatial resolution follows administrative boundaries. In the worst scenarios, it may be biased or manipulated to show specific patterns. Data from global remote sensing and modeling sources are on the opposite extreme. They have excellent coverage and are methodologically rigorous; although they constitute an excellent resource to depict global patterns, they can fail to capture local patterns and often they are not informative about fine-scale processes. Their temporal depth is limited but their revisit time is usually very adequate for most analyses. We should also look at other sources of information such as data from citizen science, big data, and data mining.

We agreed on developing some basic common guides for data gathering. In the beginning, they should be orientative rather than restrictive, with a progressive implementation. Within our network, data should be plausible to be systematized and organized not only to facilitate integration analysis but to inform policies. We should develop basic standards for informing metadata as well, and share them on accessible platforms. The issues about data handling to discuss in next meetings include data organization and storage, their internal and external communication. It is likely that a public infrastructure (e.g. platform) will demand specific funding.

Although ROSA is designed as a bottom-up structure, a coordination organization is needed. A committee of three people with latitudinal representation was selected to coordinate decisions on ROSA: Carilla (South), Ferreira (Center) and Ojeda (North). This committee will work with a group of facilitators and advisors with international connections: Llambí (CONDESAN), Piquer-Rodriguez (GLP), Grau (MRI), Nagy (GMBA). Besides, some members will coordinate specific aspects of the network, namely fundraising (Nagy), communication (Wallem) and database coordination (Osinaga Acosta). In the medium and long term, the functioning of ROSA will demand economic resources to solve operational aspects, coordinate research agendas, and handle data.

In the short term, nodal monitoring sites will continue under the “business as usual” scheme. However, in the middle term, the consolidation of the network will demand specific funds. A priority of ROSA is to gain visibility, which will ease fundraising. Thus, the priority of the next steps is to present the network in different scientific meetings. At least seven meetings have been scheduled (Argentinian Ecological Meeting, International meeting on biological invasions, Argentine and Bolivian Botanical meetings, to be held during 2023; GLP, IUFRO, and International Climate Crisis meetings, to be held during 2024, and BMI meeting to be held in 2025). Besides, there is a consensus about the need to submit a manuscript describing the structure of ROSA to a journal widely used by montane researchers (e.g. Mountain Research and Development). At the same time, a list of potential fund sources will be shared among the participants of the workshop, and responsibilities in the formulation of funding proposals will be discussed through online meetings.

Participants acknowledge that ROSA must interact with internal and external partners. CONDESAN, who is involved in the organization of the network, is likely to host ROSA

during the initial years. The signature of letters of agreement between ROSA and institutions that host existing monitoring efforts is one of the next steps of the network. Besides, ROSA should work with other networks oriented to coordinate monitoring efforts (e.g. RBA; GLORIA, ANDEX).

3.3) Objective 3: big questions and research priorities

One of the most challenging issues in a collaborative workshop is to identify an unifying question. The global questions should be transdisciplinary (interdisciplinary at least), it should be relevant for a broad public and it should try to get a general answer. Within a monitoring system, it is likely to address the state, trends, past and future of a socio-ecological system. The methods to respond to these questions should reach a balance between synthesizing and deepening (minimum number of variables); they should be answered through available data, and should not limit the emergence of new questions in the future.

We proposed ROSA's wrapping question to address how the main drivers of change (e.g. socio economic, political, climatic and land use) influence on diversity, ecosystem services and human welfare, and their effect along the Andes.

4) Conclusions

It is necessary to synthesize and systematize information. There is a community interested in carrying out the initiative. There is a collection of nodal observatories with potential as a seed for the network. But, we need to keep in mind that The Andes are complex and heterogeneous at different scales.

We used a SWOT framework to assess the potential of ROSA in the medium and long term.

Strengths: Pre-existing networks (GLORIA, RBA, etc.), pre-existing organizations (CONDESAN, GLP), motivated group of researchers associated to observatories (ROSA as a "community"); gender balance, young and senior researchers, interdisciplinary, institutional support, reliable monitoring sites that can become Nodal Sites.

Weaknesses: Little representation of social sciences, academic bias, logistical bias, structure of objectives/questions still unclear, little funding (use seed money to raise larger money)

Opportunities: ESA support and MRI Support (next workshop), contact local research groups in each observatory, incorporate links with regional networks (eg, environmental history network)

Threats: Losing motivation/momentum, forgetting the KISS (keep it simple, stupid) principle

5) Publications agenda

The following publications are proposed in the context of ROSA:

- Carilla et al. ROSA: description of the network and the creation process, its main objectives, selection of nodal monitoring sites, inclusion criteria, etc. (Mountain Research and Development).

- Piquer-Rodríguez, Zarbá et al. Develop a social-ecological land systems zonification specific for the Andes as collaborative work with the participation of the ROSA partners.
- Llambí, Grau et al. VOLUME EDITED. Book or special issue. Each chapter will describe the background of the initial nodal monitoring sites and a description of the ongoing monitoring efforts.

6) Next steps

Draft Rosa reference document: 9 June first Version, 16 June Revised Version, 20 August Final Version

Prepare Webinar presentation: June 28. Present Piquer, Carilla, Llambí and Zarbá

Metadata template for Nodal Observatories. Site incorporation strategy. Led by Osinaga And Wallen.

Consolidate a fundraising strategy; generate a base document to submit to financial sources. Through a consultancy maybe. Funds for Workshops, Equipment, Data Analysis, administration and governance, communication, organization and data storage. 1) Seed money sources: eg. CONDESAN. Adaptación para las Alturas, MRI, LOCAL STUDIES, MAB/UNESCO, SDC, 2) Gross Funding: eg. Canadian Cooperation, European Union (Potentially Less Competitive For Social Sciences), USAID, NGOS (eg MC ARTHUR, FORD), IAI, IEO GEF (LAND DEGRADATION), BELMONT FORUM, UNEP, FAPESP

Table 1. Participant list

	Name	Affiliation	Country	E-mail	Expertise/profession
1	Luis Daniel Llambí	CONDESAN – Universidad de Los Andes	Venezuela	luis.llambi@condesan.org	Ecology
2	Francisco Cuesta	Universidad de Las Américas (UDLA)	Ecuador	francisco.cuesta@udla.edu.ec	Ecology
3	Nicolás Cuvi	Facultad Latinoamericana de Ciencias Sociales (FLACSO)	Ecuador	ncuvi@flacso.edu.ec	Biology / communication
4	Tatiana Ojeda	Universidad Nacional de Loja	Ecuador	tatiana.oluna@unl.edu.ec	Ecology / socioeconomy
5	Ana Belén Hurtado	Instituto Humboldt	Colombia	ahurtado@humboldt.org.co	Ecology / botany
6	Wanderley Ferreira	Universidad Católica Boliviana, sede Cochabamba	Bolivia	wferreira@ucb.edu.bo	Agronomy / Environmental sc.
7	Patricia Breuer Moreno	Universidad del Desarrollo, centro de Tecnología para la Sociedad	Chile	patobm@gmail.com	Education / management
8	Petra Wallen	Universidad del Desarrollo, centro de Tecnología para la Sociedad	Chile	petra.wallem@gmail.com	Ecology
9	Carolina Tovar	Kew Garden	UK / Peru	c.tovar@kew.org	Ecology
10	Vivien Bonnesoeur (remote)	CONDESAN	Peru	bonnesoeur.vivien@protonmail.com	Ecology / hydrology
11	Lazso Nagi	Universidad de Campiñas	Brazil	lnagy@unicamp.br	Ecology
12	María Piquer-Rodríguez	FU Berlín	Germany	piquer.maria@gmail.com	Ecology / geography
13	Ferran Gascon	Copernicus, ESA	Italy	Ferran.Gascon@esa.int	Telecommunication
14	Ricardo Grau	Instituto de Ecología Regional (IER), UNT-CONICET	Argentina	chilograu@gmail.com	Ecology / geography
15	Julieta Carilla	IER, UNT-CONICET	Argentina	julietacarilla@gmail.com	Ecology
16	Agustina Malizia	IER, UNT-CONICET	Argentina	agustinamalizia@yahoo.com	Ecology
17	Sergio Ceballos	IER, UNT-CONICET	Argentina	serceballos@gmail.com	Ecology
18	Ezequiel Aráoz	IER, UNT-CONICET	Argentina	ezequielaraoz@gmail.com	Ecology/ models
19	Oriana Osinaga A.	IER, UNT-CONICET	Argentina	orianaosinaga@gmail.com	Ecology
20	Ignacio Gasparri	IER, UNT-CONICET	Argentina	chilograu@gmail.com	Forestry / Ecology
21	Priscila Powell	IER, UNT-CONICET	Argentina	priscilaapowell@gmail.com	Ecology
22	Cecilia Blundo	IER, UNT-CONICET	Argentina	ccblundo@gmail.com	Ecology

23	Lucía Zará	Instituto de Invest. Territoriales y Tecnológicas para la Producción del Hábitat, UNT-CONICET	Argentina	luciazarba@gmail.com	Ecology / teledetection
24	Pablo Quiroga	Municipalidad de Yerba Buena, Pcia Tucumán	Argentina	pabloadrianquiroga@gmail.com	Biology management /
25	Guadalupe Coria	Municipalidad de Yerba Buena, Pcia Tucumán	Argentina		Biology management /
26	Rodrigo Ordóñez	Dirección de Flora, Fauna S. y Suelo, Ministerio de Des. Productivo	Argentina	rog.tuc72@gmail.com	Biology management /
27	Ainoha Cormesana	Dirección de Flora, Fauna S. y Suelo, Ministerio de Des. Productivo	Argentina	ainhou@gmail.com	Biology management /
28	Gabriela Názero	Fundación Proyungas	Argentina	gabynazaro@hotmail.com	Biology / teledetection

Table 2. Face to Face workshop Program

Monday 15 may		
Local hour	Exposition	Disertant
9 – 9:30	Welcome, introduction, participants presentation	María Piquer-Rodríguez (Instituto de Geografía de FUB)
9:30 - 11	Exposition of the existent monitoring Andean site	<ol style="list-style-type: none"> 1. Luis Daniel Llambí, Cordillera de Mérida, Venezuela 2. Francisco Cuesta, Chocó, Ecuador 3. Tatiana Ojeda, Loja, Ecuador 4. Ana Belén Hurtado, Los Nevados, Colombia 5. Wanderley Ferreira, Cochabamba, Bolivia 6. Patricia Breuer, Chile 7. Priscila Powell, Tucumán, Argentina
11 - 11:15	Coffe break	
11:15 – 13	Exposition of the existent monitoring Andean site	<ol style="list-style-type: none"> 1. Vivien Bonnesoeur, Tupicocha, Perú 2. Laszlo Nagy, Brasil 3. Nicolás Cuvi, Quito, Ecuador 4. Carolina Tovar, UK / Perú 5. Gabriela Názaro, Fund. ProYungas, Argentina 6. Rodrigo Ordóñez, DFFS, Tucumán, Argentina 7. Pablo Quiroga, Municipalidad de Yerba Buena, Argentina
13 – 14	Lunch	
14:10 – 16	Bases for creation and consolidation of ROSA	Julieta Carilla (IER, UNT-CONICET)
16 - 16:15	Coffe break	
16:15 - 17:30	Synthesis - conclusions	Ricardo Grau (IER UNT-CONICET)
Thrusday, 16 may		
9 – 11	Presentation of the new versión of the SELS map for the Andes.	Lucía Zarbá (INTEPH, UNT-CONICET)
11 - 11:15	Coffe break	
11:15-12	Sharing of the SELSA map by region	By group
12 -13	Presentations: - ESA and Copernicus variables and products - Biodiversity Information and Monitoring System - SIMBIO - Community Biodiversity Monitoring in Montes de María	Ferran Gascon (Copernicus, Italia) Petra Wallem (UDD, Chile) Ana Belén Hurtado (Inst. Humboldt, Colombia)
13 - 14	Lunch	
14:10 – 16	Collective construction of challenges for the consolidation of ROSA: <ul style="list-style-type: none"> ● Methodological aspects table: scale of network operation, tools (e.g., web page), database and metadata, repository. ● Institutional aspects table: steering committee, potential partners, links with other networks, data management, hosting, where ROSA sits. ● Table of economic aspects: sources of funding, sustainability. 	Facilitators: Lucía Zarbá, (INTEPH, UNT- CONICET), Luis Daniel Llambí (CONDESAN) Ezequiel Aráoz (IER, UNT-CONICET)
16 - 16:15	Coffee break	
16:15 - 17:30	Groupal discussion space	
17:30 - 18	Internal meeting	

Wednesday, 17 may		
9 -10	Collective construction of potential monitoring sites to be part of ROSA	Luis Daniel Llambí (CONDESAN)
10 – 11	Future outlook: next steps; publication schedule, funding presentations, meetings and decision makers	Julieta Carilla (IER, UNT-CONICET)
11 -11:15	Coffee break	
11:15-13	Conclusions - closure	Ricardo Grau (IER, UNT-CONICET)
13 -14	Lunch	
14:15-19	<p>Trip to San Javier, La Sala, Tapia, Trancas (Tucumán).</p> <ul style="list-style-type: none"> • El Típal. Ligustrum invaded forest. • La Puerta. Valley view. Creative use. • El Portezuelo. Tranca valley view. • Raco-El Siambón. Counterurbanization. • Potrero de las Tablas. • Lules <p>Discussion space: how to incorporate unstructured studies into ROSA as a database (BDD national statistics, citizen science, collection of published studies).</p>	Guide: Ricardo Grau (IER, UNT-CONICET)
19.30	Dinner	Julieta Carilla
18, 19, 20 may		
18 may	<p>Socio-environmental recognition: Tafí del Valle (Tucumán)</p> <ul style="list-style-type: none"> • Jesuit ruins of Lules. Colonial history. Caspinchango River. Riverside forests. • Hidrological station Los Sosa or El Indio. • Guasacho de la Yerba Buena. The alluvium. Landslides and prehistory. • Lunch in Apeadero GeneralMuñoz. • Los Menhires hill. Rain shadow. • Abra del Rincón. Plesitocene rewilding. Tragedy of the common. • El Pelao. Tafí del Valle history. <p>Discussion space: 1) SELSA map; selection of new variables, publication scheme, responsables. 2) Book of ROSA observatories sites.</p>	Guide: Ricardo Grau (IER, UNT-CONICET)
19 de mayo	<p>Socio-environmental recognition: Cafayate (Salta).</p> <ul style="list-style-type: none"> • Carapunco. • El Infiernillo – GLORIA site • Los Cardones. • Quilmes ruins. • Tolombón. Prosopis forest. Cafayate sands. 	Guide: Ricardo Grau (IER, UNT-CONICET)
20 de mayo	Back to Tucumán	

Table 3. Potential observatories sites

	Sitios	Pais	Contacto
1	Puerto Natales	Chile	C+ UDD
2	Coyaique - Aysen	Chile	C+ UDD
3	Tierra del Fuego	Argentina	V Lencina
4	Omora	Chile	
5	Esquel	Argentina	IANIGLA
6	Pucón- Villa Rica	Chile	
7	Farallones	Reg metropolitana Chile	C+ UDD
8	San Jose del Maipo	Reg metropolitana Chile	C+ UDD
9	Mendoza	Argentina	IANIGLA
10	Valle del Elqui	Chile	Ceaza
11	Ojos del Salado	Chile	CONAF - Univ de Atacama
12	Tucumán	Argentina	R Grau / J Carilla
13	Antofagasta de la Sierra	Puna Argentina	
14	Cochabamba	Bolivia	W Ferreira
15	Sajama	Bolivia	UM San Andrés
16	Tupicocha	Perú	V Bonnesoeur
17	Huaraz	Perú	
18	Loja	Ecuador	T Ojeda
19	Saraguro	Ecuador	
20	Chocó	Ecuador	CONDESAN / F. Cuesta
21	Cordillera de Vilcanota	Perú	RI Meneses
22	Cordillera de Mérida	Venezuela	LD Llambí
23	Los Nevados	Colombia	AB Hurtado

Photos of the face to face workshop; in the hotel where the workshop took place and during the field trip.

