Mankind in the Desert: an interdisciplinary approach using integrated scientific and sustainability research

Centro del Desierto de Atacama UC (CDA – UC) – www.cda.uc.cl
September 30 to October 2

Program

Wednesday 30 September

14:00 hrs.: Arrival to the ECIM; lunch at the ECIM
16:00 hrs.: Workshop inauguration (Juan L. García, Director CDA)

Segment 1: Physical Geography of the Atacama Desert: climate, landscape and origin in the geologic past.

16:30-17:00 hrs.: **Jay Quade: "The Geologic and Climatic Evolution of the Atacama Desert"**

- When and why did the Atacama Desert hyperaridify?
- How does hyperaridity shape landscapes, soils, and ecology in the Atacama Desert?
- How has recent (the last 20 ka) climate fluctuated and impacted humans in the Atacama Desert?

17:00-17:30 hrs.: **José Rutllant: "Evolving aspects of the dynamic climatology of the Atacama Desert"**

- How the regional, diurnal cycle circulation across the Andes west slope could be modified by global warming?
- Is low coastal cloudiness reacting to the observed Hadley cell expansion?
- Is there any tendency in austral summer precipitation and temperature in the Andes highlands?

17:30-18:00 hrs.: **Antonio Maldonado: "Past climatic and environmental dynamics of the Atacama Desert since the late Pleistocene"**

- How did the environments of the Atacama Desert change (magnitude and direction) since the late Pleistocene?
- Were these changes synchronous across the Atacama Desert?
- How are these changes affecting cultural processes as the development of agriculture?

18:30 hrs.: Pisco sour and dinner at the Hotel Las Cruces

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Centro UC Desierto de Atacama

Thursday 01 October

07:30-08:30 Breakfast at ECIM

Segment 1 (S1): Physical Geography (cont….)

08:30-09:00 hrs.: **Duncan Christie: "Environmental changes in the South American Altiplano during the last millennium and some projections inferred from tree-rings and modeling"**

- What is the dendroclimatic potential in the Altiplano?
- What has been the temporal dynamics of precipitation?
- What do models suggest about future precipitation and tree species distribution?

09:00-09:30 hrs.: **Daniel Stanton: "Form and feedbacks: interactions between fog and vegetation in the Atacama desert"**

- How do the feedbacks between plants and atmospheric water shape Atacama ecosystems?
- What are the contributions of non-vascular plants (lichens, cyanobacteria, algae) to terrestrial Atacama ecosystems?
- How resilient are Atacama ecosystems to changes in fog and precipitation?

09:30-10:00 hrs.: **Pablo Marquet: "The Tillandsia ecosystem project: From fog to ecosystem processes"**

- The role of fog in affecting ecosystem patterns and processes
- The propagation of fog driven processes across the food web
- The coupling between the green and the brown food webs
- The role of bacteria, fungi and lichens and cyanobacteria in ecosystem processes.

10:00-10:30 hrs.: Coffee Break

Segment 2 (S2): The prehistory of the Atacama: human inhabitation and adaptations

10:30-11:00 hrs.: **Claudio Latorre: "Past climate change and cultural dynamics in the Atacama"**

- Can we develop a better understanding of late Quaternary climate variability in the Atacama and its long-term drivers?
- What is the relationship between climate, the hydrological cycle and human endeavor in the Atacama?
- How does past climate change relate to future human economic development of the Atacama?

11:00-11:30 hrs. **José Capriles: "The Archaeology of Peopling of the Atacama"**

- How did the earliest peopling of the Atacama unfold?
- What subsistence and mobility strategies characterize the earliest peopling of the Atacama?
- What was the environmental envelope during this migratory process, how did it change, and how did hunter-gatherers respond to these changes?
- Was there a temporal (adaptive) lag in the occupation of the Atacama and adjacent environments, such as the Pacific Coast and the Andean highlands, why?

11:30-12:00 hrs.: **Cesar Mendez: "When the Norte Chico was similar to today's Atacama: building on human responses to aridization."**

- How do hunter-gatherers respond to aridization in the long-term (millennial scales)? (Resource selectivity v. PaleoDiets)
- What is the role of neighbor environments under a mobile complementary regime during climatic stressful periods? (Differential space use: coasts, piedmont, high cordillera, eastern extra Andean plains)
- Was Mid-Holocene climate change a trigger for technological change in the Semiarid North of Chile? (Exploring different technological attributes in millennial scales)

12:00-13:00 hrs.**:** discussion/roundtable/ exploring integrative research questions (S1 and S2). Leading Table: Claudio Latorre, Jay Quade, José Rutlant, José Capriles

13:00-15:00 hrs.: Lunch at the ECIM

Segment 3: "The human Atacama today and future prospect: Desert entropy, future climate change, cultural challenges and opportunities for sustainability"

15:00-15:30 hrs.: **Pablo Osses: "The rains in the Atacama desert during fall and winter 2015; effects in urban settlements and human activities"**

- Are we considering the dynamic of the geography to develop sustainable cities?
- Was feasible to prevent the disasters?
- Is land planning a fact in Chile?

15:30-16:00 hrs.: **Rodrigo de La Iglesia: "Influence of copper on the composition of phytoplankton organisms in the bay of Chañaral, Atacama region"**

- Is there an effect on the biota present in the coast of Chañaral due to the presence of high levels of copper there?
- Is there an environmental management program dealing with this catastrophe?
- What sort of interdisciplinary activities could be developed in this area?

16:00-16:30 hrs.: **Alessandra Ponte: "Mining at Extremes"**

- Does the Atacama Desert and subarctic Canada present similarly challenging climatic condition and sparse population?
- Mining in both cases is the main economic factor. Mining, beyond having a stressful impact on environments and communities, depends on an unstable global market that further destabilizes already fragile local equilibriums.
- The Canadian mining industry has been actively operating in the Atacama Desert for decades. In fact, copper from Chile is still processed in a foundry in Rouyn-Noranda in Abitibi, one of the two regions under exam, which is now serving as a base for mining companies functioning at a worldwide scale.

16:30-17:00 hrs.: **Rosanna Ginocchio: "Metal mining activities in northern Chile: environmental impacts and their mitigation"**

- What are the risks of metal mining activities (smelting and massive solid wastes) in terrestrial ecosystems?
- What are the exposure levels of terrestrial plants to metal pollutants?
- How we can control/mitigate the risks of metal pollutants in terrestrial ecosystems (plant formations)?

17:00-17:30 hrs.: **Patricio Pliscoff: "The IUCN red list of Ecosystems: the case of Atacama Desert within the Chilean national assessment"**

- How much of Atacama Desert ecosystems are left, and how likely are they to disappear?
- Which are the best criteria to define the risk of collapse in Desert ecosystems?
- Where in the Chilean Atacama Desert we found the most endangered ecosystems?

17:30-18:00 hrs.: Coffee Break

18:00-19:00 hrs.: discussion/roundtable/ exploring integrative research questions (S3)
Leading Table: Pablo Osses, Alessandra Ponte, Rosanna Ginocchio

19:00 hrs.: Dinner at Hotel Las Cruces

Friday 02 October

07:30-08:30 hrs.: Breakfast at ECIM

Segment 4: Natural resources and sustainable technologies for the Atacama

08:30-09:00 hrs.: **Juan L. García: "The Atacama coastal fog as a new water resource"**

- How does the fog water collection vary through different time scales and what are the atmospheric and oceanographic factors that determine this behavior?
- Where in the Atacama we found the best location for fog-water collection?
- Is it possible to implement an extensive social use of fog-water in the Atacama? What are the challenges?

09:00-09:30 hrs.: **Camilo del Río: "Modelling Atacama coastal stratocumulus cloud; remote sensing and ground truth methodological approach"**

- Which is the altitudinal variation latitudinal of the inversion layer in coastal Atacama?
- Why the need for automation?
- Time-lapse camera, a feasible technique for Sc thickness monitoring?

09:30-10:00 hrs.: **Juan de Dios Rivera: "Fog water collection"**

- What else do we need to know about fog?
- Perspectives of a new measurement instrument

10:00-10:30 hrs.: **Elizabeth Lictevout: "Water Resources and Development of the North of Chile: use of non-renewable vs. non-conventional water resources."**

- What is the past and current rate of recharge of groundwater reserves? What is the proportion between fossil water and recent water?
- Evolution of groundwater reserves (quality and quantity) during the past decades and prediction of the evolution during the next decades according to different development scenarios?
- What are the challenges and opportunities for an integrated water resources management and sustainable development of North of Chile?

10:30 – 11:00 hrs.: **Josefina Hepp: "Looking at a small scale: the wonder of seeds in the coastal Atacama desert"**

- What are the main strategies used by seeds in desert environments?
- What challenges are seeds (and arid ecosystems) facing at the moment, and how can we help to protect them?
- Can we think of seeds (and native desert plants) as natural resources, and if so, what are the next steps?

11:00-11:30 hrs.: Coffee Break

11:30-13:00 hrs.**:** discussion/roundtable/ exploring integrative research questions (S1-S4).
Leading Table: Juan Luis García, Pilar Cereceda, Elizabeth Lictevout
Wrapping the meeting up.

13:00-14:00 hrs.: Lunch at the ECIM UC (outdoor parrilla)
14:00 hrs.: Return to Santiago

Talks and roundtables

The workshop program has been structured with 4 main discussion subjects to be discussed during two mornings and two afternoons from Wednesday pm to Friday am. Based on each one expertise and background, each of the invited participants has been assigned into one of these segments to give a talk. Ideally, this talk should provide to the audience a general background, science and challenges that guide present research in the context of the workshop goal. Each talk will last about 20 minutes, leaving about 10 minutes for specific questions or comments from the audience, including students. After each thematic session, a one-hour roundtable will serve to highlight and discuss research questions from an interdisciplinary point of view. We believe these activities will expose main gaps and challenges present in the Atacama that can be used in the future for joined scientific efforts.

Language

English. For those performing talks in Spanish, please prepare your slides in English.

Participants

- **José Capriles:** Archeologist, PhD of the University of Washington in St. Louis, and Researcher from the Laboratory of Archaeology at Museum University of Tarapacá San Miguel de Azapa. He is specialist in Zooarchaeology, Geographical Information Systems, Human Ecology, and Management of Cultural Heritage. Research interest: reconstruction of adaptive strategies of early settlers of the Andes and the Amazon, comparative perspectives on the evolution of grazing and animal domestication, and the processes of change and continuity associated with the use, production and control of resources during the emergence and expansion of complex societies.
- **Pilar Cereceda:** Former director of Centro del Desierto de Atacama UC and Professor at the Institute of Geography of the Pontificia Universidad Católica de Chile. Research interest: Geography of arid and semi-arid areas, fog collection, climatology, water resources, and biogeography.
- **Duncan Christie:** PhD in Forestry, Researcher and Professor at the Faculty of Forestry Sciences and Natural Resources of the Universidad Austral de Chile. Research areas: Paleoclimatology, Forest Ecology, and the response of Ecosystems to Climate Variability and human disturbance.
- **Camilo del Río:** Master of Geography, Professor at the Institute of Geography of the Pontificia Universidad Católica de Chile. He specializes in Remote Sensing and Geomatics, and his recent research focuses on the solar energy resource through geomatics tools.
- **Juan Luis García:** PhD in Earth Sciences at the University of Maine, Professor at the Institute of Geography of the Pontificia Universidad Católica de Chile, director of the Centro del Desierto de Atacama UC. He is head of the Laboratory of Physical Geography UC. Research interest: climate change during Quaternary, geomorphology, glacier landscape, fog-water, fog climatology.
- **Rosanna Ginocchio:** PhD in Biological Sciences with mention in Ecology and Postdoc at the University of Exeter. Professor of the Department of Ecosystem and Environment of the Faculty of Agriculture and Forestry at the Pontificia Universidad Católica de Chile. Research interest: impacts of mining in the environment, bioavailability of metals in soil, environmental pollution by metals, metal-tolerant plants.
- **Josefina Hepp:** Agronomist, Master in Environmental Protection and Management at the University of Edinburgh, and doctoral candidate in Agricultural Sciences of the Pontificia Universidad Católica de Chile. She is the Project Coordinator of the CDA UC and Leader for the Local Communities line of the CDA. Her research is focused on the physiology of seeds

in desert and semi-desert environments, native flora, biodiversity conservation, ethnobotany and education for sustainable development.

- **Rodrigo de la Iglesia:** PhD in Biological Sciences of the Pontificia Universidad Católica de Chile and Postdoc in Marine Microbiology at the Universidad de Concepción. Professor and Researcher at the Faculty of Biological Sciences of the Pontificia Universidad Católica de Chile. Research interests: marine microbiology, metagenomics analysis of microbial communities, and responses of microbial communities to environmental perturbations in the Atacama.
- **Claudio Latorre:** PhD in Ecology and Evolutionary Biology, Professor and Researcher at the Faculty of Biological Sciences of the Pontificia Universidad Católica de Chile, and Leader of the Paleoenvironment research line of the CDA. His research focuses on Paleoecology, Paleoclimatology, and Biogeography and Botany, specifically in understanding past and modern distribution of plants and associated climate thresholds in the Atacama Desert.
- **Elisabeth Lictevout**: Hydrogeologist and past Director of the Centro de Investigación y Desarrollo en Recursos Hídricos (CIDERH). Msc Hydrogeology, expert in hydrogeology and water resources management.
- **Pablo Marquet:** PhD in Macro-ecology and Professor in the Department of Ecology at the Pontificia Universidad Católica de Chile. The focus of his research is the macroecology and ecological systems, the spatial structure of species assemblages at regional scales, and metapopulation dynamics. Dr. Marquet is the Director of the Departamento de Ecología at the Pontificia Universidad Católica de Chile.
- **Antonio Maldonado:** Doctor in Ecology and Evolutive Biology of the Universidad de Chile. He is a reseracher at the Centro de Estudios Avanzados en Zonas Áridas (CEAZA). The focus of his research is paleoecology, paleoclimatology and geoarqueology using pollen records from the Quaternary period, with enphasis en arid amd semiarid regions, including the Atacama Desert.
- **César Méndez:** Archeologist, MA in Archaeology, Anthropology mention, Doctor in Anthropology with a mention in archeology. Professor and Director of Research and Publications at the Faculty of Social Sciences of the University of Chile. Research interest: early peopling of South America; human and landscape interaction.
- **Pablo Osses:** Master in Agrarian Economy, Professor at the Institute of Geography of the Pontificia Universidad Católica de Chile. Leader of the Water research line at the CDA UC. Research interest: fog-water, fog climatology.
- **Patricio Pliscoff:** PhD obtained at the Department of Ecology and Evolution hosted by the University of *Lausanne.* His research is focused on Biogeography, particularly in understanding patterns of plants species' distribution in space and time. His main purpose of study is looking for identifying relevant biogeographical questions for the conservation

and protection of the biota of Chile by using modeling methods, herbarium data and environmental variables. Other research aims include working with vegetational and bioclimatological classification, and methods that allow spatialize climatic and environmental variables.

- **Alessandra Ponte:** PhD in History and Theory of Architecture and Professor at the School of Architecture of the University of Montreal. She has recently completed a book on North American landscapes (The House of Light and Entropy, London, 2014). She is part of the research group Future North, a project initiated by the Institute of Urbanism and Landscape and Design Institute of the School of Architecture of Oslo in collaboration with the Barents Institute. Currently, she is investigating mining practices in arctic and sub-arctic Canada.
- **Jay Quade:** Doctor and Professor at the University of Arizona, geochemistry of soils. His research focuses on geochemical aspects of soil, as well as the ecological aspects and paleoecological indicators, climate, radiocarbon dating, and paleohydrology.
- **Juan de Dios Rivera:** PhD of Philosophy from the Pennsylvania State University and Professor at the School of Engineering of the Pontificia Universidad Católica de Chile. Interest areas: Thermofluids and combustion, atmospheric pollution, energy conversion, and home modeling, Fog catchers technology.
- **José Rutllant:** PhD in meteorology from the University of Wisconsin, Electrical Engineer and Researcher at the Centro de Estudios Avanzados en Zonas Aridas – CEAZA. His research is related to the Regional Dynamic Climatology and ocean-atmosphere-land interaction. Member of the American Meteorological Society and the American Geophysical Union.
- **Daniel Stanton:** PhD and Researcher at the Department of Ecology, Evolution and Behavior at the University of Minnesota. He is a specialist in the interaction between plants and environment, interaction between vegetation and fog in the Chilean-Peruvian desert, and ecology and eco-physiology of bryophytes, lichens and vascular plants.

CDA Organizing Committee

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