



Teaching and Understanding knowledge about past and present land use and landscape dynamics under climate change in the northern Ecuadorian Andes

We all face the same global challenges under climate, resource and land use change that require local solutions adapted to the configuration and history of local (cultural) landscapes. With the vision to initiate academic exchange and inter- to transdisciplinary research, a pilot visit to Quito and its surrounding Andean mountains took place from 22-Aug to 11-Sep 2024 by an international research team coordinated by University Göttingen (UGö) and the Ecuadorian Fundación Cambugán (FC).

With funding from a DAAD Fact Finding Mission, UGö members Elisabeth Dietze (Institute of Geography), Volker Karius (Geoscience Center) and Alejandra Valdes-Urbe (Tropical Forest Ecology) visited four universities in Quito with natural and social science foci, i.e. the Universidad San Francisco de Quito (USFQ), FLACSO Ecuador, Universidad de las Fuerzas Armadas (ESPE) and the Universidad Andina Simón Bolívar (UASB, our generous host during our stays in Ecuador's capital). We learned about our respective university structures, study programs and academic exchange opportunities, along with visits to the campus, laboratories, and field sites nearby Quito. Complemented by short visits to EPN, PUCE and the national biodiversity institute (INABIO), we are impressed by the quality and diversity of the Ecuadorian university landscape and the already existing connections. We are looking forward to continuing this productive exchange with **an Ecuadorian delegation visiting U. Göttingen from 11th to 15th Nov, 2024 (everyone interested: welcome to join).**

As part of a DFG-funded pilot study with RWTH Aachen, University Bonn and the Polish Academy of Sciences (PAS) we exchanged with the Ecuadorian university partners that we met and that supported us logistically in the natural science part of the pilot visit (including members of the Universidad Técnica del Norte (UTN), Ibarra, and the local NGOs Fundación Cambugán, EkoRural and local community members that they introduced to us. In a joint workshop at UASB and at the experimental farm of FC in Pintag, we explored local knowledge systems and perception of "landscape" to identify the research perspectives and collaboration interests to plan joint research and research-oriented teaching in a next step. As a basis for further research, we explored six lake systems in the páramo grassland and cloud forest zones (Laguna Muertepungo, Laguna Chiriyacu and Caricocha Mojanda at c. 3700-4000 m asl) and the Interandean valleys (San Pablo, Cuicocha, Lagunas Secas at c. 2700-3400 m asl). Together with partners from USFQ and UTN, we explored water and lake sediment properties (using acoustic subbottom profiling for sediment and lake bottom structures, retrieving 21 water, 14 lake surface sediment samples and 6 up to 1.25 m long sediment cores). We mapped forest composition and microclimate in remnant forests around the lakes and areas protected by FC. Using a mobile laser scanner, we collected data of the spatial distribution of vegetation elements across 14 plots (30 m diameter). TMS sensors were installed for at least one year in 10 study sites. Soil profiles in the forest and onshore were assessed. The water and soil samples will mostly be analyzed at USFQ (with N. Carpintero, M. Ruiz-Uriguen, D. Rosero), together with water samples from village infrastructure that the communities we work with have requested, to support the chemical and microbiological monitoring of water quality. From exchange with local people and FLACSO/UASB colleagues, we learned about societal structures, regional climate, land use and lake change perceptions, resource exploitation, tourism, and especially past and ongoing land degradation and water pollution. We recognized the role of active vulcanism and tectonics for biodiversity, and ongoing dryness for power

supply and local security. Despite several logistical and health-related challenges, it was a great start of scientific and academic collaboration.

Thanks to everyone that we met, that helped us in the field and in making this pilot visit possible. Elisabeth, Ana, Liseth, Ann-Kathrin, Alejandra, Volker, Michal, Agnieszka, Marek



Exploring Laguna Muertepungo (left) and Caricocha Mojanda (right) with new boat, adapter for the sediment acoustic - thanks to GZG Workshop colleagues, and a gravity coring system (from left to right: micropaleontologist/limnologist L. Pérez, Aachen, Environmental CoreLab member E. Llumiquinga, USFQ, V. Karius and students N. Rohde & B. Heyer, Göttingen).



Páramo vegetation and soils around 4000 m asl, nearshore Muertepungo lake, in contrast to valley landscape that experienced centuries of intense land use and soil erosion, here at the extinct volcano Ilaló.



From left to right: Learning about native forest remnants in Ilaló (w Steve Sherwood, Fundación EkoRural), plot preparation for 3D vegetation scanning (A. Valdés-Uribe), mobile laser scanner used during the survey.



TMS dataloggers (from left to right) in the 60 years regenerated natural forest in Pintag and a small peatland in the Laguna Mojanda region, to understand microclimate, installed by PAS colleagues. Right: Lis analysing water samples in the evening.



Inactive and active volcanoes, like the Cotopaxi, shape the tropical Andes around Quito. Partly visible: community-driven reforestation, mostly with non-native species.



Discussing ecosystem functions, services and recovery in Pintag (A. Valdés-Urbe, UGö and Leonardo Zurita, USFQ) before community workshop with Asociación Muertepungo (led by Ana Mariscal and Patricio Lopez, FC & AK Volmer).



Heavy wildfire season in Quito (photo taken on the 04.09.24, fires are ongoing) - little studied in Ecuador, but of high relevance for local societies and ecosystems, closely connected to climate and land use change.



Exchange with local community members in Atahualpa about land use change and conservation (right). Erika from the USFQ CoreLab conducting microbiological analysis on household and irrigation water samples from Píntag (left).



Lakes as sentinels to climate and land use change in protected areas (Mojandas) and densely populated regions (San Pablo).



Most members of the team (from left to right): Memo (partly, video doc), Atma Rosa Linda (FC), Marta (Rumipamba local support), Alejandra, Bjarne, Elisabeth (all UGö), Carlos (UASB), Ana (FC), Sarah (UGö), Mario (local support), Nico (UGö), Ann-Kathrin (CALAS/UBonn /UBielefeld), Volker (UGö). Not on photo: Michal, Aga, Marek (PAS), Liseth.

Right: Universidad Andina Simon Bolivar full of art.

