

Water Quality in the Napo River Basin (Ecuadorian Andean Amazonia): The Andean Amazon Rivers Analysis and Management project (AARAM)

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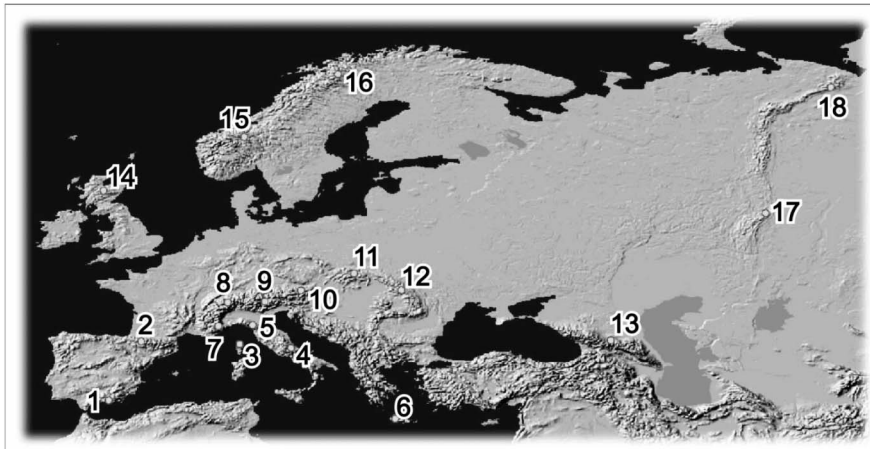
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GLORIA–EUROPE: Report on the Kickoff Meeting, 25–29 April, Vienna



The 18 target regions of the Gloria Research Initiative in Alpine Environments.

GLORIA–Europe is a pilot project of the Global Research Initiative in Alpine Environments, which will ultimately operate on a worldwide scale (see *MRD* Vol 20 No 2, pp 190–191). The project is funded by the European Union as a contribution to the fifth research and technological development (RTD) framework. The research consortium is coordinated by the Institute of Ecology and Conservation Biology of the University of Vienna under the leadership of Prof Georg Grabherr and his team (consisting of Michael Gottfried, Daniela Hohenwallner, Harald Pauli, and Karl Reiter). It is made up of a data supplier group and a user group. Data suppliers are contractors responsible for implementing the basic GLORIA setting on summits at different elevations in their particular target region (ie, the multisummit approach previously described in *MRD*).

The 18 target regions are (1) Sierra Nevada (Spain), (2) Central Pyrenees (Spain), (3) Ritundu of Corsica (France), (4) Central Apennines (Italy), (5) Northern Apennines (Italy), (6) Lefka Ori of Crete (Greece), (7) Mercantour–South-

western Alps (France), (8) Entremont–Western Alps (Switzerland), (9) Dolomites–Southern Alps (Italy), (10) Hochschwab–North-eastern Alps (Austria), (11) Tatra–Western Carpathians (Slovakia), (12) Rodnei–Eastern Carpathians (Romania), (13) Central Caucasus (Georgia), (14) Cairngorms–Scotland (UK), (15) Dovrefjell–Southern Scandes (Norway), (16) Latnjajaure–Northern Scandes (Sweden), (17) Southern Ural (Russia), and (18) Polar Ural (Russia).

A broad network

The supplier groups are based either at universities close to the target regions or at research institutes. Two NGOs are involved as users: CIPRA (International Commission for the Protection of the Alps) and WWF International (World Wide Fund for Nature). Prof Martin Price (University of the Highlands and Islands, Perth College, Scotland) provides a link to the International Mountain Forum (MF) and to socioeconomic perspectives on GLORIA, while the recently established Mountain Research Initiative (MRI) in the International Geosphere-Biosphere

Program (IGBP) is a link to international research programs. Close contacts also exist with the Global Mountain Biodiversity Assessment (GMBA) program of DIVERSITAS and the Global Terrestrial Observation System (GTOS). GLORIA–Europe is also recognized by the European Environmental Agency (EEA) as a part of European environmental monitoring activities.

Kickoff meeting in Vienna

GLORIA activities were officially initiated on 1 January 2001. At the kickoff meeting organized by the coordinating group in Vienna, held from 25 to 29 April, 38 scientists discussed and finalized the field manual for the basic GLORIA settings. As an introduction, the coordinating group demonstrated how to establish a setting in the field: a prehistoric tumulus (Hallstatt Period) close to Vienna, covered by pannonic steppe vegetation, was chosen as a “perfect summit.” It was an exciting experience for the participants to discuss the GLORIA program and methodology on an old Celtic tomb far from the place where Celts live today. This group of scientists from all over Europe, who will be working in close cooperation in the future, thus had a profound impression of the historic roots of modern Europe.

The second day was devoted to the presentation of the particular target regions by the contractors. They provided an excellent overview of the differences among Europe’s mountains while also stressing the similarities of European high mountain systems. On the third day, the draft version of the field manual was discussed and revised. This field manual will be the basic document used in fieldwork by all GLORIA partners. It is available to all interested parties

and can be downloaded from the Internet at www.gloria.ac.at.

This final version of the multi-summit approach is the result of 2 years of international discussions and cooperation. The GLORIA coordinators received many useful comments, not only from the European contractors but also from many other scientists and colleagues around the globe.

At the end of the meeting, discussions focused on a contract dealing with publication and handling of data. A small group

extended their stay in Vienna to see more of the Eastern end of the Alps, that is, the city of Vienna and its surroundings.

Plans for the future

The time schedule for GLORIA–Europe is 1 January 2001 to 31 July 2003. The first outputs, that is, descriptions of the target regions, will be available in about 1 year. A book will be produced as a final product, presenting the first comprehensive comparison of Alpine biodiversity based on a standardized

methodology. The enthusiastic atmosphere of the kickoff meeting convinced everyone that the GLORIA initiative is on its way to establishing a simple, low-cost but highly efficient ecological monitoring system at the European and, ultimately, the global scale.

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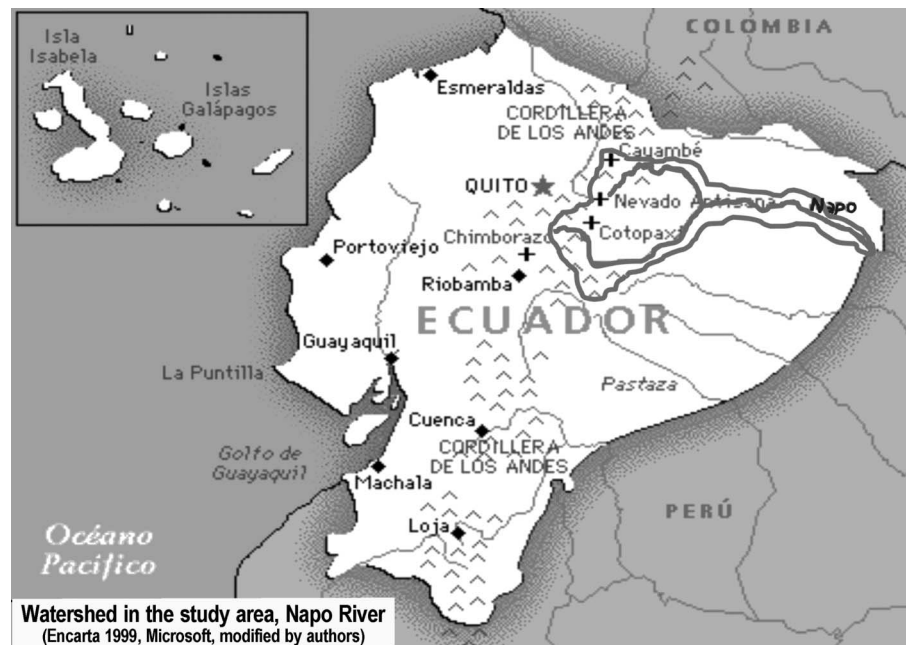
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Significance of the Amazon region

Tropical forests cover around 7% of the Earth's surface and contain half of its species of animals and existent plants. The Amazon region is the habitat for almost half the tropical native forests of the globe and a huge natural savanna area. It is a region abundant in water, and its fluvial system is one of the largest in the world; some areas are therefore subject to periodic floods. Land use changes result in significant physical alterations that affect water flow, sediment transport, and the biogeochemistry of the fluvial systems in the region. It is thought that variations in the water, solar energy, and carbon and nutrient cycles may have climatic and environmental impacts at local, regional, and global scales due to changes in the natural vegetation cover in Amazonia.

Ecuador's role

The Ecuadorian Amazon Territory is part of the Great Amazon Basin. Although it covers only 2.5% of the Basin, it represents almost 50% of the total surface of Ecuador. This does not diminish the importance of studying it since actual land use and the senseless use of its



resources could endanger the sustainability and the future of the Amazon Ecuadorian region. Land use changes, change in vegetation cover due to agriculture and ranching in the upper basins, oil exploitation, and increased colonization may have negative impacts on water quality, especially in the lower basins.

The AARAM project

The regional Andean Amazon Rivers Analysis and Management project (AARAM) is funded by the Inter-American Institute for Global Change Research (IAI) and is being carried out in Colombia, Peru, Bolivia, and Ecuador. Its main objective is to understand the effects of land use change in the Andean

Amazon region on water quality in the lower basin and thus contribute to effective natural resource management. The AARAM project coordinates water quality analyses in the Napo River Basin, a tributary of the Great Amazon River, which carries the highest discharge of any river in Ecuador. The Napo River Basin is located in the northeastern Amazon region of Ecuador.

In order to determine water quality in the bodies of water, the following environmental parameters were analyzed: temperature, pH, dissolved oxygen, minerals, nutrients, heavy metals, phytoplankton, and zooplankton. The results of these analyses enabled us to determine the state of the bodies of water and the degree of influence of human activities in the zone.

The main objective of this ongoing project is to determine water quality in the Napo River Basin as a first approximation. In order to do this, a hydrochemical monitoring network including several bodies of water was established, and 2 field campaigns were carried out, one during the rainy season and the other during the dry season. The Napo River Basin consists of 2 geographical regions: the upper basin, or sub-Andean region, where rivers come from the mountain with clear water, and the lower basin, where the waters are turbid.

AARAM activities in Ecuador

Two institutions carry out this project in Ecuador. One is the National Institute of Meteorology and Hydrology of Ecuador (INAMHI), which is responsible for implementing and operating the monitoring network, carrying out fieldwork in the area of discharge measurements, and providing support for modeling through hydrometeorological information and personnel. The second institution is the National Polytechnic School (EPN), which coordinates the project and monitors and supports hydrobiogeochemical modeling.

This effort also includes NGOs, national institutions, municipal and provincial governments, the community (native people from the zone and settlers), and other national, regional, public, and private entities, such as CDC, CLIRSEN, CNRH, DINAPA, ECORAE, and ECOCIENCIA, among others. These entities develop various scientific activities. Student research is also carried out in relation to the main project areas. In the future, we hope to make the results of this research available to governmental institutions in each region through seminars.

Preliminary results: Based on fieldwork, it can be established that most of the sampling points meet the standards of water quality set by the Regulation of Control and Environmental Protection of Water Resources (Ministerial Agreement Not. 2144 RO 204-5-VI-89). This agreement is based on criteria for water used for human and domestic consumption that requires conventional treatment (raw water) and criteria for flora and fauna preservation in natural cold and warm waters. Significant indications of water contamination were not found, but some pollution was present. Inputs of organic and inorganic constituents existed in proportions that exceed the ecological equilibrium, although they have not yet produced noxious conditions. These inputs probably come from human activities throughout the entire region.

Temperature, pH, and the dissolved oxygen are within normal limits. The main stream has been favored by large discharges and acceptable water oxygenation characteristics; it effectively dilutes pollutants, allowing recovery of the river as it flows downstream within the Amazon Basin. Mineral levels in water depend on the type of soils the water goes through and the geological material dissolved.

The results show that the waters are weakly mineralized (soft

waters), although in the upper basin there are high concentrations of magnesium, potassium, silica, and sulfates. The remaining parameters maintain a certain level of uniformity around the basin, with slight variations in the midbasin, especially nutrients (ammonium, nitrites, and nitrates). Nutrient variations in the midbasin are mainly due to the fact that this is the most populated zone of the basin, with more agroindustry and tourism.

Laboratories where analyses were carried out did not find concentrations of hydrocarbons and heavy metals above the detection limits, so there is a degree of uncertainty about their presence in waters. The outcomes of biological analyses revealed a great diversity of phytoplankton—an indicator of water under normal conditions.

Perspective for the future: These results represent the current state of water quality. It is therefore important to carry out more frequent sampling in order to determine the temporal trend of each of the principal parameters studied.

This research project complements investigations of this type that have been carried out in areas influenced by the oil industry. In future, it is hoped that the water around the basin can be characterized to understand ecosystem dynamics (biogeochemical cycles). This will enrich other research activities related to biology, sustainable development, biodiversity, ecology, and other fields.

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