



Evolution of Ecosystems

Kurt Hanselmann

Swiss Federal Institute of Technology, ETH Zürich
Department of Earth Sciences – Geology Institute
Biogeosciences



High Altitude Research is “IN” again

Dear MRI Community,

High mountains were on the agenda at the World Meteorological Organization in Geneva earlier this month, when I attended a meeting to develop a White Paper for the WMO's High Mountains Strategy in collaboration with mountain research experts. The White Paper is a key input to be presented at the [WMO Congress](#) in June, and later as part of the [WMO High Mountains Summit](#) in October 2019, at which the MRI will be present as the event's Co-Chair.

In March, the discussion of high mountains will continue during the IPCC Fourth Lead Author Meeting for SROCC. Over the course of this six-day meeting, I will be working with my fellow authors to improve the High Mountains chapter of this report by taking into account the valuable comments submitted by the mountain research community during the review phase.

Later in the month, I'll be attending a workshop in Munich that aims to capitalize on the results of the ESPON project [Alps 2050](#), which developed spatial perspectives and scenarios for the Alpine region towards the year 2050. Then it's off to Rome for the next [Mountain Partnership Steering Committee meeting](#), before heading back to Geneva for the WMO's Ninth Session of the Executive Council Panel of Experts on Polar and High Mountain Observations, Research, and Services – during which we'll be framing the Polar and High Mountain Agenda for the next WMO Financial Period (2020-2023).

All in all, a busy March ahead!

Enjoy your read,

Dr. Carolina Adler
MRI Executive Director

Mail February 28, 2019



Short History of high-Altitude Research in Switzerland

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#history



<http://www.mountainresearchinitiative.org/en/>

Swiss Polar Institute (SPI), established at EPFL in 2018

Centre interdisciplinaire de recherche sur la montagne.
Université de Lausanne, established 2018



The GeoBio Website

Integrated Earth Systems Sciences (I-ESS) - Geo-Biology and Geo-Ecology in High-Altitude Ecosystems



Contents and Summaries

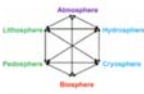
BGS Colloquium 190307

I-ESS Courses Geo-Ecology Geo-Biology Discoveries & Highlights

Key words: Biogeosciences, Geobiology, co-evolution, origin of life, Earth Systems, Earth-spheres, global changes, rock weathering, habitable spaces, aquatic and terrestrial ecosystems, evolution of biomes, high altitude, vanishing glaciers, colonising organisms, pioneering communities, biodiversity, soil, peat and lake sediment formation, re-forestation of alpine meadows and scree, effects on climatic cooling, Earth history, Anthropocene.

Interacting Earth Compartments

The **Sciences of GeoBiology and GeoEcology** deal with processes at interfaces between rocks, water, air and life. Chemical and physical interactions between rock minerals, water and atmospheric gases have played key roles for more than 4 billion years in making Earth a habitable planet and in the evolution of organisms. Chemical, physical and biological processes are still shaping the co-evolution of Earth-spheres today: the lithosphere, pedosphere, hydrosphere, atmosphere, cryosphere and biosphere.



Global Change

The **geobioscience discovery workshops in the high mountains of the Alps** offer unique opportunities to learn in remote areas which are only minimally disturbed by human activities, how Earth's spheres are affected by ongoing global changes and how physical, chemical and biological processes regulate their responses.

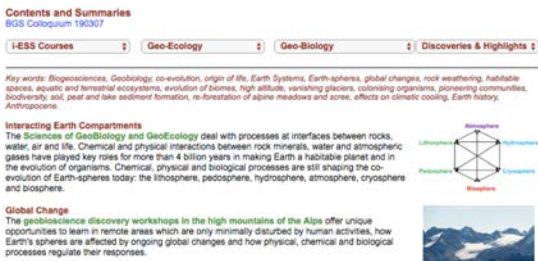
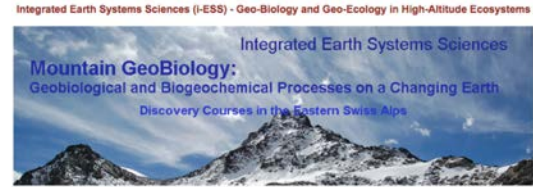


Where we are

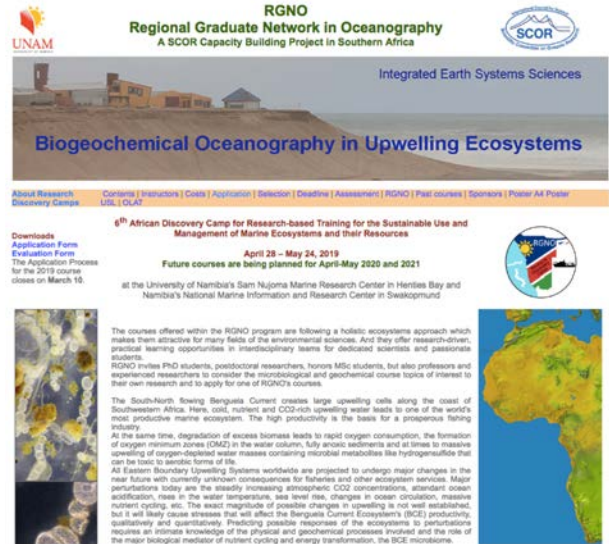


A Course Concept: End Members of the Carbon Cycle

Initial Carbon Sequestration

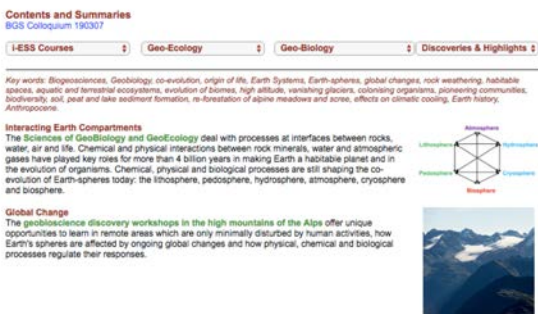


Final Carbon Deposition



A Course Concept: End Members of the Carbon Cycle

Initial Carbon Sequestration



A Course Concept: End Members of the Carbon Cycle



Final Carbon Deposition



RGNO
Regional Graduate Network in Oceanography
A SCOR Capacity Building Project in Southern Africa

Integrated Earth Systems Sciences

Biogeochemical Oceanography in Upwelling Ecosystems

Abstract Research Discovery Camps | Careers | Institutions | Coasts | Agriculture | Selection | Deadlines | Assessment | RGNO | Past courses | Sponsors | Poster At Poster

Downloads
Application Form
Evaluation Form
The Application Process
for the 2019 course
closes on March 15.

6th African Discovery Camp for Research-based Training for the Sustainable Use and Management of Marine Ecosystems and their Resources
April 28 – May 24, 2019
Future courses are being planned for April-May 2020 and 2021
at the University of Namibia's Sam Nujoma Marine Research Center in Henties Bay and Namibia's National Marine Information and Research Center in Swakopmund

The courses offered within the RGNO program are following a holistic ecosystems approach which makes them attractive for many fields of the environmental sciences. And they offer research-driven, practical learning opportunities in interdisciplinary teams for dedicated scientists and passionate students. RGNO invites PhD students, postdoctoral researchers, honors MSc students, but also professors and experienced researchers to consider the microbiological and geochemical course topics of interest to their own research and to apply for one of RGNO's courses.

The South-North flowing Benguela Current creates large upwelling cells along the coast of Southwestern Africa. Here, cold, nutrient and CO₂-rich upwelling water leads to one of the world's most productive marine ecosystems. The high productivity is the basis for a prosperous fishing industry. At the same time, degradation of excess biomass leads to rapid oxygen consumption, the formation of oxygen minimum zones (OMZ) in the water column, fully anoxic sediments and at times to massive upwelling of oxygen-depleted water masses containing microbial metabolites like hydrogen sulfide that can be toxic to sensitive forms of life. All Eastern Boundary Upwelling Systems worldwide are projected to undergo major changes in the near future with currently unknown consequences for fisheries and other ecosystem services. Major perturbations today are the steadily increasing atmospheric CO₂ concentrations, attendant ocean acidification, rise in the water temperature, sea level rise, changes in ocean circulation, massive nutrient cycling, etc. The exact magnitude of possible changes in upwelling is not well established, but it will likely cause stresses that will affect the Benguela Current Ecosystem's (BCE) productivity, qualitatively and quantitatively. Predicting possible responses of the ecosystems to perturbations requires an intimate knowledge of the physical and geochemical processes involved and the role of the major biological mediator of nutrient cycling and energy transformation, the BCE microbiosphere.



Evolution of Ecosystems (Orientation)

Download from

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html

GeoBio-Science Arena Silvretta

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#arena

The Great Diversity of Study Sites

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#study_topics

From Ecology to Geology-based Economy

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#humangeo

New Landscapes and Natural Disasters

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#disaster1

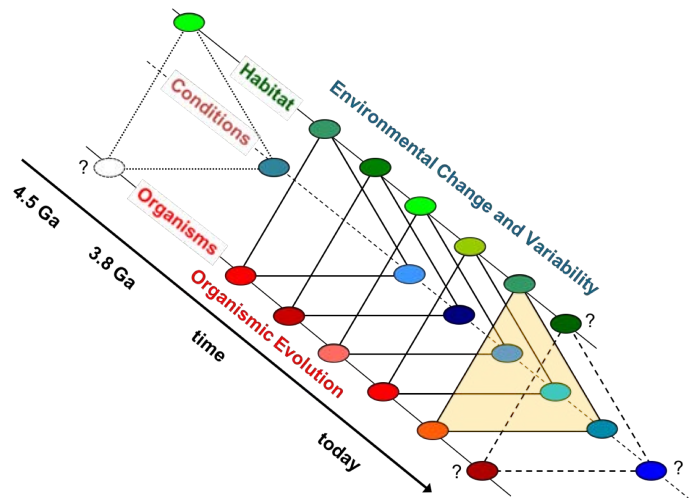
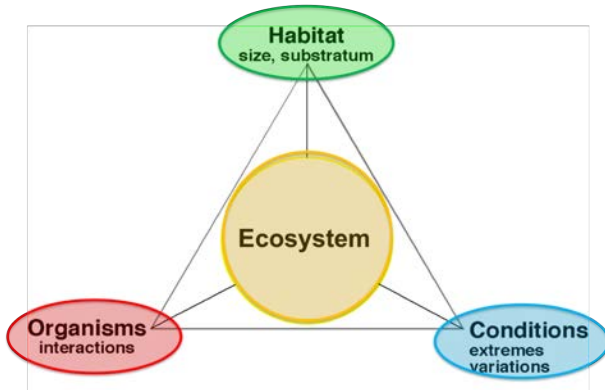
http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#disaster2

Opportunities for Study Preferences

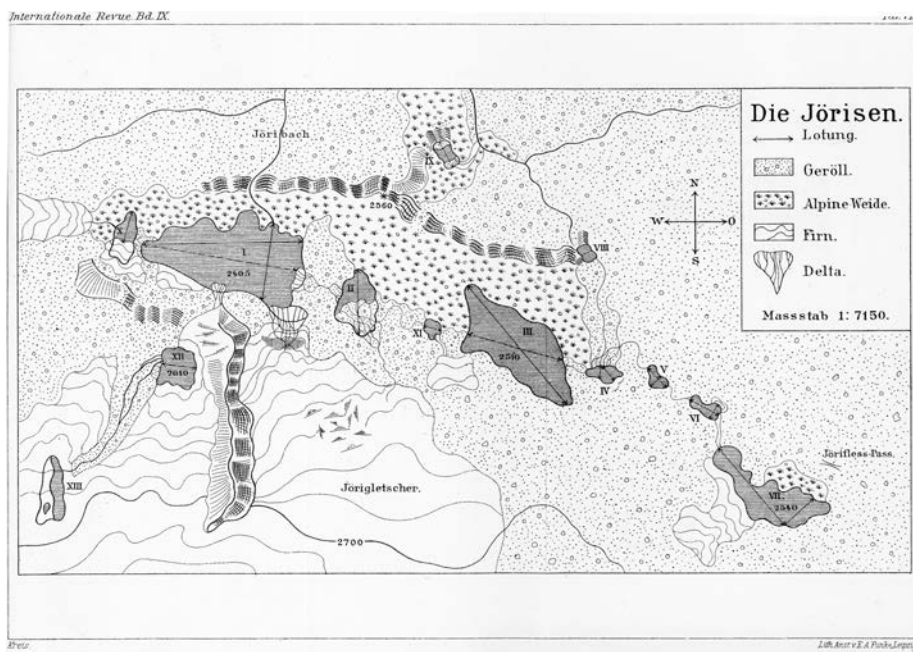
http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#study_opportunities



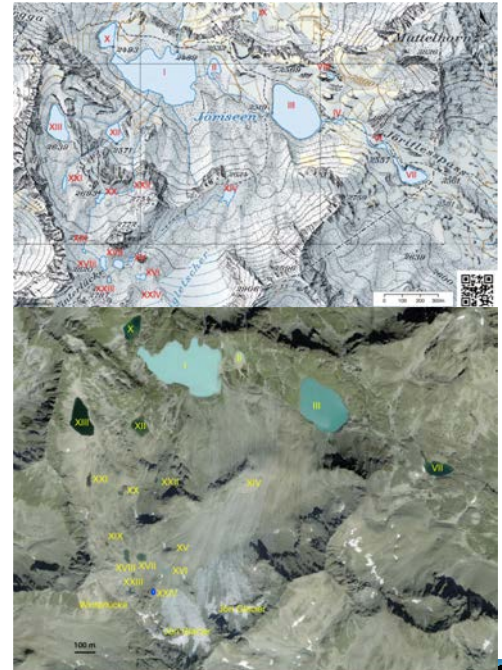
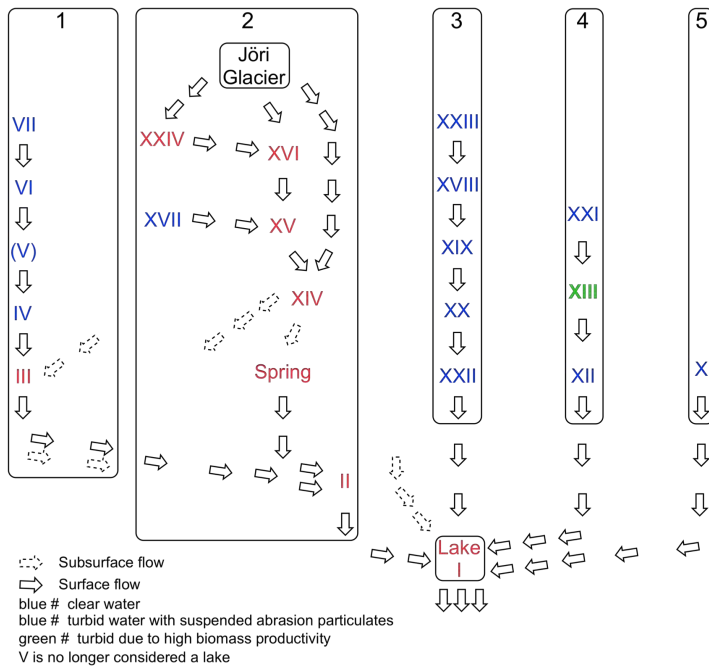
Evolution of Ecosystems: What GeoBioScience Questions to ask



What began 100 years ago with the Dissertation of Hans Kreis is “Third Polar” Research today



The 5 Sub-Catchments in the Jöri Area



High-Altitude Research, Selection: Glacial Forefields, Community Evolution, Geochemical Cycles

Environmental Science & Technology

Oxygen Isotopes Unravel the Role of Microorganisms in Phosphate Cycling in Soils

Federica Tamburini,^{1,2} Verena Pfäber,¹ Elke K. Bütemann,¹ Kathi Goelland,² Stefano M. Bernasconi,³ and Emmanuel Frossard¹

Speciation of Phosphate in Iron Rich Mineral Deposit in a High Mountain Lake Environment, a Study at the Micron Scale at the LUCIA Beamline

D. Vantelon¹, A. Hofmann², K. Hanselmann³, A.M. Flank¹

Microb. Ecol.
DOI: 10.1007/s00248-011-9991-8

ENVIRONMENTAL MICROBIOLOGY

Bacterial, Archaeal and Fungal Succession in the Forefield of a Receding Glacier

Anita Zumsteg · Jörg Luster · Hans Göransson · Rieck H. Smittenberg · Ivano Brunner · Stefano M. Bernasconi · Josef Zeyer · Beat Frey

BIOTROPIA VOL. 13 NO. 2:2006: 85-98

BACTERIAL COMMUNITY SHIFTS OF A HIGH MOUNTAIN LAKE IN RESPONSE TO VARIABLE SIMULATED CONDITIONS: AVAILABILITY OF NUTRIENTS, LIGHT AND OXYGEN

MENITI YULIANA¹, THOMAS HORATH² AND KURT HANSELMANN³

Inventur und Dynamik der organischen Substanz in Böden der alpinen Stufe

Untersuchungen im Verelna-Tal GR, Schweiz

Christian Hitz

Dissertation

Microbial Community Analysis in Oligotrophic, Glacial High Mountain Lakes

Brigitte Hinder

DISSERTATION

Biogeochemistry
DOI: 10.1007/s10533-012-9785-1

Evolution of carbon fluxes during initial soil formation along the forefield of Damma glacier, Switzerland

K. Goelland · F. Hagedorn · R. H. Smittenberg · H. Göransson · S. M. Bernasconi · I. Hajdas · R. Kretschmar

PARAMETERIZATION OF INCOMING LONGWAVE RADIATION IN HIGH-MOUNTAIN ENVIRONMENTS

Mathias Caballero
Atmospheric Science
Swiss Federal Institute of Technology
ETH Hönggerberg
8093 Zürich
Switzerland

Christoph A. Marty
Physical Meteorological Observatory Davos
World Radiation Center
Dorfstrasse 33
7260 Davos
Switzerland

Kurt W. Hanselmann
University of Zürich
Institute of Plant Biology
Department of Microbiology
Zollikerstrasse 107
8008 Zürich
Switzerland

Measuring the Critical Zone: Lessons from the Damma Glacier Critical Zone Observatory

Stefano M. Bernasconi^{1*}
Geological Institute, ETH Zürich, Sälggassstrasse 3, 8092 Zürich, Switzerland

Evolution of Ecosystems (Topics)

1. Monitoring Technologies

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#technology

2. High Mountains as Geobiological Hotspots of Global Change

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#hotspot

3. Evolution of Habitats to Ecosystems

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#habitat_evolution

4. Driving Force for Habitability - Geochemical Weathering

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#weathering

5. Links between Geo-, Bio- and Atmosphere

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#geobioatmo

6. Atmospheric CO₂-Sequestration Promotes Ecosystem Fertility

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#CO2-weathering

7. Organic Carbon Sequestration in High Altitude Soils and Sediments

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#C-sequestration

8. Fertilization and Nutrient Flow in Remote Areas

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#fertilization

9. Selection of Organismic Diversity by Habitat Conditions

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#biofilms

10. Recycling of Nutrients by Short "Biogeochemical Pumps"

http://www.microeco.ethz.ch/geobio/GeoBiology_field_courses_Kurt_Hanselmann_ETHZ.html#biopump



Why we are there

