Remote sensing at the ECHOLAB, University of Helsinki

SYKE, Helsinki
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Earth Change Observation Laboratory

1. People
2. Infrastructure
3. Past and current research
4. Capacity building
5. Teaching
6. Applications

ECHOLAB

Rami Piiroinen

Pekka Hurskainen

Xiaochen Zou

- Earth Change Observation Laboratory
- www.helsinki.fi/echolab
- Global Change, Climate change
- Land cover and land use change
- Snow and glaciers
- Agricultural expansion (in Africa)
- Consequences of the change to

  climate, water resources, biodiversity, livelihoods
- Human-nature interaction, sustainability
- Funding from the Academy of Finland, University of Helsinki, Ministry for Foreign Affairs of Finland

www.helsin

ECHOLAB

Janne Heiskanen

- 6 senior scientists: Petri Pellikka, Janne Heiskanen, Eduardo Maeda, Mika Sijander, Petteri Muukkonen, Anders Siren

- 12 PhD students (China, Nepal, Ethiopia, Finland, Sierra Leone, Kenya

- Affiliated members from biology, physics, forestry

- Finnish Meteorological Institute, cooperation in PhD studies

- Previous PhD students as teachers in China, Africa, Canada

- Research, development cooperation, capacity building

- Kenya, Ethiopia, Eritrea, Tanzania, Sierra Leone, China

- Biogeoclimate modelling group led by Prof. Miska Luoto

Mika Siljander

Matti Räsänen

UNIVERSITY OF TORONTO

ADDIS ABABA UNIVERSITY

University of Nairobi

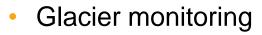University of Victoria

Infrastructure

- Hyperspectral sensors
  - Aisa Eagle, Aisa Kestrel, Specim IQ
  - Field spectrometers

- Taita Research Station
  - Field instruments, cars, assistants, accommodation, labs, GIS lab
  - 5 Academy projects and 3 Foreign Ministry projects since 2003
  - About 30 MSc and 10 PhD theses in remote sensing and GIS

- Geospatial infrastructure
  - Taita Taveta County, Kenya
  - Lidar, hyperspectral about 3000 Sq km
  - Multitemporal aerial photography (50s →), satellite imagery (1970s →)
  - Finland…

Past and current research

- Glacier monitoring

- Hyperspectral remote sensing

- Land cover / land use, forest research in Finland

- Land cover / land use changes in Africa, Taita especially

- Impacts of changes to environmental sustainability, ecosystem services

  - Water resources, pollination, biodiversity, habitats, soil erosion, local climate

- In addition, some theses in remote sensing of soil erosion, water, aquatic vegetation, snow, glaciers

- New area: remote sensing of air pollution in China (also Helsinki)

Capacity building

- About 30 courses in remote sensing and GIS in Africa

- Ministry for Foreign Affairs of Finland, HE ICI

- Ethiopia, Kenya, Tanzania, Eritrea, Sierra Leone, Burkina Faso

- Development of 2 geoinformatics MSc programmes

- CHIESA. Climate change impacts on ecosystem services and food security in Eastern Africa - increasing knowledge, building capacity and developing adaptation strategies. 2011-2015

- BIODEV. Building biocarbon and rural development in Africa. 2011-2016

- TAITAGIS. Improving capacity, quality and access of Geoinformatics teaching, research and daily use in Taita Taveta, Kenya 2017-2020

- GIERI. GIERI - Strengthening geoinformatics teaching and research capacity in Eritrea higher education institutions.

Next: North Korea?

Teaching

- Remote sensing 1

  - Basics, classification, optical satellite data, some laser scanning data

- Remote sensing 2

  - Image corrections, atmospheric, topographc, segmentation

- Imaging spectroscopy

- Some 3 BSc, 4 MSc thesis and 2 PhD theses yearly in remote sensing

Focus on applications, some Academy projects

- Understanding mechanisms of <u>habitat change</u> in fragmented tropical forests for improving conservation

- Environmental sensing of ecosystem services for developing <u>climate smart landscape</u> framework to improve food security in East Africa

- Remote sensing of <u>water harvesting and carbon sequestration</u> by forests in the Taita Hills, Kenya

- Integrated <u>land cover-climate-ecosystem process</u> study for water management in East African highlands

- Geoinformatics in <u>environmental conservation and community based natural resource management</u> in the Taita Hills, Kenya

Remote sensing PhDs

- Samuel Nthuni, 2018. Identification of <u>tree species</u> using airborne hyperspectral remote sensing data.

- Jinxiu Liu, 2017. Application of satellite image time series and texture information in <u>land cover</u> characterization and burned area detection.

- Miia Salminen, 2017. Remote sensing of snow: factors influencing seasonal <u>snow</u> mapping in boreal forest region.

- Mark Boitt, 2016. Hyperspectral remote sensing for <u>cropland</u> assessment and modeling for agro-ecological zones.

- Xiaochen Zou, 2015. Leaf orientation and the spectral reflectance of field <u>crops</u>.

- Binyam Tesfaw Hailu, 2015. Multi-scale assessment of <u>land changes</u> in Ethiopia – understanding the impacts of human activities on ecosystems services.

- Eduardo Maeda, 2011. Integrated assessment of potential <u>environmental impacts</u> from agricultural expansion and climate change in the Taita Hills, Kenya

Some recent titles

- Abera, T.A., Rainfall–vegetation interaction regulates temperature anomalies during extreme dry events in the Horn of Africa.

- Pellikka, P. Impact of land cover change on aboveground carbon stocks in Afromontane landscape in Kenya.

- Pfeifer, M. Tropical forest canopies and their relationships with climate and disturbance - results from a global dataset of consistent field-based measurements.

- Adhikari, H. Determinants of aboveground biomass across an Afromontane landscape mosaic in Kenya.

- Piiroinen, R. Classification of tree species in a diverse African agroforestry landscape using <u>imaging spectroscopy</u> and <u>laser scanning</u>.

- Schäfer, E. Mapping tree species diversity of a tropical montane forest by unsupervised clustering of airborne <u>imaging spectroscopy</u> data.

- Liu, J. Land cover characterization in West Sudanian savannas using seasonal features from annual <u>Landsat time series</u>.