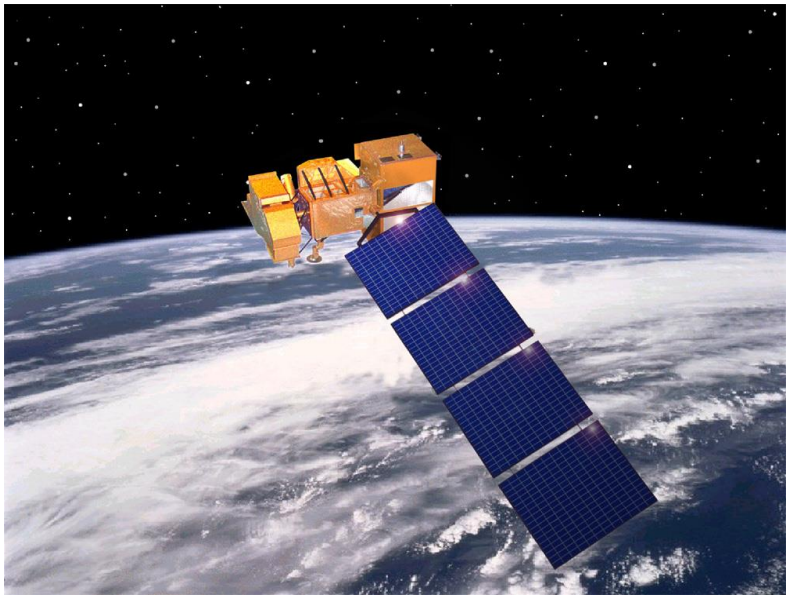
Vegetation from space and from the ground

CHIESA SHORT COURSE: INFORMATION SHEET

17-22 March 2014, Nairobi



Left: Landsat 7, sampling from above. Right: hemispherical photography, sampling canopy structure traits from below

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INTRODUCTION

The course will provide an introduction to the use of Earth Observation (EO) products in the assessment of biome distributions over time, vegetation structure and carbon. A particular focus will be on spatial scaling issues, comparing remotely sensed measurements to those obtained *in situ* during a day in the field.

The material is aimed at post-graduate students and research staff interested in monitoring and modelling environmental change. A basic **familiarity with Quantum GIS and R statistical software will be essential**, but otherwise no formal training in EO or vegetation studies will be assumed. The course is to be held over five and a half days, with the provisional programme as outlined below.

The **first day** will revise the pre-course assignment and introduce Vegetation Indices (VIs), which measure a given property of vegetation (e.g. 'greenness') using satellite imagery. Participants will gain experience in accessing such products, and in calculating VIs for themselves from raw satellite imagery using QGIS. The trade-off between spectral and spatial resolution in different types of EO data will be discussed, using data from MODIS and Landsat to estimate vegetation structure within Karura Forest Reserve.

The **second day** will introduce canopy structure traits such as the Leaf Area Index (LAI), an essential climate variable related to vegetation quality and productivity. Seasonality and variation between biomes will be explored using QGIS and R. Participants will be encouraged to think about the relationships between VIs, LAI, biomass/carbon and climate.

Day three will be at Karura Forest Reserve (Nairobi), setting up vegetation plots, measuring tree structure (for carbon estimation) and using hemispherical photography (for canopy structure traits).

Days four and five will be back in the lab, processing and analysing data collected in the field. From the tree structure data, participants will derive plot-based estimates of biomass and carbon using allometric equations. LAI and related traits will be derived from the hemispherical images. Because LAI is related to productivity, we will compare these results to the derived biomass estimates. Advanced students will be given a larger database of ground-measured LAI and assisted in exploring how canopy structure varies with climate and disturbance, as well as with vegetation greenness measured from space (Landsat-based VIs).

Day six (half-day) will briefly introduce downscaled climate scenarios for Africa, and how these might be used to predict future changes in vegetation structure. There will then be a short map-making workshop, in which participants learn how to create maps for presentations and reports using QGIS.

SKILLS AND KNOWLEDGE REQUIREMENTS

The course is recommended for students who have completed the CHIESA short courses "*Introduction to GIS*" and "*Introduction to R*". Participants who have not attended these courses may still apply, but should demonstrate a similar level of knowledge. This may involve studying the course materials provided at http://chiesa-gis.geography.helsinki.fi:8080/geonetwork, or though other online tutorials (http://hub.qgis.org/projects/quantum-gis/wiki/How_do_I_do_that_in_QGIS, http://cran.r-project.org/other-docs.html). The CHIESA short course "*Introduction to Remote Sensing*" would also be very beneficial, although this is not essential (see pre-course assignment).

PRE-COURSE ASSIGNMENT

To familiarise participants with EO data and its provision through web-based portals, a pre-course assignment will be given to all successful applicants. This will involve reviewing some literature on EO and its application in vegetation studies. Participants will then be asked to conduct a land cover change analysis, using data derived from MODIS. The materials necessary to guide participants through these tasks will be provided upon acceptance on the course. Assignments **must** have been completed by **all participants** before the course begins.

It is essential for the assignment to download and install the R statistical software (http://www.r-project.org/) and Quantum GIS (http://www.qgis.org/). In addition, please download and install the CANEYE v6.310 canopy analysis software (https://www4.paca.inra.fr/can-eye), ready for processing the hemispherical images that we will collect in Karura.

Practice navigating the following websites, which provide free access to a range of EO products and data: http://reverb.echo.nasa.gov/reverb/ and http://earthexplorer.usgs.gov/. You will need to **register with the websites**: remember your password and username, as you may be asked to download further data during the course.

COURSE OBJECTIVES

The primary aim of this course is for the students to develop an understanding of how EO data and products can be utilised to assess vegetation status and trends across spatial and temporal scales.

The **basic** level learning objectives. **All participants** will:

- gain an overview of freely available EO data for vegetation analysis, focussing on passive sensors (e.g. MODIS and Landsat, but not LiDAR)
- understand the definition, potential and limitations of VIs, and their use in environmental research
- understand the definitions of canopy traits such as LAI and fraction of absorbed photosynthetically absorbed radiation
- develop an appreciation of how VIs and canopy traits vary over time and between biomes, and how these variations relate to biomass and carbon
- learn how to measure vegetation biomass and canopy traits in woodlands and forests
- be introduced to high resolution climate change scenarios for Africa

The **advanced** level learning objectives. **Some participants** will be able to:

- statistically analyse vegetation structure at plot and biome level, relating spatial variability to differences in climate and disturbance
- extrapolate these relationships under scenarios of climate and land use change

COURSE CONTENT

Time share (% of total course hours) of each type of course work: lectures (10%), computer-based practical (70%), fieldwork (20%)

COURSE MATERIALS

Pre-course assignment(s): **see above**

Materials used during the course

- Satellite imagery from MODIS and Landsat
- Climate and elevation maps
- Hemispherical photography (camera plus fish eye lens, tripod)
- Measuring taps, clinometers, GPS units
- CANEYE v 6.310 canopy analysis software: https://www4.paca.inra.fr/can-eye
- R statistical software project: http://www.r-project.org/
- Quantum GIS spatial analysis software: http://www.qgis.org/

Please download, **install and explore** each of the above three software packages **before** the start of the course.

EQUIPMENT AND CLOTHING

Please bring the following to the course / fieldwork

- A laptop for all days in the lab, with all software as indicated above already installed and working. Please note that netbooks and tablets are **not** sufficient due to limited processing and memory. If you do not have access to a laptop, please let us know and we will try to help
- Fieldwork will be carried out in Karura Forest Reserve. Please wear appropriate clothing: sturdy shoes, long trousers, rainproof coat etc. Bring stationary with you (pens and paper)

COURSE FACILITATORS

Dr Philip Platts, University of York, UK (philip.platts@york.ac.uk)
Dr Marion Pfeifer, Imperial College London, UK (m.pfeifer@imperial.ac.uk)

Assistants: Dr Colin Courtney Mustaphi and Ms Esther Nyambura Githumbi

COURSE VENUE, DURATION AND COSTS

African Insect Science for Food and Health (ICIPE)
Duduville Campus, Kasarani, Nairobi, Kenya
Map: http://goo.gl/maps/O4ulx

Fieldwork will be at Karura Forest Reserve: http://www.friendsofkarura.org/

The course **begins on 17/03/2014 and ends on 22/03/2014**. Most days we will start at 9:00 and finish at 18:00, with one hour for lunch. The field day starts at 8:00. The last day ends at 13:00. The total length of the course is 50 hours including breaks.

Participants will receive a course certificate. The course is provided free of charge

TRAVEL AND ACCOMMODATION

Travel and accommodation is to be organised by the participants. For CHIESA students, these costs will be covered by the respective work packages.

HOW TO ENROLL TO THE COURSE

Applications by email to Dr Philip Platts (University of York, UK): philip.platts@york.ac.uk

In your application, please be sure to include your full name, affiliation and current position. We ask that you provide very brief personal statement, indicating your research interests and how the course would benefit your studies. Please also indicate whether you have attended (or otherwise completed: e.g. web-based learning) any of the following CHIESA short courses: "Introduction to GIS", "Introduction to R", "Introduction to Remote Sensing" or "GIS Modelling and Applications".

The deadline for applications is 31/01/2014

Class of 2013, relaxing after a long day of fieldwork in Karura Forest Reserve