Spatial thinking: Monitoring and Mapping Natural Resources

1. Course Description

Natural resources are one of the most potential sources of wealth that provide various economic, social and environmental benefits. These natural resources are under immense pressure due to the influence of population and economic growth, natural and human induced activities (e.g. industrial and agricultural) activities. This pressure destabilizes the environment by changing, disturbing, even degrading it status. As a result, these disturbances impact the qualities and services of natural and cultural ecosystems (e.g. biological diversity, food supply, medicines supply, and forest quality) on which we depend.

In-order to care and strategize for the future of natural resources, it is indispensable to comprehensively understand the distribution, health, interrelations and functioning in space and time of the natural and cultural ecosystems. Thus it requires a robust spatio-temporal data bases at various scale. The outcomes of this module will be the spatio-temporal models which depict status of natural resources in simplified graphical form. In short, this course will deal with the theory and practice of mapping and monitoring the characteristics and spatial/temporal dimensions of natural and cultural eco(logical) systems using remote sensing and GIS.

Using geo-information and earth observation techniques, this module will address the following fundamental questions for managing the natural resources.

- What is where (covering the spatial aspect)?
- What and how it is changing with time (temporal aspect)?
- How serious is the effect/impact (quantifying the intensity)?

2. Learning outcomes

Towards the end of this module students will be in the position to:

- Comprehend the dissimilarity between spatial and temporal characteristics of ecosystems.
- Select appropriate methods (qualitative empirical and/or quantitative physical-based techniques) for acquiring spatial and/or temporal data for the defined research question or project aim;
- Determine the required field data and design a (stratified) sampling scheme.
- Apply the selected methods of spatial and or temporal data collection for mapping spatial and temporal characteristics and change detection;
- Evaluate the quality / reliability of the acquired data;
- Identify and select criteria and indicators for monitoring.
- Demonstrate a scientific attitude towards using methods for earth observation and geo-information acquisition for mapping and monitoring of the environment.

3. Course contents

The course consists of the following parts:

Mapping (the state of) the natural resources

- Regression analysis for RS based modelling of image characteristics and natural ecosystem properties.
- Sampling statistics for (field) data collection.
- Analytical/physical based/quantitative mapping techniques, focusing on the relation between image characteristics (optical remote sensing) and image based indices (like NDVI) on the one hand and spatial / temporal object properties on the other.
- Qualitative / landscape guided approach of mapping the ecosystems with focus on the relation between landscape forming factors (including human interference) and land cover / land use, based on image classification and fieldwork.
- Accuracy assessment of the mapped spatial information.

Temporal ecosystem characteristics

- Time and temporal aspects of spatial databases.
- Temporal characteristics of natural and agricultural ecosystems.

Mapping the temporal dimension

- Remote sensing and the temporal dimension (multi temporal images, hyper temporal imagery)
- Sequential mapping and change detection
- Sequential mapping and error propagation.
- Hyper-temporal remote sensing (data preparation, interpretation and mapping), with emphasis on hyper-temporal NDVI images, cross correlation with existing maps and data mining for legend construction and NDVI classes for stratified field sampling.

4. Teaching and assessment

Teaching consists of:

Lectures
Group assignments (e.g. project, workshop)
Individual assignments
Self-study
Overhead (e.g. exam, opening)

In this module,

The participants required to complete the various assignments (spatial and temporal in nature)

They need to perform satisfactorily in the quizzes, midterm and final exams

They are also required to present a small project and submit the report.

5. Grades

1) The passing marks for this module are 60.

2) To pass the module each student is required to have passed the exam, completed his/her portfolio, and to have participated in all compulsory course elements.

3) The final grade for the course will be determined by the result of assignments, quizzes, mid and final written examination.

6. Prerequisites

- Taken courses on Remote Sensing and GIS (such as course RG-712)
- Correlation and regression (Inferential/descriptive Statistics).

7. Important

Field visits are mandatory of this module, so there will be 1 or 2 short field visits to collect the ground trough data. The collected data will be analyzed in the course projects