Food and Agriculture Organization of the United Nations

EcoNet

Earth Cover Network Programme

Land-cover data and its changes over time are information of primary importance in satisfying the ever-increasing demand for reliable data to support studies and research at regional and global scales. Data are essential for the comprehension and analysis of natural and human driven phenomena, such as climatic change, loss of biodiversity, land planning, disaster management provide a means to assess carbon stock accountability; and help monitor agriculture development.

Land cover is one of the most easily detected indicators of human interventions on the land. Information on land cover is therefore critical for the implementation of environmental, food security and humanitarian programmes of UN, international and national institutions. Many efforts exist to measure and monitor changes in different landscape; recent reviews have found that while there has been a proliferation of indicators of ecosystem services over the last decade, the usefulness of these indicators is limited mainly by lack of accurate data and measurements from satellite and field.

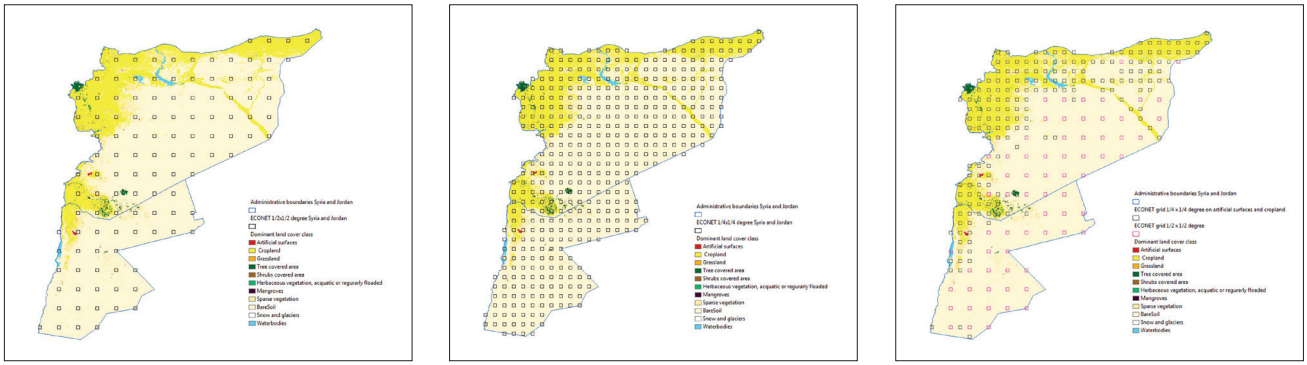
This need for land cover information is especially marked in developing countries where there are few reliable data sources and limited efforts to improve the availability and quality of detailed information on land cover and of its dynamics.
Land-cover information currently available often lacks sufficient accuracy, or is collected using a variety of procedures and tools, thus preventing comparisons between regions and precluding compilation of global data. Since the accuracy of predictive models depends directly on the quality and quantity of available data, the production of detailed, reliable and well distributed land cover data is fundamental to feed models and support studies and analysis at local and global scale.
Accordingly, FAO has devoted considerable attention to the development of techniques for land cover and land cover changes mapping using enhanced methodologies and tools underpinned by standards (LCML, LCCS). Two alternative mapping approaches are considered:

- **Wall-to-wall**
- **Sample based**, derived from the methodology developed with the FAO's EcoNet programme.

The **EcoNet** approach has already been applied to estimate land cover changes in Tunisia, Kenya and Guinea Conakry; it is being applied in Angola and Lesotho and it is planned to in the Syria Crisis region (see examples of alternative sampling design), Afghanistan and Pakistan.

EcoNet a sample base approach for producing land cover

There're two different approaches for producing estimates of land cover and land cover change: **wall-to-wall** (an analysis that covers the full spatial extent of the study area) and **sample base**. They are both suitable methods, but it's necessary to consider any details before choosing between them.
Wall-to-wall is a common approach if appropriate for national circumstances, in particular when a benchmark land cover map is needed. But if resources are not sufficient to complete wall-to-wall coverage, a systematic-based sampling (**EcoNet**) is an efficient alternative, in particular for large area.



EcoNet grids at ½ x ½ and ¼ x ¼ degrees superimposed on artificial surface and croplands of Jordan and Syria (from GLC share).

METODOLOGY

The ECONET methodology is characterized by:

1. **Unprecedented level of detail** based on high resolution satellite images at large nominal scale.

2. **Unique flexibility of the data** organized in an ad-hoc structured data-base, generated from a list of attributes in the form of FAO Land Cover Meta- Language (LCML) Elements. A very detailed description of the real world with reduced loss of information.

3. **Innumerable and well defined Categories (or Classes)** describing selected areas according to specific needs of the end users, combining the LCML Elements, by means of a specific software, to form their own category (class). No single legend with a given list of classes (as in traditional databases), but a database containing the LCML Elements (attributes and modificators), each end-user will be able to construct their own legend better fitting their specific needs.

THE SAMPLE GRID

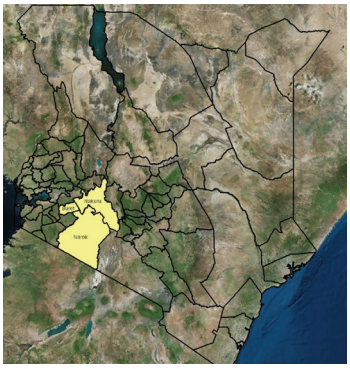
The data production will be based on the photo-interpretation and analysis of very high resolution satellite imageries of 10 km x 10 km portion of land surface (tiles), distributed according to a fixed grid.

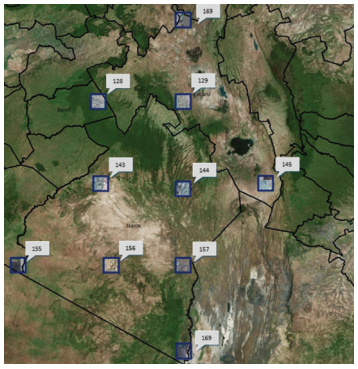
The design of the sample grid has to ensure a sound statistical basis for the validity of the results, at regional, sub-regional and country levels and will follow basic zonation criteria:

- ½°× ½° basic sample design
- ¼°× ¼° intensified grid density where required, e.g. agriculture areas
- 1°x 1° generalized grid density for reduced change probability, e.g. desert areas

The design of the grid will be fixed, but not rigid, moveable in a certain range (10 km) in any direction to ensure the most efficient use of available high resolution images. The sample grid will be permanent, in the future it can be intensified, but not changed, ensuring that future analysis to verify change trends on the same areas, permitting valid statistical estimation of changes.

EcoNet-based approach on Kenya for land cover change





#	Step	Description
1	Selection of the study area	Provinces: Narok, Nakuru, Buret
2	Selection of ECONET tiles	10 tiles
3	Generation of a new grid inside each tile	▪ 1600 points ▪ 250 distance ▪ 25 by 25 m size
4	Interpretation of the confluence points of the grid using historical images	Google Earth images 2004-2009
5	Application of the main classes of LCML legend to labelling the points	See LCML legend
6	Refine the interpretation on-fly with LCML modificators and attributes, when known	MADCAT software
7	Perform the comparative analysis with the most recent image	▪ Google Earth 2016 ▪ Sentinel 2 2016
8	Analysis of the results	Statistical analysis and presentation of graphs

For the analysis of the land cover changes in three Provinces (fig. 1) the EcoNet methodology has been applied, selecting 10 tiles (fig. 2).

Goals

- **Create a database for the description of land cover** with detailed information to be used at local, regional or global scale for a wide range of research activities;
- **Serve as multi-statistical source of information** at any level of detail or complexity. Using specific software any end-user, worldwide, will be able to define on the Web, a geographical area and extract the categories to produce and utilize statistical information;
- **Work as a reference data-set** for any future mapping activity at regional, national and sub-national levels;
- **Create a global network of experts** on natural resources, able to communicate and exchange information through a common language and protocol;
- **Contribute to create a common shared awareness** on the importance and value of the natural resources.