FAO Land Cover Mapping methodology, tools and standards & GLC-SHARE database

Renato Cumani & John Latham
Land and Water Division (NRL)

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NATURAL RESOURCES DEPARTMENT (NR)

FAO Global Land Cover Network (GLCN)

Main Objectives:

- To improve linkages between global, regional and national studies on land cover and the environment
- To improve standardization, homogenization, compatibility and efficiency of information provided by different applications
- To provide information that improves design and efficiency of sampling for validation of land cover products at global, regional and national levels.
- To increase use and sharing of remote sensing data and its derived datasets
- To provide comparable products at global, regional, and national and lower levels
- To undertake capacity development and institution strengthening to maximize benefits for developing countries
- To support operational development and use by national stakeholders of products emanating from the programme
FAO GLCN Core activities

- Establish global network
- Develop Land cover mapping methodology
- Standards development (LCCS/LCML)
- Land Cover Mapping Toolbox (LCCS/MadCat/ADG)
- Technical assistance to national experts for land cover mapping activities
- Preparation of guidelines, manuals, templates, workshops, technical papers, metadata
- Capacity building
- Awareness raising workshops, training resources and sessions
- Dissemination and outreach (FAO GeoNetwork and FAO GLCN website)
- Enable use of the land cover information
Definition: Land Cover

Land cover (LC) is the observed (bio)physical cover on the earth’s surface.

includes vegetation and man-made features as well as bare rock, bare soil and inland water surfaces
Definitions - Land Use

Land use is characterized by the arrangements and activities undertaken in a certain land cover type to produce change or maintain it.

- Land use establishes a direct link between land cover and the actions of people in their environment (socioeconomic functions).

The example refers to the land cover term “grassland”, while “rangeland” or “golf court” refer to the use of a grass cover. Vice versa “recreation area” is a land use term that may be applicable to different land cover types: for instance a sandy surface like a beach; a built-up area like a pleasure park; woodlands.
Forest Land in Global Land Cover Datasets

Important factors for disagreement:
1. Land cover/forest definitions:
   - IGBP legend: percent tree cover > 60%
   - GLC2000 legend: percent tree cover > 15%
2. Thematic accuracies
3. Spatial heterogeneities
Why do we need standards...?

Area estimates: 11 cover types, different global datasets

[Bar chart showing area estimates for different cover types across various datasets]
Forest definition example (area > 0.5 ha, tree cover > 10%) mapping of change

Case 1  year 2000 tree cover 20%  
year 2010 tree cover 12%  
Cover lost 8%  
No Change

Case 2  year 2000 tree cover 15%  
year 2010 tree cover 7%  
Cover lost 8%  
Change from Forest to no Forest

Case 3  year 2000 tree cover 100%  
year 2010 tree cover 20%  
Cover lost 80%  
No Change
Standards and Classification System
LCCS / LCML / ISO 19144-2:2012

- LCCS: Comprehensive methodology for description, characterization, classification and comparison of most land cover features identified anywhere in the world, at any scale or level of detail: basis for comparative classification. (6 UN official languages)

- Created in response to a need for a harmonized and standardized collection and reporting on the status and trends of land cover
FAO Land Cover Mapping Toolbox

THEMATIC & CART. ASPECT

INTERPRETATION EFFICIENCY

ACCURACY ANALYSIS

MULTI USER DATA BASE BROWSER

DATA PRODUCERS

DATA USERS

Land
Cover
Class.
Syst.

MAD CAT

GeoVIS 2.2

Map
Acc.
Prog.

Advanc.
Database

GATEW.
LCCS 2: 2001 (use LCCS)

ADG 2: 2003

LCCS 3: 2013 (use LCML/UML)

ADG 3: 2013

ADG 3 for ArcGIS 10.x: 2013
Mapping Device - Change Analysis Tools (MADCAT)

- Application designed by FAO
- Uses object-base classification
- Current version – Release June 2013
- Wizard driven installation
- Implemented using .Net Framework
- Coding with LCCS2 and LCCS3
- Requires Windows XP / Vista / 7 /8 (32 and 64 bit)
- **Free to use** for FAO programmes
- One time activation needed:
  - Institution, User Name, Address, PC CODE
  - send request by email
FAO’s Land Cover Mapping in Africa

Country scale (30m or better resolution)

- **on going** ECONET
  - Ethiopia
- **2012**
  - Fouta Djallon Highlands
  - Malawi
- **2011**
  - Sudan
- **2010**
  - South Sudan
  - Tunisia
  - Kenya Update
- **2007**
  - Somalia
- **2006**
  - Kenya LCC
- **2005**
  - Senegal
- **2004**
  - Libya
- **1998-2002**
  - AFRICOVER
GLCN/AFRICOVER: East Africa Module

Development of a regional database and regional aggregation

- **Project facts:**
  - Mapped area: 8.5 million Km²
  - Countries covered: 10
  - Landsat Scenes used: more than 400
  - Period of activity: 1998-2004
  - Result: Multipurpose Africover Database for the Environmental Resources produced at a 1:200,000 scale (1:100,000 for small countries and specific areas)

*Burundi, DR Congo, Egypt, Eritrea, Kenya, Rwanda, Somalia, Sudan, Tanzania and Uganda.*
Fouta Djallon Highlands land cover change

- **Fouta Djallon AOI:** ca. 400,000 Km²
- **5 Countries within the AOI:** Guinea, Guinea-Bissau, Mali, Senegal, Sierra Leone

**LANDSAT coverage (30m res) 1990-2005**

**ASTER coverage (17 m res) 2008-2011**

**RapidEye coverage (5 m res) ~2005**

![Map showing land cover changes](image)
Senegal Land Cover Change: 1990-2005

- 55 land cover classes
- Landsat 1990’s and 2005’s
- Completed in Senegal with involvement of national exerts
GLC-SHARE approach

- FAO System of Environmental Economic Accounts (SEEA) London Group process
- Global Consultations, interviews, comments, questions, recommendation
- A significant step in improving the information accuracy of global land cover database
- It integrates the best land cover data available (at sub-national, national, regional and global level) into one single harmonized database
- It uses international standards: ISO TC 211 - 19144-2:2013 LMCL

Recommendation 19b.1: That the Land Cover Classification System (LCCS 3) developed by FAO should be adopted as the land cover classification system in the revised SEEA and that the LCML (ISO 19144-2) should be adopted at the methodology for linking to external sources of land cover data described in other land cover systems.
GLC-SHARE: fact-sheet

- Uses the FAO SEEA LCML(*) legend
- 30 arc-second pixel resolution
- 11+1 layers indicating the % share of each class
- Dominant land cover layer and quality score
- Overall class accuracy ~80%
- Designed as a platform to facilitate crowd-sourcing
- Compatible with FAOSTAT classification
- Designed to be used for GAEZ 2010 update

Methodology and datasets published in 2014
GLC-SHARE Summary

- GCL-SHARE is the first global database created using the ISO standard for land cover classification ISO TC 211 - 19144-2 LMCL (Land Cover Meta Language) and is designed to be improved over time.
- GLC-SHARE will be used for GAEZ 2010 update.
- GLC-SHARE will be used to update Land Use Systems 2010 (FAO).
- Planned to be made publicly available for comments and feedback by end of 2013.
- Fully documented, including metadata, LCML/LCCS3 legend.
- Update of the beta release with new available datasets including the global coverage of Landsat 30 meter and new national land cover datasets.
- Maintained by FAO and community of practice partners such as GEO, CGIAR, JRC, IIASA.
Thank you

Contacts:

renato.cumani@fao.org
john.latham@fao.org

FAO

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