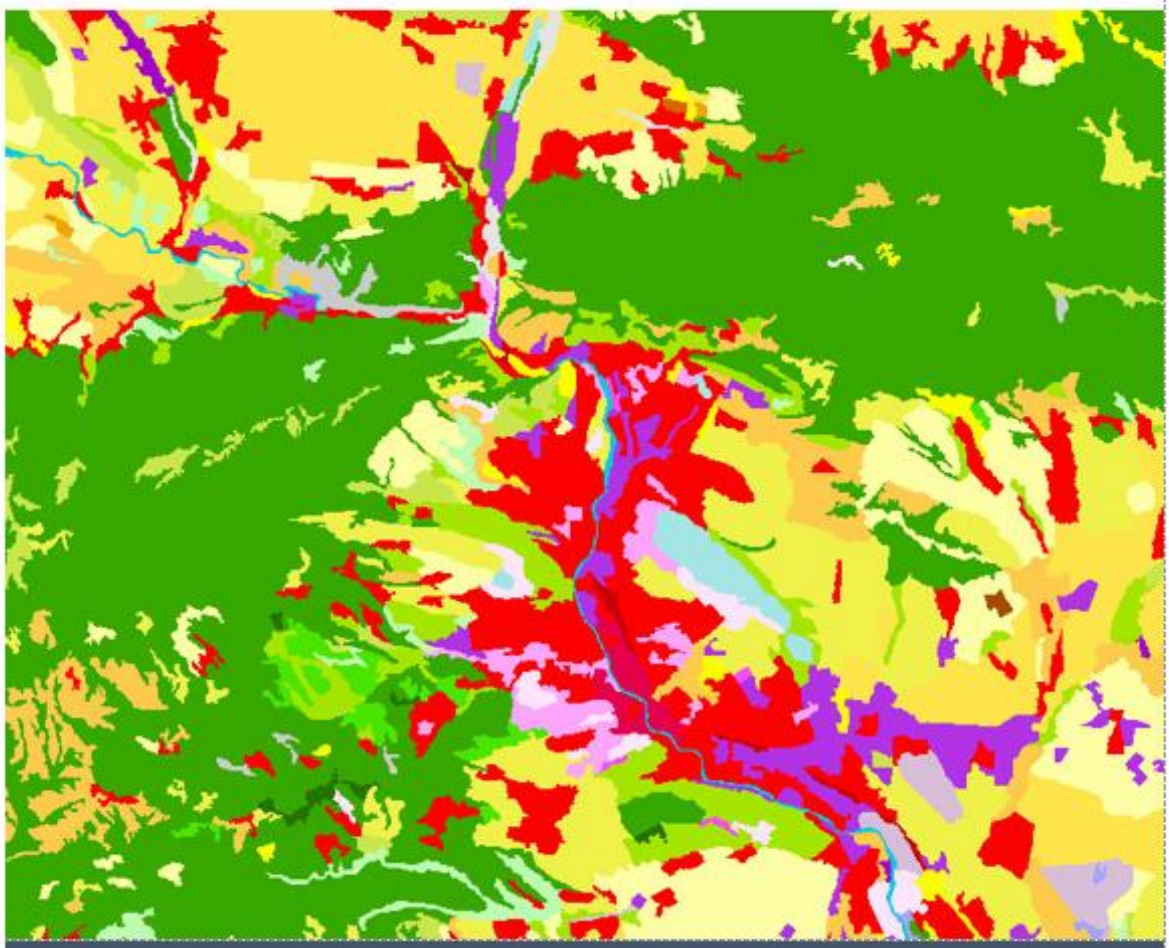

CORINE Landcover-Change Mapping for Pilot Area in Georgia

Final Report

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Contents

Introduction

The European land cover mapping scheme CORINE is a standardized classification system with 44 land cover and land use classes. Changes in land use and land cover are most important for global environmental studies, especially in regions with high dynamics of social and environmental pressure, especially in countries like Georgia, where there is still no unified spatial land-use system.

The project began in June 2018 and ended with the delivery of the final product in January 2019. The main tasks in the project were to select the appropriate satellite scenes, processing of 2001 data, and mapping of Land Cover 2017 and its changes for 2001, validation, and data quality control.

The largest city in Georgia, Tbilisi and its environs were selected for the pilot project. Compared with the other parts of Georgia, the territory is distinguished by its land diversity. The pilot area covers 250000 hectares, which included dynamically developing urban areas, forested mountains, semi-arid rangelands, water bodies and etc.

Coordination meetings and training of CORINE Land Cover in Georgia were held in May and November 2018 in Tbilisi. 12 participants from 3 governmental 1 non-governmental and 1 private organization participated in the meeting to discuss the possible use of CLC data in various application areas as well as have training in the field of Land cover mapping and change.

Software application

To create a CORINE Land Cover maps specially developed InterChange software was used. Instead of classic GIS, InterChange software offers a specialized, problem-oriented software tool, which significantly facilitates the updating, change detection, quality control and correction of CORINE Land Cover databases by means of computer-assisted visual photointerpretation. (Gábor 2012)

InterChange program provides a tool for the revision of CLC2018 database and supports the interpretation of land cover changes in order to create the CLC-Change 2011–2017 database. The program provides a convenient and easy-to-use interface for editing polygons in CLC2001 and CLC-Change databases. (Gábor 2012)

Selected images

The main image for creating a Landcover for the base year 2018 was the ortho-rectified image of the Sentinel-2, which was downloaded from the Copernicus data portal. The Sentinel-2 satellites will each carry a single multi-spectral instrument (MSI) with 13 spectral channels in the visible/near infrared (VNIR) and short wave infrared spectral range (SWIR) of 10, 20m ground resolution.

For change detection, Sentinel-2 data from 2018 had to be compared with Landsat 7 2001 (7 spectral bands of 30m ground resolution) and Aster Terra 2001 (14 spectral bands 15, 30, 90 m ground resolution) data.

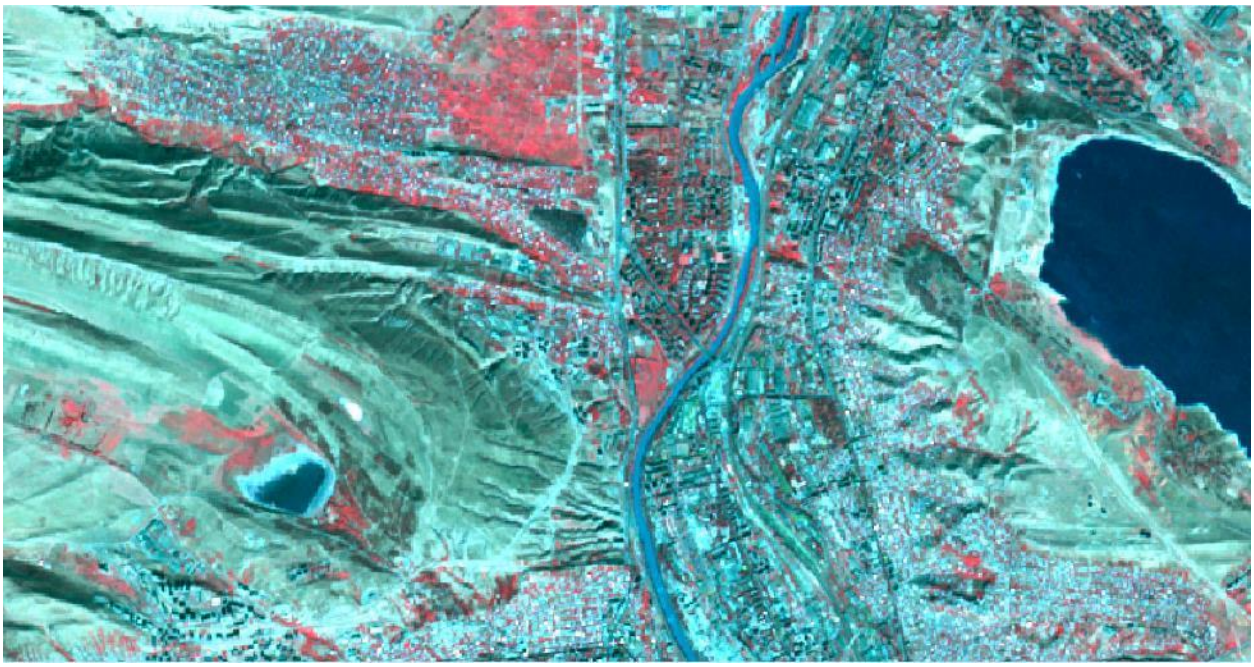

Fig 1. Aster Terra 15 m resolution image (2001)

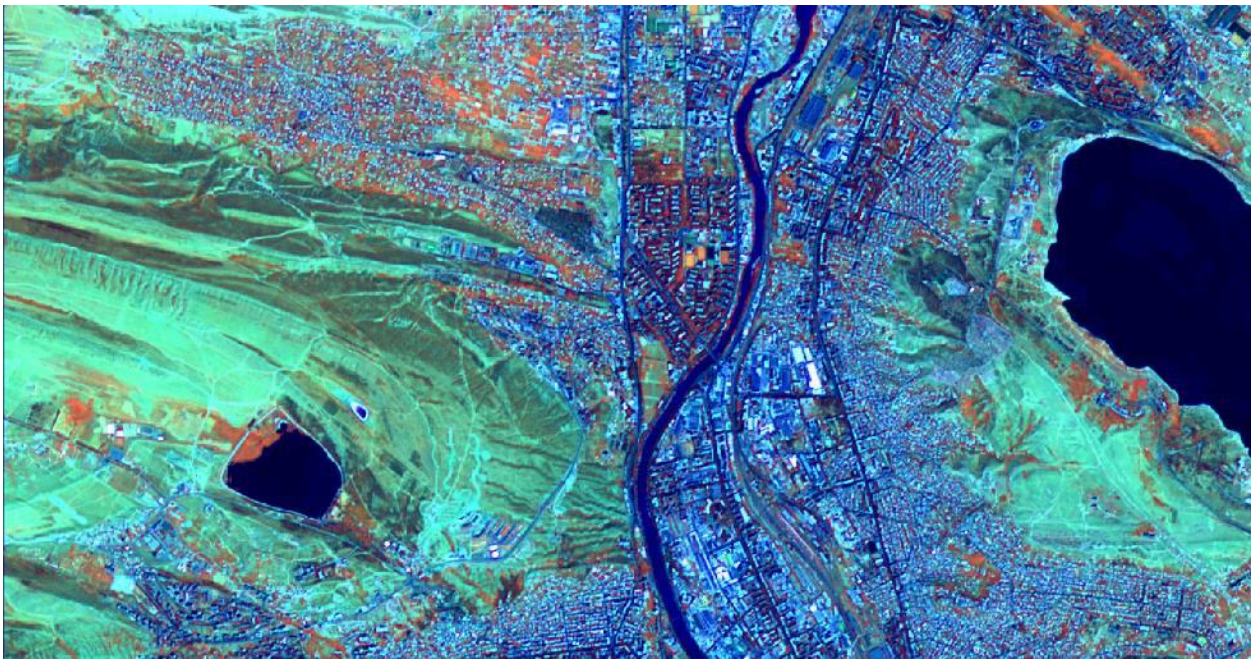

Fig 2. Sentinel-2 10 m resolution image (2017)

Ancillary Data

The main ancillary data were digital topographic maps of 1: 10,000 with an updated status from 1985 to 1989, IKONOS with high resolution, Quickbird images from 2005-2010 and a cadaster geodata of 1: 2000 scale from the National Registry. Vector data of irrigation schemes were also used.

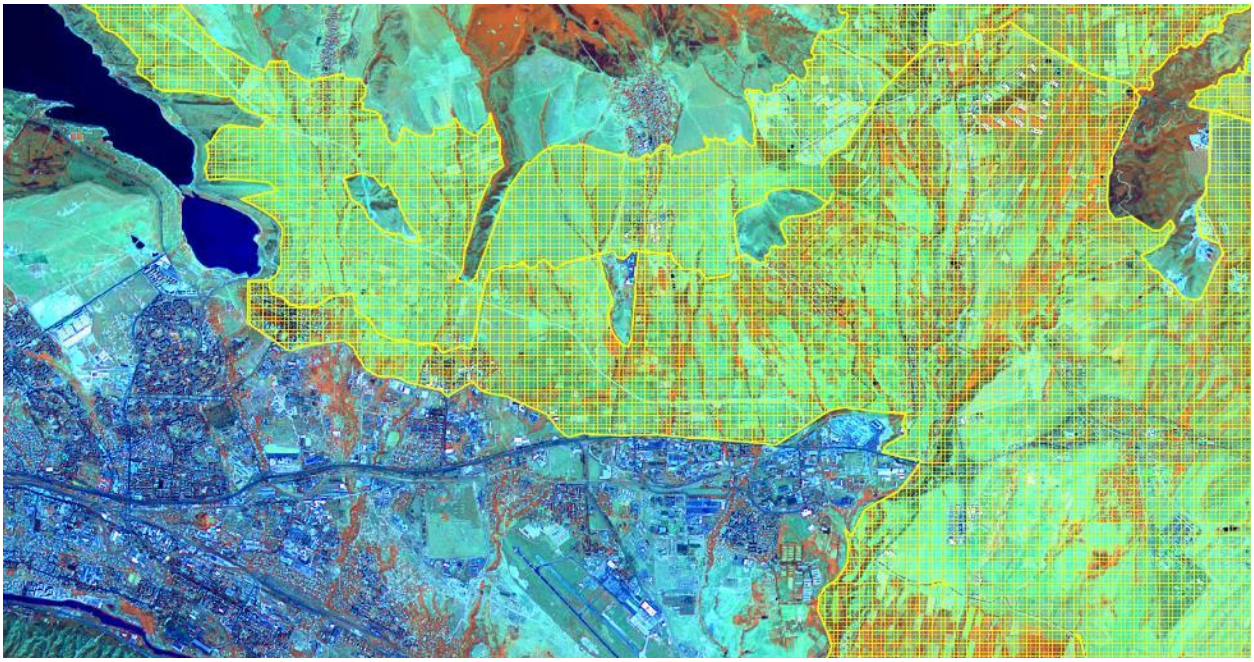

Fig 3. Irrigation scheme

Preprocessing

The orthorectification of Sentinel-2 and Landsat TM images has already been performed by the provider. In order to decrease the effect of atmosphere, Sen2Cor tool was used. Sen2Cor, which is a processor for Sentinel-2 Level 2A product generation and formatting, was used to perform the atmospheric and cirrus correction of Top-Of- Atmosphere Level 1C input data. Bottom-Of-Atmosphere Level 2A reflectance images were created using the following parameters: solar zenith angle, sensor view angle, relative azimuth angle, ground elevation, visibility, and water vapor. All parameter values were derived from image metadata. Following the atmospheric correction, the images were topographically corrected by applying the Minnaert Correction (Law & Nichol 2004), using a Digital Elevation Model (DEM) with a resolution of 30 m.

Interpretation and Mapping Procedure

Interpretation instructions are provided in the CORINE Land Cover Technical Manual. Explanations are included on how to assign and generalize land cover objects for CORINE Land Cover classes in special situations.

By the CORINE Land Cover, a 1: 100000 mapping scale was agreed, and minimum mapping units were introduced to delineate land cover units and for changed areas. Minimum cartographic units were 25 hectares for new land cover units and 5 hectares for changes areas. In addition, polygons had a minimum width of 100 m. According to the CLC update guide (EEA AND ETC, 2002, p. 18), changes from 5 to 25 hectares are recorded only in case of displacement of already existing land cover.

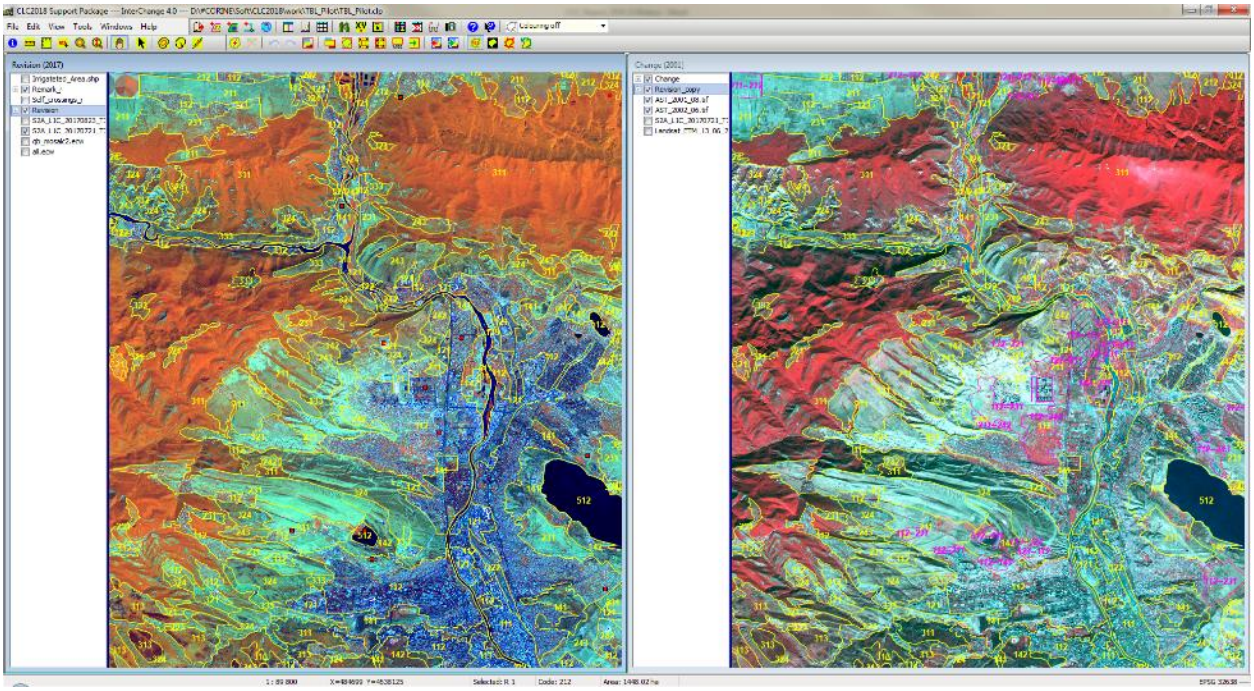

Fig.4 Interpretation and change detection using CLC 2018 Support package.

Land Use Changes

The procedure of comparing and delineation was performed by a semi-automatic method in the InterChange environment. The mapping of changes in the map units was done in several passes. The situation in 2001 and 2018 were compared using two windows with overlays of the old ASTER/Landsat and new Sentinel-2 and the vector data.

Field survey

One day field survey was performed to assist the interpretation process and to clarify questionable interpretations when no other appropriate ancillary data was available.

Fig 5. Permanently irrigated arable land

Fig. 6 Sparse vegetated area

Quality Assessment and Verification

During the phase of interpretation and change mapping, the quality control was carried out in several steps. The interpretation work in the individual lots was based on the "Updated CLC illustrated nomenclature guidelines" and knowledge which were learned during the meeting with CLC TT experts at the beginning of the project as well as on the accompanying field survey.

The chief interpreters were responsible for the thematic controls. The technical control procedures including checks of compliance with the minimum mapping units and topology checks were performed automatically by InterChange software.

A draft version of the CLC was sent to the CLC TT experts for verification and evaluation. Back sent remarks were used to update and finalization the CLC maps

Results and statistics

As we have already mentioned, the pilot total area occupies 250,000 hectares of a very diverse and dynamic areas. Revision database include 715 polygons with average 153 points. Change database 101 polygons with average 43 points. Changed area is 6 137 ha, 2.45% of the total area.