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GRANT

Pilot studies on the provision of harmonized land use/land cover statistics

(Synergies between LUCAS and the national systems)

(LUCAS Grant, Part A)

Greece

Final report

Abbreviations

ELSTAT	Hellenic Statistical Authority
GAEC	Good Agricultural and Environmental Conditions
KOSE	Focal Points of Contact (working group) for the collection, production, procurement, management, sharing and distribution of geospatial data
LPIS	Land Parcel Identification System
NCMA	National Cadastre & Mapping Agency
OPEKEPE	Greek Payment Authority of Common Agricultural Policy
OSDE	Integrated Administration and Control System (IACS)
RAE	Regulator Authority for Energy

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Metadata

This document outlines the project activities during the entire project .

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1 Introduction

The statistic service of the European Union (EUROSTAT) has published a call towards the national statistics authorities of the European Union state members (Including Iceland, Lichtenstein, and Norway) so as to submit technical proposals for “Issue 4.03: Statistic data land use and land cover” Title “Pilot Studies on the provision of harmonized land use/land cover statistics-Synergies between LUCAS and the national systems”.

The Hellenic Ministry of Rural Development and Food (MRDF) is the body that has at his disposal extended data of land use and land cover, given the range of agricultural activities in Greece and that the collecting bodies of the above mentioned data are the ministry’s departments. What is more MRDF is responsible for collecting statistic data regarding rural development.

MRDF supported by Charokopio Univeristy of Athens (CUA) and Agricultural University of Athens(AUA) submitted through the Directorate of Agricultural Policy and Documentation the relevant project proposal at the 02-08-2012. The proposal was approved at 22-11-2012 from Eurostat and the MRDF and the EUROSTAT were assigned as counterparts. The MRDF has officially signed collaboration contracts with the AUA and the CUA as subcontractors in the project in 8-4-2013.

For the needs of the project in addition to the management team have set up two working groups composed of responsible officials from MRDF with the following responsibilities:

- Coordination of the project (design, implementation, processing and dissemination of results including meetings in Eurostat) and its accounting throughout its duration.
- An extensive investigation of the available data sources from official statistics, cadastral offices, public services which have both geographic data and non-geographic data, GIS government web resources and other information available at national and regional level.

- An in-depth assessment of data quality and reliability focusing on three geographic levels of analysis: a) NUTS-2 region, b) NUTS-3 prefecture and c) LAU-1 municipality.

- A comparative assessment through a calibration will be given to all available data sources based on the following criteria: reliability, ease of updating, spatial resolution and coverage rate of the Greek territory.

Permanent staff of the Ministry of Rural Development and Food (MRDF), was responsible for the general management of the project, as well as for all administrative affairs, providing also the available statistical and geographical data necessary for project implementation. For the purposes of the project, a management team has been consisted by the staff of the involved Entities of the Ministry of Rural Development and Food (MRDF). This team reports to the project coordinator and is responsible for the successful implementation and delivering of the project.

The initial duration of the project was 18 months starting from the 27-12-2012. Due to delays that were mainly attributed to the fundamental Public Administration Reform Procedures that took place in Greece during the last years (that caused remarkable delays from administrative point of view such as appointment of subcontractors, working groups, committees etc as well as to data delivery and consequently to data processing) a risk that was predicted in the technical proposal "ANNEX II STANDARD GRANT APPLICATION FORM FOR AN ACTION ", section d, the MRFD requested to prolong the above agreement for 6 months, a request that was approved by the EUROSTAT. Therefore, the new date of the project's termination was the 27-12-2014.

2 Existing data sources for land cover and land use

In this chapter, National and European data sets concerning land cover and land use are described.

Towards the fulfilment of the project's scopes the collection of National and International data sets relating to land use / land cover from various sources was initiated. First on sources' list were KOSE (focal contact points) data sets. KOSE are constant coordinating committees representing a specific number of public authorities. Their role is to coordinate and authorize the registration and safeguarding of Law 3882/2010 for the procurement, maintenance and update of all geospatial data sets and services of the public authorities they represent.

After a thorough review of the description and metadata of about 2000 geospatial data sets, we concluded that almost one hundred across the entire country were related to land use / land cover classes. Further, those had real value on extracting land use / land cover characteristics. Detailed description of the above data sets, (finally from 8 Greek Authorities: Ministry of Environment, Energy and Climate Change, Ministry of Rural Development and Food, National Cadastre & Mapping Agency of Greece, Hellenic Statistical Authority, Ministry of Education, Llifelong Learning and Religious Affairs, Ministry of National Defense, Ministry of Finance) have been presented in Annex I of the Interim Report.

During the last one and a half year, all efforts in obtaining the above data sets were reached to a dead end due to bureaucratic reasons.

Data sets, that cover entire Greece and are either freely available or are rather effortless to acquire, were finally used. A short description of these (nine International and two European) datasets is presented.

1. The research program Urban Atlas (part of GMES / Copernicus) provides comparable land use data at European level for 305 metropolitan areas in Europe with more than 50,000 inhabitants. The first Urban Atlas was created in 2006 and the second is still in progress, started in 2012.
2. Urban Atlas, completes another European land cover inventory program, the well-known CORINE Land Cover (CLC), which also uses high resolution satellite images.
3. The Land Parcel Identification System (LPIS) is the key component of the Integrated Administration and Control System (IACS) for grants based on agriculture. It is a modern supportive tool in the form of spatial register used in an environment that assists the farmer, intending to apply for financial assistance under any of the EU aid.

4. Farmers' Statements is the main subsystem of LPIS system, deepening in cultivated species on arable land.
5. Forestry Archive from the Special Secretariat for Forests of the Ministry of Environment Energy and Climate Change.
6. Renewable Energy Sources from the geospatial portal of the Regulator Authority of Energy (RAE) of Greece.
7. Roads from the National Cadastre & Mapping Agency of Greece.
8. The blocks and buildings from the Hellenic Statistical Authority (ELSTAT).
9. The lakes of the country from the geospatial portal Geodata.gov.gr.
10. The rivers of the country from the geospatial portal Geodata.gov.gr.
11. Data Set concerning geo spatial information for Good Agricultural and Environmental Conditions (GAEC) from the Topographic Agency of the Rural Development and Food Ministry.

3 Pilot data collection

Selection of the pilot area for the implementation and testing of the proposed methodologies was based mainly on the diversity of the land cover and land uses classes. Shannon Diversity Index and Shannon Evenness Index (*Eiden* et al., 2000*) were calculated in order to choose the most suitable pilot area. Between 5 candidate prefectures, prefecture of Boeotia was the most representative and suitable for our study, presenting increased diversity as well as increased uniformity on the most of the available data sets.

The Prefecture of Boeotia, the administrative center of which is Livadia (Census 2011 – Population: 31,315), is bounded by the Prefecture of Attica (southeast), the Gulf of Corinth (south), the Prefecture of Phocis (west), the Gulf of Euboea (east), and the Prefecture of Phthiotis (north). Boeotia has two extensive fertile plains separated by a low ridge, an offshoot of Mount Helicon (1,748 meters) on which Thebes stands. The northern plain is a drained basin that formerly contained Lake Copais, once the largest lake in Greece, and now a fertile plain growing cereals and cotton and supporting pedigreed cattle. The southern plain is watered by the Asopos River (length: 57 km - Basin area: 718 km^2).

Taking into consideration all the above, it can be easily understood that the Prefecture of Boeotia is combining the majority of the land use and land cover classes that are presented in LUCAS classification index.

The Working groups which were established under this Project recorded all available data of the pilot area. Complete and detailed description of all datasets is presented in ANNEX I.

*Eiden, G., Kayadjanian, M. and Vidal, C. 2000. Capturing landscape structures: Tools. At: http://europa.eu.int/comm/agriculture/publi/landscape. Accessed on 15/1/2015.

4 Summary of access conditions to microdata

In general, most data sets require a fee or special permission in order to be provided, except for the ones accessed through the European Environment Agency's website and the geospatial portals www.geodata.gov.gr and www.rae.gr/geo. Access to password protected data sets is granted only to the authorities that created them for entrepreneurship use.

1. Urban Atlas is provided for free via the European Environment Agency's website.
2. Corine Land Cover is provided for free via the European Environment Agency's website.
3. The Land Parcel Identification System (LPIS) is for use only by OPEKEPE (the Greek payment and control agency for guidance and guarantee community aid) users.
4. The same restrictions as the above, apply to the Farmers' Statements system.
5. Forestry Archive is partially available for download (.jpeg files).
6. Renewable Energy Sources' data set is available for free on www.rae.gr/geo.
7. Roads' data set is not provided for free, but less detailed data sets are available on www.geodata.gov.gr.
8. The blocks and buildings' data sets require a fee in order to be provided.
9. The lakes of the country are available for free on www.geodata.gov.gr.
10. The rivers of the country are available for free on www.geodata.gov.gr.
11. GAEC are not publicly available as access is only allowed to the Topographic Agency of the Rural Development and Food Ministry.

5 Compliance and precision for each data set

All available data sets, provide nationwide data that delivers land use / land cover information. Although GAEC data set could not be obtained for the entire Greece, except a demo file containing the data of the Pilot Area of Boeotia.

1. Urban Atlas was compiled by thousands of photographs taken by European satellites. It was originally compiled during 2006 and a new update is under preparation (2012).The mission of the Urban Atlas is to provide high-resolution maps of land use changes in urban centers and indicators for users, such as the decision-making bodies of a city.

Table 5.1. Urban Atlas – LUCAS Harmonisation table.

Class code	Urban Atlas Land Use Class	LUCAS Code	
		Land Cover	Land Use
11100	Continuous Urban Fabric (Sealing Degree>80%)	A10	Not Relevant (N.R.)
11210	Discontinuous Dense Urban Fabric (Sealing Degree 50% - 80%)	A10	N.R.
11220	Discontinuous Medium Density Urban Fabric (Sealing Degree 30% - 50%)	A10	N.R.
11230	Discontinuous Low Density Urban Fabric (Sealing Degree 10% - 30%)	A10	N.R.
11240	Discontinuous Very Low Density Urban Fabric (Sealing Degree<10%)	A10	N.R.
11300	Isolated Structures	A10	N.R.
12100	Industrial, commercial, public, military and private units	N.R.	U220
12210	Fast transit roads and associated land	A22	U312
12220	Other roads and associated land	N.R.	U312
12230	Railways and associated land	A22	U311
12300	Port areas	N.R.	U313
12400	Airports	N.R.	U314
13100	Mineral exrtaction and dump sites	A21	U140
13300	Construction sites	N.R.	U330
13400	Land without current use	F40	N.R.
14100	Green urban areas	N.R.	U370
14200	Sports and leisure facilities	N.R.	U360
20000	Agricultural + Semi-natural areas + Wetlands	H00	U110
30000	Forests	C00	N.R.
50000	Water bodies	H00	N.R.

The scale of Urban Atlas is 1: 10,000. The updated Urban Atlas will include all urban areas with more than 50,000 residents.

2. Corine Land Cover data set was created by resolution satellite images. Second level classes were created by 1:500.000 to 1:1.000.000 scale images and third level classes were created by 1:100.000 scale images.

Table 5.2. CORINE Land Cover– LUCAS Harmonisation table.

CORINE Land Cover nomenclature						LUCAS CODE	
Level 1		Level 2		Level 3		**Land Cover**	**Land use**
1	Artificial Surfaces	11	Urban fabric	111	Continuous urban fabric	Not Relevant (N.R.	U370 - U330
				112	Discontinuous urban fabric	N.R.	U370 - U330
		12	Industrial, commercial and transport units	121	Industrial or commercial units	N.R.	U220 - U340
				122	Road and rail networks and associated land	N.R.	U311 - U312
				123	Port areas	N.R.	U313
				124	Airports	N.R.	U314
		13	Mine, dump and construction sites	131	Mineral extraction sites	N.R.	U140
				132	Dump sites	A21	N.R.
				133	Construction sites	N.R.	U330
		14	Artificial, non-agricultural vegetated areas	141	Green urban areas	C10	U370
				142	Sport and leisure facilities	N.R.	U362

Level 1		Level 2		Level 3		**Land Cover**	**Land use**
2	Agricultural areas	21	Arable land	211	Non-irrigated arable land	B00	N.R.
				212	Permanently irrigated land	B00	U111
				213	Rice fields	B17	N.R.
		22	Permanent crops	221	Vineyards	B82	N.R.
				222	Fruit trees and berry plantations	B70	U111
				223	Olive groves	B81	U111
		23	Pastures	231	Pastures	B55 - E10 - E20	N.R.
		24	Heterogeneous agricultural areas	241	Annual crops associated with permanent crops	N.R.	U111
				242	Complex cultivation patterns	N.R.	U111
				243	Land principally occupied by agriculture, with significant areas of natural vegetation	N.R.	U111
				244	Agro-forestry areas	N.R.	U111

Level 1		Level 2		Level 3		**Land Cover**	**Land use**
3	Forest and semi natural areas	31	Forests	311	Broad-leaved forest	C10	U120
				312	Coniferous forest	C20	U120
				313	Mixed forest	C30	U120
		32	Scrub and/or herbaceous vegetation associations	321	Natural grasslands	E00	U120
				322	Moors and heathland	D00	U120
				323	Sclerophyllous vegetation	CXX9	U120
				324	Transitional woodland-shrub	D10	U120
		33	Open spaces with little or no vegetation	331	Beaches, dunes, sands	F20	U120
				332	Bare rocks	F10	U120
				333	Sparsely vegetated areas	D10 - D20 - E10	U120
				334	Burnt areas	F40	U120
				335	Glaciers and perpetual snow	G50	U120

Level 1		Level 2		Level 3		Land Cover	Land use
4	Wetlands	41	Inland wetlands	411	Inland marshes	H11	N.R.
				412	Peat bogs	H12	N.R.
		42	Maritime wetlands	421	Salt marshes	H21	N.R.
				422	Salines	H22	N.R.
				423	Intertidal flats	H23	N.R.

Level 1		Level 2		Level 3		Land Cover	Land use
5	Water bodies	51	Inland waters	511	Water courses	G20	N.R.
				512	Water bodies	G10	N.R.
		52	Marine waters	521	Coastal lagoons	G30	N.R.
				522	Estuaries	G30	N.R.
				523	Sea and ocean	G00	N.R.

3. LPIS was created by colored orthophotomaps (panchromatic multispectral) for better identification of healthy green (based on NDVI index). Orthophotomaps were taken on 2003 with a scale of 1: 5,000 and pixel size of 1 meter.

Table 5.3. LPIS– LUCAS Harmonisation table.

COVER_ID	COVER_DESCR	LAND COVER	LAND USE
10	FOREST	C00	U120
11	FOREST MIXED	C30	U120
20	URBAN	A10	U370
21	URBAN MIXED	A10- A20	U370
90	OTHER	N.R.	Not Relevant (N.R.)
91	ROADS - WATER	A22 - G00	N.R.
92	ABANDONED LAND	F40	U400

LPIS ELIGIBLE COVER ID		LUCAS	
COVER_ID	COVER_DESCR	LAND COVER	LAND USE
12	PASTURABLE FOREST LAND	E10	U120
30	MEADOW 2007	E20	U120
31	MEADOW MIXED	E20	U120
32	MEADOW 2003	E20	U120
33	MEADOW NO 2003_2007	E20	U120
40	ARABLE LANDS	B00	U111
41	ARABLE LANDS MIXED	B00	U111
50	PERMANENT CROPS	B70	U111
51	PERMANENT CROPS MIXED	B00	U111
60	OLIVE GROVES	B81	U111
61	OLIVE GROVES MIXED	B81	U111
70	VINEYARDS	B82	U110
71	VINEYARDS MIXED	B82	U110

4. Farmers' Statements system is a new subsystem integrated into LPIS. Based on the LPIS data set, each farmer annually declares his property into the system by assigning certain values on Land Cover Agriculture Map.

Table 5.4. Farmers' Statements – LUCAS Harmonisation table.

Crop Group Code	Crop Description	LUCAS	
		LAND COVER	LAND USE
1. 1	DURUM WHEAT	B12	Not Relevant (N.R.)
1. 2	QUALITY DURUM WHEAT	B12	N.R.
2	OTHER CEREALS	B19	N.R.
3. 1	WATERING MAIZE	B16	N.R.
3. 2	SILAGE MAIZE	B16	N.R.
4	OILSEEDS	B00	U110
5	PROTEINACEOUS CROPS	B00	N.R.
6	LAY FARMING LAND RIGHTS	B00	U112
7	RICE FOR ACTIVATION OF RIGHTS AND SPECIAL STATUS	B17	
7.1	RICE FOR ACTIVATION OF RIGHTS - NOT FOR SPECIAL STATUS	B17	N.R.

Crop Group Code	Crop Description	LUCAS	
		LAND COVER	LAND USE
8	FODDER CROPS	B50	N.R.
9	MEADOW	E10	U111
10	SUGAR BEET	B22	N.R.
11	LEGUMES	B53	U111
12	COTTON	B34	N.R.
13	NOT FABRIC FLAX	B35a	N.R.
14	FLAX FOR FABRIC	B35a	N.R.
15	OLIVE GROVES	B81	N.R.
16	ENERGY CROPS	B00	U210
17	TOBACCO	B36	N.R.
18	TOMATOES FOR PROCESSING	B42	N.R.
19	CITRUS FOR PROCESSING	B76 -B77	U111
20	PEACHES & PEARS FOR PROCESSING	B75i - B72	N.R.
21	NUTS	B74	N.R.
22	UNDERSOWN CROSS COMPLIANCE LEGUMINOUS CROPS	B43c	N.R.
23	MAIN CROSS COMPLIANCE LEGUMINOUS CROPS EXCEPT LEGUMES	B00	N.R.
24	STARCH PRODUCTION POTATO	B21	N.R.
25.1	SEEDS (CEREALS - OIL)	B35	U111
25.2	SEEDS (THOSE COUNTING IN EXTENDIBLE RIGHTS)	B35	U111
25.3	SEEDS (THOSE WHO NOT COUNTING IN EXTENDIBLE RIGHTS)	B35	U111
26	AGRICULTURAL LANDS IN GOOD CONDITION COUNTING IN EXTENSIBLE RIGHTS	N.R.	U111
27	DRY UNPROCESSED FIGS & PRUNES	B75c	N.R.
28.1	RAISINS	B82	N.R.
28.2	RAISINS - REPLANTING DUE TO GRAPE FYLLOXERA	B82	N.R.
29	BANANAS	B75q	N.R.
31	POTATO IN SMALL ISLANDS OF THE AEGEAN SEA	B21	N.R.
32	VINEYARDS FOR PRODUCTION OF QUALITY WINES (VQPRD) IN SMALL ISLANDS OF THE AEGEAN SEA	B82	N.R.
33	HOPS	B37b	N.R.
34	SILKWORMS - MULBERRIES FOR SERICULTURE	B75p	N.R.
35	HONEY - LANDS WITH BEES	N.R.	N.R.
36.1	VINEYARDS - RESTRUCTURING	B82	N.R.
36.2	OTHER VINEYARDS FOR TABLE USE	B82	N.R.
36.3	OTHER VINEYARDS FOR WINE PRODUCTION	B82	N.R.
37	OTHER CITRUS	B77	U111
38.1	LONG DURATION HORTICULTURALS	B43	N.R.
38.2	LIMITID DITARION HORTICULTURALS	B43c - B43e - B43h	N.R.
39	UNDER COVER HORTICULTURALS	A13	N.R.
40	FLOWER CROPS	B44	N.R.
41	AROMATIC PLANTS - HERBS	B37d - B84g - E30 - CXXB	N.R.
42	LAND NOT EMBEDDED IN CULTIVATION ACTIVITY	E30	N.R.
43	DRIED FORAGE PLANTS	B53	N.R.
44	HONEY IN SMALL ISLANDS OF THE AEGEAN SEA	N.R.	N.R.
45.1	OTHER CROPS	B75 - B77 -B80	N.R.
45.2	OTHER CROPS - TREES	B70	N.R.
46.1	OTHER MEASURES TO SUPPORT SMALL ISLANDS OF THE AEGEAN SEA	N.R.	N.R.
46.2	OTHER MEASURES TO SUPPORT SMALL ISLANDS OF THE AEGEAN SEA - TREES	N.R.	N.R.
46.3	OTHER MEASURES TO SUPPORT SMALL ISLANDS OF THE AEGEAN SEA - MASTIC	N.R.	N.R.

5. Forests' Archive was created by black & white or colored orthophotomaps dated from 1965 to 1991. The archive became available in digitized form in 1999.

Table 5.5. Forests 'Archive– LUCAS Harmonisation table.

A_VEG_TYPE	Vegetation Name	LUCAS LC	LC Main Categories	LUCAS LU
ΟΙΚ	Settlements	A11	A	U370
ΓΚΑ	Agricultural crops	B00	B	U110
ΓΚΕ	Agricultural crops installed	B00		
ΠΔΑ	Pinus sylvestris	C22	C	U120
ΠΘΑ	Pinus maritima	C22		
ΠΚΟ	Pinus pinea	C22		
ΠΛΔ	Pinus leucodermis	C22		
ΠΜΑ	Pinus nigra	C22		
ΠΧΑ	Pinus halepensis	C22		
ΕΛΑ	Fir	C23		
ΕΡΛ	Picea abies	C23		
ΚΡΠ	Cypress	C23		
ΣΗΜ	Betula	CXX4		
ΦΙΛ	Linden	CXX4		
ΚΑΣ	Chestnut	CXX6		
ΟΞΥ	Beech	CXX6		
ΣΦΕ	Maple	CXX8		
ΦΠΛ	Deciduous broadleaf	CXX8		
ΔΡΥ	Oak	CXX9		
ΦΟΙ	Palm tree	CXX9		
ΑΡΚ	Juniperus	CXXA		
ΠΑΡ	Riverine vegetation	CXXC		
ΕΥΚ	Eucalyptus	CXXE		
ΘΑΜ	Shrubs	D10	D	
ΦΘΑ	Deciduous shrubs	D10		
ΛΙΒ	Meadows, sparse woody vegetation	E10	E	
ΑΓΟ	Infertile	F10	F	U400
ΛΙΜ	Lake	G10	G	N.R.
ΛΧΡ	Other uses	N.R.	N.R.	N.R.

Field work for collecting data covered country's area and took place by forester working groups of the Central Forest Service. With the help of a series of aerial photographs referring to various years from 1960 to 1996 the groups produced approximately 1780 orthophotomaps of scale 1: 20,000, on the 1: 50,000 scale

basemap of the Military Geographic Service. On the basemap, topography, place names, contours, trigonometric points, coastlines and roads are featured.

6. Information on the creation of the Renewable Energy Sources' data set is unavailable and hence could not be recovered.

   All renewable energy sources are classified in U210 class of LUCAS land use.

7. Information on the creation of the Roads' data set is unavailable and hence could not be recovered Data source is Cadastre and Mapping Service of Greece. Data were modified in 2004 and 2005 by the Geoinformation and Mapping Laboratory of Geography Department in Aegean University. The produced file is a polyline ESRI shapefile.

   Roads are classified in A22 class (land cover) and U312 class (land use) of LUCAS.

8. Information on the creation of the blocks and buildings' data sets is unavailable and hence could not be recovered, but their registration is taking place every 10 years, following the census.

   Areas characterized by an artificial and often impenetrable level, mainly of anthropogenic activity, are classified in A00 main category of LUCAS. Further information possessed by the ELSTAT (Hellenic Statistical Authority) would deepen our knowledge in building height and their land use characterization.

9. Information on the creation of the lakes data set is unavailable and hence could not be recovered.

   Inland areas covered by water and flooded surfaces, belong to G20 class of LICAS Land cover.

10. There are no details on the creation the rivers data set.

    Inland running water areas as rivers and streams are grouped in G10 class of LUCAS land cover.

11. There are no details on the creation of the GAEC data set.

Table 5.11. GAEC– LUCAS Harmonisation table.

Code	Name	Description	LUCAS Code	
			Land Cover	Land Use
1	Unwanted - spontaneous vegetation	Uncultivated grassy areas within the plots with continuous or non-coverage of trees and / or shrubs with a minimum width of 2 meters.	Not Relevant	U112
2	Unwanted - spontaneous linear vegetation	Uncultivated grassy areas within the plots with continuous or non-coverage of trees and / or shrubs with a maximum width of 2 meters.	Not Relevant	U112
3	Native shrubs	Soil zones covered by shrubs in the limits of agricultural land with roads and / or natural water reservoirs.	D20	Not Relevant
4	Native trees	Soil zones covered by trees in the limits of agricultural land with roads and / or natural water reservoirs.	B70 - C00	Not Relevant
5	Native shrubs and trees	Soil zones covered by shrubs and trees within the limits of agricultural land with roads and / or natural water reservoirs.	D10	Not Relevant
6	Individual native trees	Individual native trees within the limits of agricultural land with roads and / or natural water reservoirs.	Not Relevant	Not Relevant
7	Weedy grooves (irrigation or drainage)	Uncultivated grassy area with continuous, discontinuous or incomplete coverage of trees and / or shrubs, which has a characteristic shape mostly following the field's slope and it is used for irrigation or drainage of it.	E30	Not Relevant
8	Terraces	Engineering structures (stairs) to retain the soil mainly on steep soil slopes.	Not Relevant	Not Relevant
9	Areas with terraces	Areas of terrace structures.	Not Relevant	Not Relevant
10	Dry stone walls	Walls of stone used for boundaries parcels retain the soil, etc.	Not Relevant	Not Relevant
11	Hedgerows	Fences made of plants or shrubs that represent boundaries parcels.	Not Relevant	U113
12	Dikes	Volumes of soil in a linear array to protect soils from floods	Not Relevant	U318
13	Natural slopes	Inclined planes result of natural balancing of soils' forfeiture.	Not Relevant	Not Relevant

6 Methodology and technical solutions

Under the purposes of data processing, a methodology was followed for integrating the selected different data sources and special geospatial tools were developed for the production of two hybrid maps (land cover and land use).

Due to the fact that data sets were obtained from various sources having different layer properties, a preprocessing step was necessary in order to harmonize data for further management.

Firstly, the coordinate systems of all data sets were redefined in order to gain projection on GGRS87 / Greek Grid (2100 - EGSA '87). The reprojection carried out under the QGIS environment. The CORINE Land Cover, Urban Atlas and the LUCAS 2012 survey data sets were originally projected in the ETRS 1989 (3035 - ETRS_1989_LAEA) coordinate system.

Following previous studies (Herold et al., 2008[1]), the nomenclature of the data sets used (CORINE, LPIS, GAEC) was compared with the nomenclature of LUCAS, instead of performing a direct correlation between them (Giri et al., 2005[2]; McCallum et al., 2006[3]). This allowed the review of a number of criteria which are mainly used in classification systems.

The methodology consisted of three main phases:

a) the translation of the nomenclature of the available data sets in LUCAS and the definition of a data profile (Harmonization of national data sets to LUCAS LC/LU classes)
b) a decision tree approach in relation to weight factors have been used to be faced the existence of the overlapping and of the duplication of the data sets
c) the calculation of the degrees of association

[1] Herold M, Mayaux P, Woodcokc CE, Baccini A, Schmullius CC (2008). Some challenges in global land cover mapping: an assessment of agreement and accuracy in existing 1 km datasets. Remote Sensing Environment 112(5): 2538-2556.

[2] Giri,C., Z. Zhu, B. Reed (2005) A comparative analysis of the global land cover 2000 and MODIS land cover data sets. Remote Sens. Environ., 94, pp. 123–132.

[3] McCallum I, Obersteiner M, Nilsson S, Shvidenko A (2006). A spatial comparison of four satellite derived 1 km global land cover datasets. Int J Appl Earth Obs Geoinf 8(4): 246-255.

After a thorough review of the data sets and of their technical specifications the harmonization of every data set's nomenclature with LUCAS' nomenclature was accomplished. The Corine Land Cover systems, LPIS, Urban Atlas, Blocks and Buildings, Roads, Farmers' Statements and the dataset of the Special Secretariat of Forests were the basic reference sets for the creation of the land use / land cover hybrid map.

The majority of the data sets' classes matched directly to the classes of LUCAS, provided that they complied with the standards and the common description for each of the classes. Concerning the remaining classes that could not be initially and directly harmonized with LUCAS categories, they were undergone a check in order to ascertain whether a certain main class or subclass was coincide with another class belonging to another data set. If this was not the case, the data set was checked again after the creation of the hybrid map, for possible identification with the previously created main categories, classes or subclasses.

The approach followed for the estimation of the overlapping degree between different classes on the same areas, consisted of the comparison of every class with the class of the overlapping data set. The degree of overlap was calculated for each main category and further an aggregated single value was produced. The same methodology was followed by Pérez and Hoyos (2011)[1] for creating a hybrid European map, possessing datasets of CLC, GLC2000 and MODIS.

The calculation of overlapping result was presented for the pilot area of Boeotia. The results (Table 6.1) exceeded Boeotia's coverage by 1.67 times.

Table 6.1. National data sources' overlapping results for the pilot area of Boeotia.

Classes	A20	B00	B17	B55	B70	B80	B81	B82	C00	C30	E10	E20	G10	G20	G30	Total
Area (ha)	7.805,31	171.263,47	0,00	46.609,88	666,90	12.814,34	29.336,02	6.468,54	62.679,80	423,96	57.031,72	93.408,77	5.386,15	624,72	0,00	494.519,58
															Voiotia	295.431,34
															Percentage Covered =	167,39%

[1] Pérez-Hoyos, A., F.J. García-Haro, J. San-Miguel-Ayanz (2011). A methodology to generate a synergetic land-cover map by fusion of different land-cover products. International Journal of Applied Earth Observation and GeoinformationVolume 19, Pages 72-87.

6.1 Comparative evaluation of national data sources.

A value classification scheme ranging between "0" and "100" based on the characteristics of the data sources was created. Additionally, a weighting factor (Table 6.2) was introduced in order to weight each data source, for further evaluation and in case of overlapping or duplication.

Table 6.2. Weighting Factors

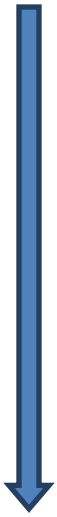
Characteristics	Weighting Factor
Coverage	0.30
Scale	0.20
Number and Range of Classes	0.20
Latest Update	0.10
Update Frequency	0.10
NUTS Level	0.05
Access Conditions	0.05
Sum	**1.00**

The evaluation of National data sources was based on the characteristics of each data source shown in the table below (Table 6.3). Among the 10 National Data Sources covering the Greek territory, 100 points is the maximum possible score that can be attained by the classification scheme and is classified as excellent. Benchmarking each dataset, scale, level NUTS, coverage, latest update, frequency of update and the conditions of access to these data sets were assessed. In Table 6.3 the score achieved by each data set based on the aforementioned criteria is presented.

Table 6.3. Available data sources evaluation based on their characteristics.

Data Set	Cove-rage	Scale	Number and Range of Classes	Latest Update	Update Frequency	NUTS Level	Access Condi-tions	**Sum**
LPIS	30	20	18	10	10	5	5	**98**
Farmers Statements	15	20	20	10	10	5	0	**80**
Geodata.gov.gr	30	15	5	6	6	5	5	**72**
Forests' Archive	30	10	20	1	4	5	0	**70**
CORINE Land Cover	30	3	10	5	1	5	5	**59**
GAEC	2	20	15	6	8	5	3	**59**
RAE	2	20	2	6	8	5	5	**48**
Roads	5	20	5	5	6	5	1	**47**
ElStat (Blocks and Buildings)	2	20	5	5	4	5	1	**42**
Urban Atlas	2	2	20	2	6	5	5	**42**

According to their characteristics the National Data Sources were ranked from the most reliable to the least reliable source as follows:



LPIS

Farmers Statements

Geodata.gov.gr

Forests' Archive

CORINE Land Cover

GAEC

RAE

Roads

ElSTAT (Blocks and Buildings)

Urban Atlas

These 10 data sets are covering the matching needs of LUCAS land use / land cover classification system in a very large proportion (spatially over 95%). Mostly the files of LPIS, Farmers' statements, Forests' Archive, and ELSTAT –data sets are the most important national data sets, covering all anthropogenic interventions, agricultural activities and country's forests.

6.2 Development of a geographical – harmonisation tool (1) that integrates different data sources to support the LUCAS land cover methodology and the results of this system.

Within the scope of this project, the "LUCAS Harmonisation Toolbox" was developed, via which the user can automatically convert each authority's classification system into LUCAS classification system (just by selecting the authority responsible for the data set) and to be able to easily produce statistics based on the regularly updated national land-use/land cover data sets

Additionally, in order to particular implement the previously mentioned steps, in a more user-friendly way; toolboxes were created in ArcGIS environment. In Figure 6.2 the specific toolbox, which harmonises the available data sets' classification system with the classification system of LUCAS is presented. On the left, the toolbox is presented on its collapsed form and on the right its tools are revealed. The tools – models under the produced toolbox are as many as the services whose spatial data sets need to be harmonised with the LUCAS classification system of Eurostat.

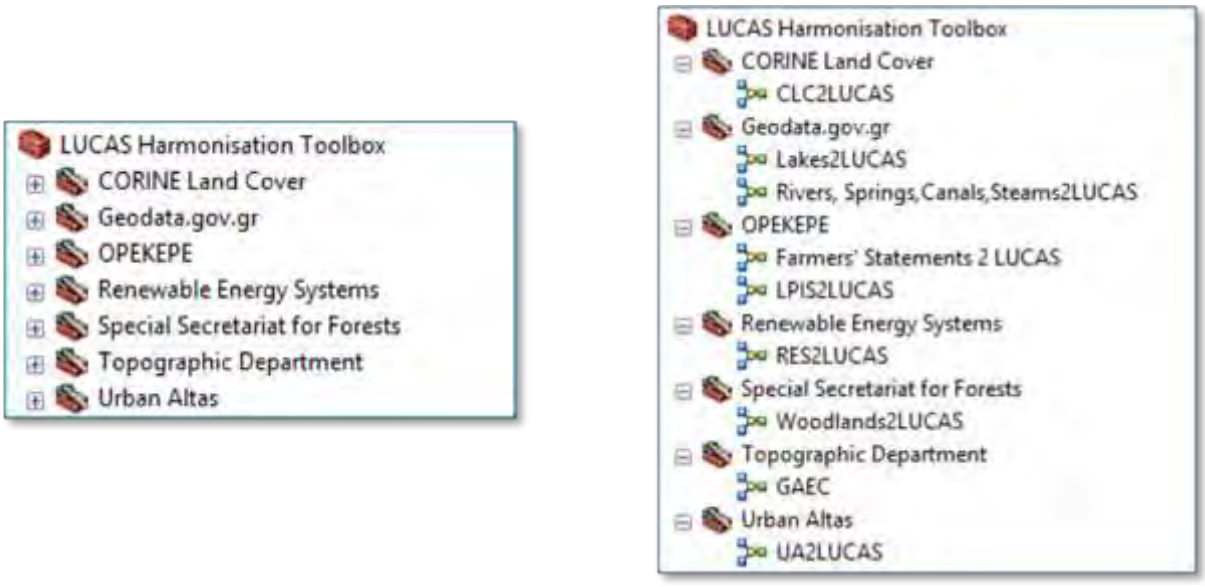


Figure 6.2. The toolbox for the harmonisation of the data sets.

6.3 Development of a geo-statistical model-tool (2) integrating different data sources in order to support LUCAS land-use statistics.

A geographical and geo-statistical model has also been developed integrating these different data sources in order to support LUCAS land-use statistics and derived products and for the map production and nationwide hybrid map synthesis in order to support LUCAS methodology.
The commercial GIS software ArcGIS (version 10.2.1 Advanced) and the open source GIS software QGIS (versions 2.2 to 2.6 Brighton) were used. Several routines were developed using python programming language with the use of ArcPy library. The final GIS tool is compatible with ArcGIS (versions 10.0 and previous) but can be also used outside the GIS environment (use only at the terminal level).

The developed software contains four main routines:

- Geodatabases' harmonisation with LUCAS LC/LU classification system.
- Integration of harmoniseharmonised national datasets
- Creation of the final hybrid maps (land cover and land use)
- Validation of the results

In ANNEX II there is a detailed description of the developed routines of the geospatial and the geo-statistical models.

The flowchart in Figure 6.3.1 .presents the workflow of the LC harmonisation procedure. The basic steps are:

- Urban Atlas, LPIS and Roads data set are combining to create the LUCAS main category Artificial Land (A).
- Farmers' Statements data set is providing the main category Cropland (B).
- LPIS and Forests' Archive are combining to provide the main category WoodLand (C).
- Forests' Archive provides us with main categories Shrubland (D), Grassland (E) and Bare Land and Lichens/Moss (F) with a combination with CORINE Land Cover.

- Water Bodies data sets (from Geodata.gov.org) provide main category Water Areas (G).
- CORINE Land Cover provides information on main category Wetlands (H).

In Figure 6.3.2 the Land Cover Integration Model is presented. The basic points of the conceptual model are:

- Classes of the national data sets that were examined to automatically correspond with LUCAS LC main categories/classes/subclasses are getting an extra field with the LUCAS LC characterization.
- According to the degrees of affinity, the overlapped features are recalculated and the higher rated is ruling the controversial area.
- A raster file is created for every LC Main Category and the LC Hybrid Map is created.
- The classes of the national data sets that were not automatically corresponded with a LUCAS LC category/class/subclass, were checked in case of filling empty areas that could not be identified by the rest of the classes.
- Exported file feedback the indirect corresponded classes and after the monitoring taking place, the Greek Hybrid Land Cover Map is created as a final product.

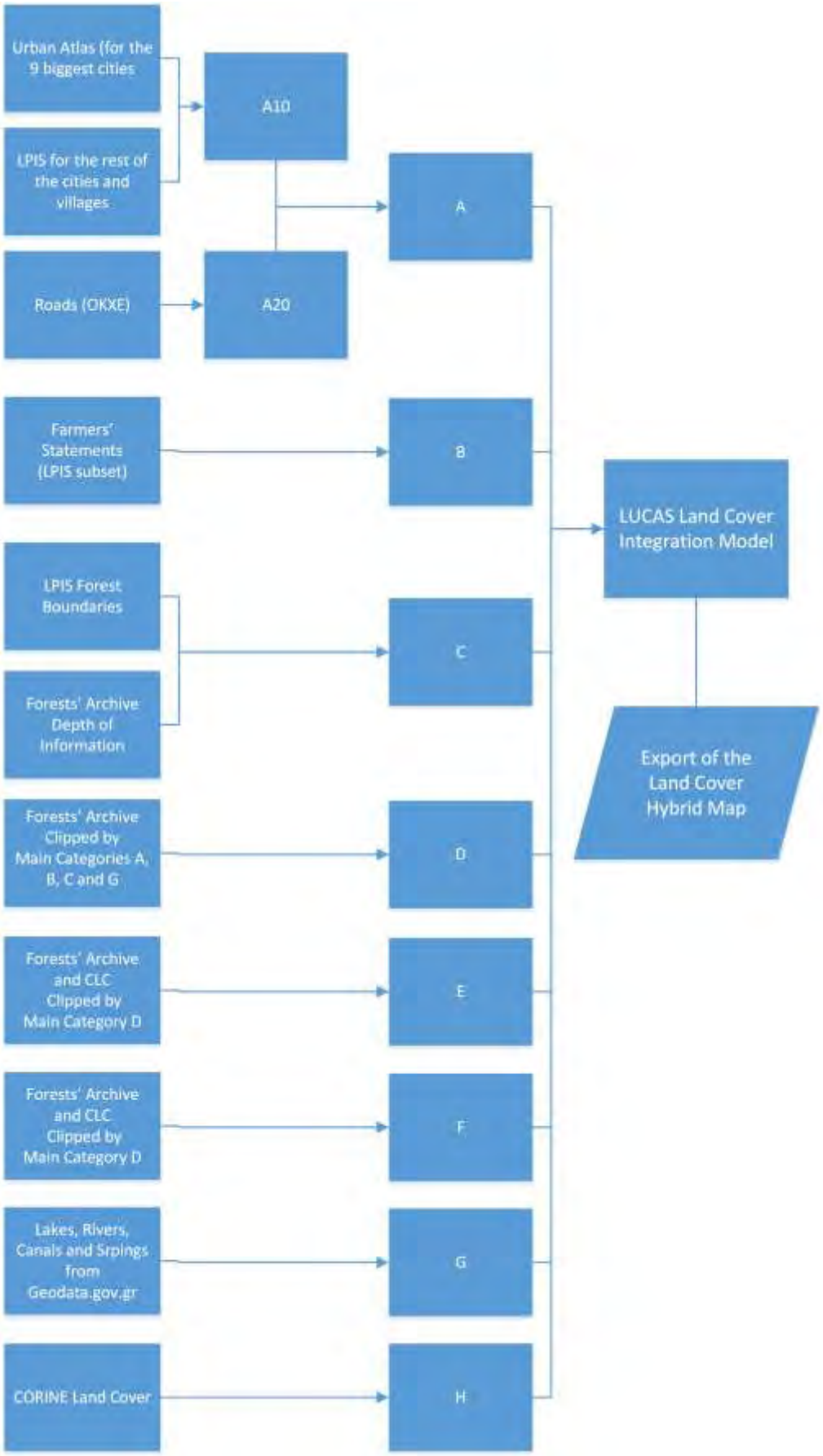


Figure 6.3.1. Flowchart of the Land Cover Harmonisation procedure.

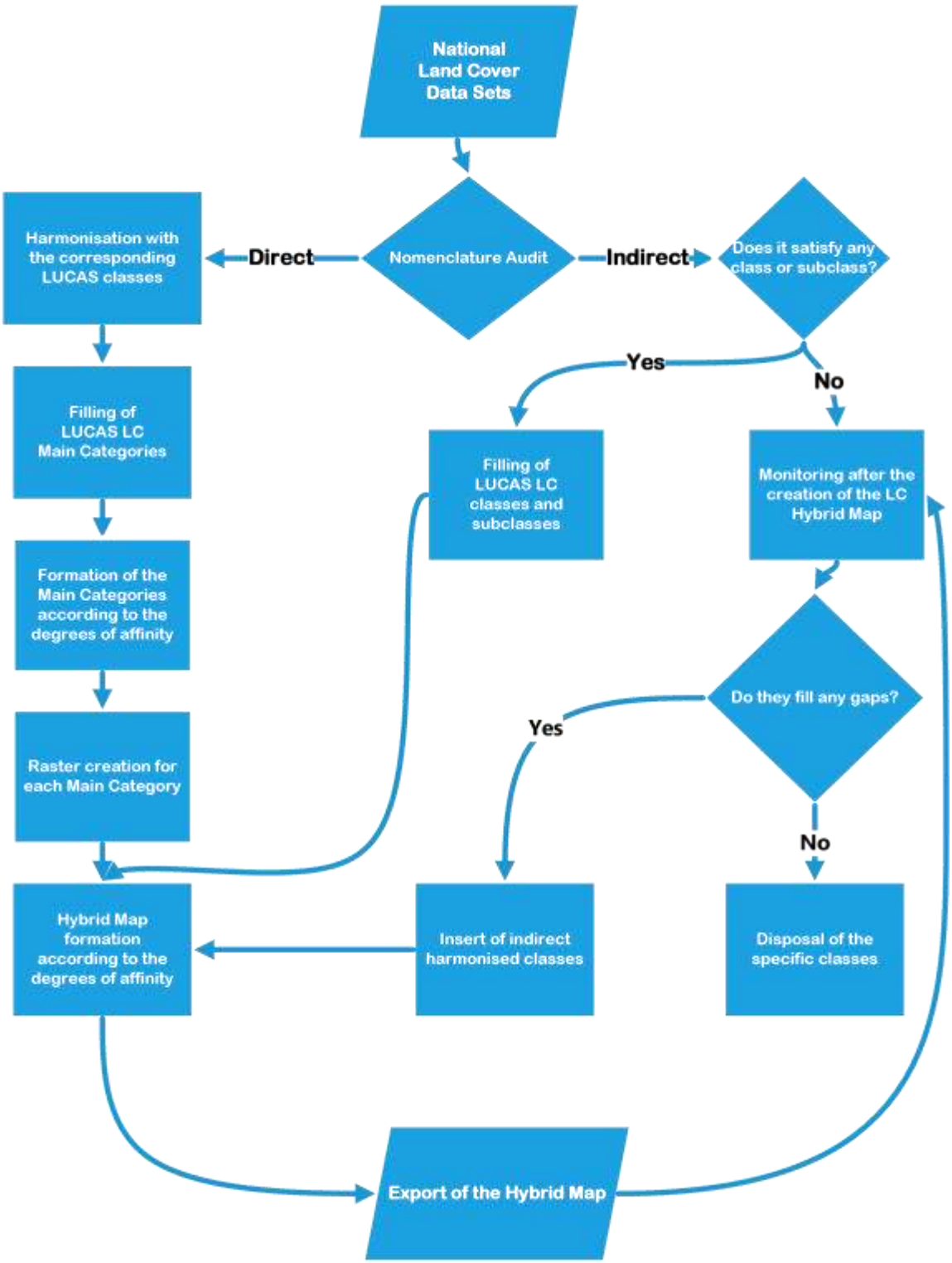


Figure 6.3.2. Land Cover Integration Model.

7 Results

7.1 Land Cover Harmonization Tables

Table 7.1.1 and Table 7.1.2 show the harmonization between the available data sets' classes and LUCAS land cover classes. LPIS is the greatest contributor in the land cover hybrid map, as it covers the entire country and involves Farmers' Statements frequent update. CORINE Land Cover is "filling" many empty classes while Forests' Archive data set presents third level of detail data concerning the main category C.

Table 7.1.1. Harmonization of available data sets with LUCAS land cover classification system.

LAND COVER - Great Data Sets									
Land Cover Classes	Description	Classes							
		CORINE	LPIS COVER ID	Farmers' Statements CROP CODE	Urban Atlas	Special Secretariat for Forests	ELSTAT	Roads (NCMA)	Geodata.gov.gr
A00	Artificial Land								
A10	Built-up Areas	111, 112, 121	20, 21		11100, 11210, 11220, 11230, 11240, 11300, 12100, 12300, 12400	ΟΙΚ			
A11	Buildings with one to three floors								
A12	Buildings with more than three floors								
A13	Greenhouses			39					
A20	Artificial Non-Built-up Areas				13100				
A21	Non built-up area features	123, 124, 131,132,133							
A22	Non built-up line features	122			12210, 12230				
B00	Cropland	211, 212	40, 41, 51	4, 5, 6, 16, 23	13400	ΓΚΑ, ΓΚΕ			
B10	Cereals			1					
B11	Common wheat			1.2					
B12	Durum wheat			1.1					
B13	Barley								
B14	Rye								
B15	Oats								
B16	Maize			3.1, 3.2					
B17	Rice	213		7, 7.1					
B18	Triticale								
B19	Other cereals			2					
B20	Root crops								
B21	Potatoes			24, 31					
B22	Sugar beet			10					
B23	Other root crops								
B30	Non-Permanent Industrial Crops								
B31	Sunflower								
B32	Rape and turnip rape								
B33	Soya								
B34	Cotton			12					
B35	Other fibre and oleaginous crops			4, 13, 14					
B36	Tobacco			17					
B37	Other non-permanent industrial crops			16, 25.1, 25.2, 25.3, 33, 41					
B40	Dry Pulses, Vegetables and Flowers								
B41	Dry Pulses, Vegetables and Flowers			38, 38.1, 38.2, 39, 40					
B42	Tomatoes			18					
B43	Other fresh vegetables			11, 22					
B44	Floriculture and ornamental plants								
B45	Strawberries								
B50	Fodder Crops			8					
B51	Clovers								
B52	Lucerne								
B53	Other Leguminous and mixtures for fodder			43					
B54	Mix of cereals								
B55	Temporary grassland	231							

B70	Fruit trees & berries	222	50	19, 20, 27, 29, 34, 37, 45.1, 45.2					
B71	Apple fruit								
B72	Pear fruit								
B73	Cherry fruit								
B74	Nuts trees			21					
B75	Other fruit trees and berries								
B76	Oranges								
B77	Other citrus fruit			37					
B80	Other Permanent Crops			41, 45.1					
B81	Olive groves	223	60.61	15, 15.1, 15.2, 15.3					
B82	Vineyards	221	70, 71	28.1, 28.2, 32, 36.1, 36.2, 36.3					
B83	Nurseries								
B84	Permanent industrial crops		51						
C00	Woodland	334	10, 12		30000				
C10	Broadleaved and evergreen woodland	311							
C20	Coniferous woodland	312							
C21	Spruce dominated coniferous woodland								
C22	Pine dominated coniferous woodland					ΠΔΑ, ΠΘΑ, ΠΚΟ, ΠΛΔ, ΠΜΑ, ΠΧΑ			
C23	Other coniferous woodland					ΕΛΑ, ΕΡΛ, ΚΠΡ			
C30	Mixed woodland	313	11						
C31	Spruce dominated mixed woodland								
C32	Pine dominated mixed woodland								
C33	Other mixed woodland								
CXX1	Boreal forest								
CXX2	Hemiboreal forest and nemoral coniferous forest and mixed broadleaved-coniferous forest								
CXX3	Alpine coniferous forest								
CXX4	Acidophilous oak and oak-birch forest					ΣΗΜ, ΦΙΛ			
CXX5	Mesophytic deciduous forest								
CXX6	Beech forest					ΚΑΣ, ΟΞΥ			
CXX7	Mountainous beech forest								
CXX8	Thermophillous deciduous forest					ΣΦΕ, ΦΠΛ			
CXX9	Broadleaved evergreen forest	323				ΔΡΥ, ΦΟΙ			
CXXA	Coniferous forest of the Mediterranean region					ΑΡΚ			
CXXB	Mire and swamp forests								
CXXC	Floodplain forests					ΠΑΡ			
CXXD	Non-riverine alder, birch or aspen forest								
CXXE	Exotic forest					ΕΥΚ			
D00	Shrubland	322				ΘΑΜ, ΦΘΑ			
D10	Shrubland with sparse tree cover	324							
D20	Shrubland without tree cover								
E00	Grassland	321				ΛΙΒ			
E10	Grassland with sparse tree/shrub cover			9					
E20	Grassland without tree/shrub cover		30, 31, 32, 33						
E30	Spontaneous re-vegetated surfaces			42					
F00	Bare Land and Lichens/Moss					ΑΓΟ			
F10	Rocks and Stones	332							
F20	Sand	331							
F30	Lichens and Moss								
F40	Other bare soil	334							
G00	Water Areas		93		50000				
G10	Inland water bodies	512				ΛΙΜ			Lakes
G20	Inland running water	511							Rivers
G30	Coastal water bodies	521, 522, 523							
G50	Glacier, permanent snow	335							
H00	Wetlands								
H10	Inland wetlands								
H11	Inland marshes	411							
H12	Peatbogs	412							
H20	Coastal wetlands								
H21	Salt marshes	421							
H22	Salines	422							
H23	Intertidal flats	423							
Non Compatible Classes		333 (can belong to many classes), 244, 243, 242, 241, 142, 141, 133	14, 90, 91 (contains roads or water bodies), 92	26, 35, 44, 46.1, 46.2, 46.3	20000 (contains Agricultural, Semi-natural areas, Wetlands), 12100, 12220, 13300, 14100, 14200	ΛΧΡ (refers to "other")			
Symbology	**Overlapping Datasets (they are produced by different services, they have different classes but they conern the same type of land cover)**								

Table 7.1.2. Harmonization of available specific data sets with LUCAS land cover classification system.

LAND COVER - Specific Data Sets				
Land Cover Classes	**Description**	KOSE 2012 ID Numbers		
		Ministry of National Defense	Ministry of Labour and National Insurance	Ministry of Rural Development and Food
A00	**Artificial Land**			
A10	Built-up Areas	192	54, 55, 84	
A11	Buildings with one to three floors			
A12	Buildings with more than three floors			
A13	Greenhouses			
A20	Artificial Non-Built-up Areas			
A21	Non built-up area features			
A22	Non built-up line features			
B00	Cropland			29
B10	Cereals			3
B11	Common wheat			
B12	Durum wheat			
B13	Barley			
B14	Rye			
B15	Oats			
B16	Maize			
B17	Rice			
B18	Triticale			
B19	Other cereals			
B20	Root crops			3
B21	Potatoes			
B22	Sugar beet			
B23	Other root crops			
B30	Non-Permanent Industrial Crops			3
B31	Sunflower			
B32	Rape and turnip rape			
B33	Soya			
B34	Cotton			
B35	Other fibre and oleaginous crops			
B36	Tobacco			
B37	Other non-permanent industrial crops			
B40	Dry Pulses, Vegetables and Flowers			3
B41	Dry Pulses, Vegetables and Flowers			
B42	Tomatoes			
B43	Other fresh vegetables			
B44	Floriculture and ornamental plants			
B45	Strawberries			
B50	Fodder Crops			3
B51	Clovers			
B52	Lucerne			
B53	Other Leguminous and mixtures for fodder			
B54	Mix of cereals			
B55	Temporary grassland			
B70	Fruit trees & berries			3
B71	Apple fruit			
B72	Pear fruit			
B73	Cherry fruit			
B74	Nuts trees			
B75	Other fruit trees and berries			
B76	Oranges			
B77	Other citrus fruit			
B80	Other Permanent Crops			3
B81	Olive groves			2
B82	Vineyards			1
B83	Nurseries			
B84	Permanent industrial crops			

C00	Woodland			29, 64
C10	Broadleaved and evergreen woodland			
C20	Coniferous woodland			
C21	Spruce dominated coniferous woodland			
C22	Pine dominated coniferous woodland			
C23	Other coniferous woodland			
C30	Mixed woodland			
C31	Spruce dominated mixed woodland			
C32	Pine dominated mixed woodland			
C33	Other mixed woodland			
CXX1	Boreal forest			
CXX2	Hemiboreal forest and nemoral conigerous forest and mixed broadleaved-coniferous forest			
CXX3	Alpine coniferous forest			
CXX4	Acidopholous oak and oak-birch forest			
CXX5	Mesophytic deciduous forest			
CXX6	Beech forest			
CXX7	Mountainous beech forest			
CXX8	Thermophillous deciduous forest			
CXX9	Broadleaved evergreen forest			
CXXA	Coniferous forest of the Mediterranean region			
CXXB	Mire and swamp forests			
CXXC	Floodplain forests			
CXXD	Non-riverine alder, birch or aspen forest			
CXXE	Exotic forest			
D00	Shrubland			
D10	Shrubland with sparse tree cover			
D20	Shrubland without tree cover			
E00	Grassland			
E10	Grassland with sparse tree/shrub cover			
E20	Grassland without tree/shrub cover			
E30	Spontaneous re-vegetated surfaces			
F00	Bare Land and Lichens/Moss			
F10	Rocks and Stones			
F20	Sand			
F30	Lichens and Moss			
F40	Other bare soil			
G00	Water Areas			
G10	Inland water bodies	170		5, 61
G20	Inland running water	170		62
G30	Coastal water bodies	45		63
G50	Glacier, permanent snow			
H00	Wetlands			
H10	Inland wetlands			
H11	Inland marshes	170		
H12	Peatbogs	170		
H20	Coastal wetlands	45		
H21	Salt marshes			
H22	Salines			
H23	Intertidal flats			
Symbology	**Overlapping Datasets (they are produced by different services, they have different classes but they conern the same type of land cover)**			

7.2 Land Cover Hybrid Map

Based on the developed ArcGIS toolbox a final Land Cover Hybrid Map was prepared at LUCAS main Land Cover categories level (Figure 7.1). Land Cover Hybrid map for each of the thirteen Administrative Regions of Greece are presented in Annex III.

The file of Administrative Regions of Greece derived from the file of Prefectures of Greece (provided at http://geodata.gov.gr/geodata/index.php?option=com_sobi2&sobi2Task=sobi2Details&catid=16&sobi2Id=182&Itemid=) and according to the tables available at the website of the Ministry of Interior (http://www.ypes.gr/el/regions/aytodioikhsh/perifereies/perifereiakesenothtes/). The creator of the file is the Mapping and Cadastral Organisation of Greece and the last update has been made at 18/07/2011.

Based on the Land Cover Hybrid Map area, final results and statistics for the LUCAS main categories are presented for Greece in Table 7.2.1 and also for each administrative region (NUTS2 level) in Table 7.2.2. Area in hectares according to the requested LUCAS project classification system.

Every Land Cover Main Category (according to which the Hybrid Land Cover map were created) was clipped with every administrative region of Greece and the statistics were exported. Final results derive from the use of all the available national data sources, thus no certain metadata could be produced. Each Main Category was created by following the methodology described in previous chapters.

Based on Table 7.2.1 the 94.37% of the total area of Greece is covered by the Land Cover Main Categories.

Table 7.2.1. The rate and extent of coverage of the main land cover categories through national datasets.

Main Categories	Total Area (ha)	Percentage of Total Greece Area
A	299,094.34	2.26%
B	4,412,484.64	33.44%
C	5,663,296.11	42.92%
D	976,470.43	7.40%
E	1,607,293.70	12.18%
F	136,659.32	1.04%
G	197,641.64	1.50%
H	55,821.10	0.42%
Total Area (National Data Sources)	12,451,538.43	94.37%
Greece	13,194,186.82	100.00%

Table 7.2.2. The Land Cover main categories statistics for the administrative regions (NUTS2) of Greece.

Administrative Regions of Greece	Total Area (ha)		LUCAS Land Cover Main Categories							
			A	B	C	D	E	F	G	H
East Macedonia and Thrace	1,416,781.70	Percentage	1.15%	33.10%	49.71%	4.28%	7.98%	0.76%	0.96%	1.27%
		Area	16,247.56	468,957.46	704,341.50	60,665.63	113,018.87	10,720.30	13,550.26	18,037.96
Central Macedonia	1,881,852.16	Percentage	2.69%	44.48%	38.00%	3.29%	7.74%	0.63%	2.25%	0.86%
		Area	50,697.76	837,119.95	715,118.90	61,911.04	145,650.97	11,931.31	42,317.18	16,174.87
West Macedonia	946,487.41	Percentage	0.95%	25.06%	44.79%	2.63%	20.95%	0.48%	4.83%	0.24%
		Area	8,957.23	237,166.65	423,893.75	24,894.05	198,309.51	4,506.31	45,694.91	2,269.98
Epirus	916,575.72	Percentage	1.33%	15.02%	60.19%	3.41%	16.23%	1.79%	0.88%	0.66%
		Area	12,156.74	137,696.03	551,692.17	31,223.33	148,741.84	16,362.46	8,041.88	6,044.27
Thessaly	2,077,918.56	Percentage	1.71%	35.34%	40.25%	7.10%	11.78%	0.64%	0.64%	0.10%
		Area	35,541.99	734,253.54	836,419.03	147,597.87	244,696.79	13,231.19	13,381.77	1,983.14
Ionian Islands	230,578.51	Percentage	2.41%	34.99%	38.85%	10.54%	7.01%	0.62%	0.25%	0.15%
		Area	5563.1964	80687.484	89587.549	24297.208	16152.535	1423.665	571.0106	338.3446
West Greece	1,131,583.73	Percentage	1.34%	33.26%	41.02%	7.03%	6.61%	1.15%	4.04%	0.54%
		Area	15,175.16	376,413.64	464,189.00	79,536.18	74,817.47	13,011.74	45,694.91	6,102.27
Central Greece	1,554,908.33	Percentage	0.95%	27.21%	46.94%	9.51%	8.32%	0.81%	1.33%	0.09%
		Area	14,841.13	423,043.65	729,904.69	147,946.19	129,413.53	12,536.34	20,648.28	1,423.37
Attica	381,176.37	Percentage	26.63%	21.49%	42.24%	5.16%	3.71%	0.35%	0.32%	0.05%
		Area	101,501.28	81,925.84	161,003.83	19,666.43	14,145.55	1,338.55	1,216.92	197.35
Peloponissos	1,548,874.45	Percentage	0.98%	31.66%	47.68%	7.36%	6.75%	0.35%	0.26%	0.08%
		Area	15,184.32	490,438.23	738,443.58	114,063.36	104,529.40	5,454.16	4,056.91	1,284.64
South Aegean	531,202.17	Percentage	1.18%	20.43%	20.80%	13.01%	27.89%	3.32%	0.06%	0.05%
		Area	6,256.91	108,499.44	110,514.90	69,117.89	148,160.65	17,635.38	335.93	251.52
North Aegean	383,661.64	Percentage	0.87%	32.07%	22.40%	9.32%	21.04%	1.67%	0.19%	0.45%
		Area	3,327.21	123,041.65	85,925.33	35,760.52	80,740.35	6,404.05	741.42	1,713.39
Krete	832,346.22	Percentage	1.64%	37.63%	6.28%	19.20%	22.70%	2.66%	0.17%	0.00%
		Area	13,643.87	313,241.08	52,261.89	159,790.72	188,916.23	22,103.88	1,390.26	0.00
Greece	13,194,186.82		2.26%	32.04%	40.87%	7.49%	1.73%	11.86%	1.17%	0.52%

.

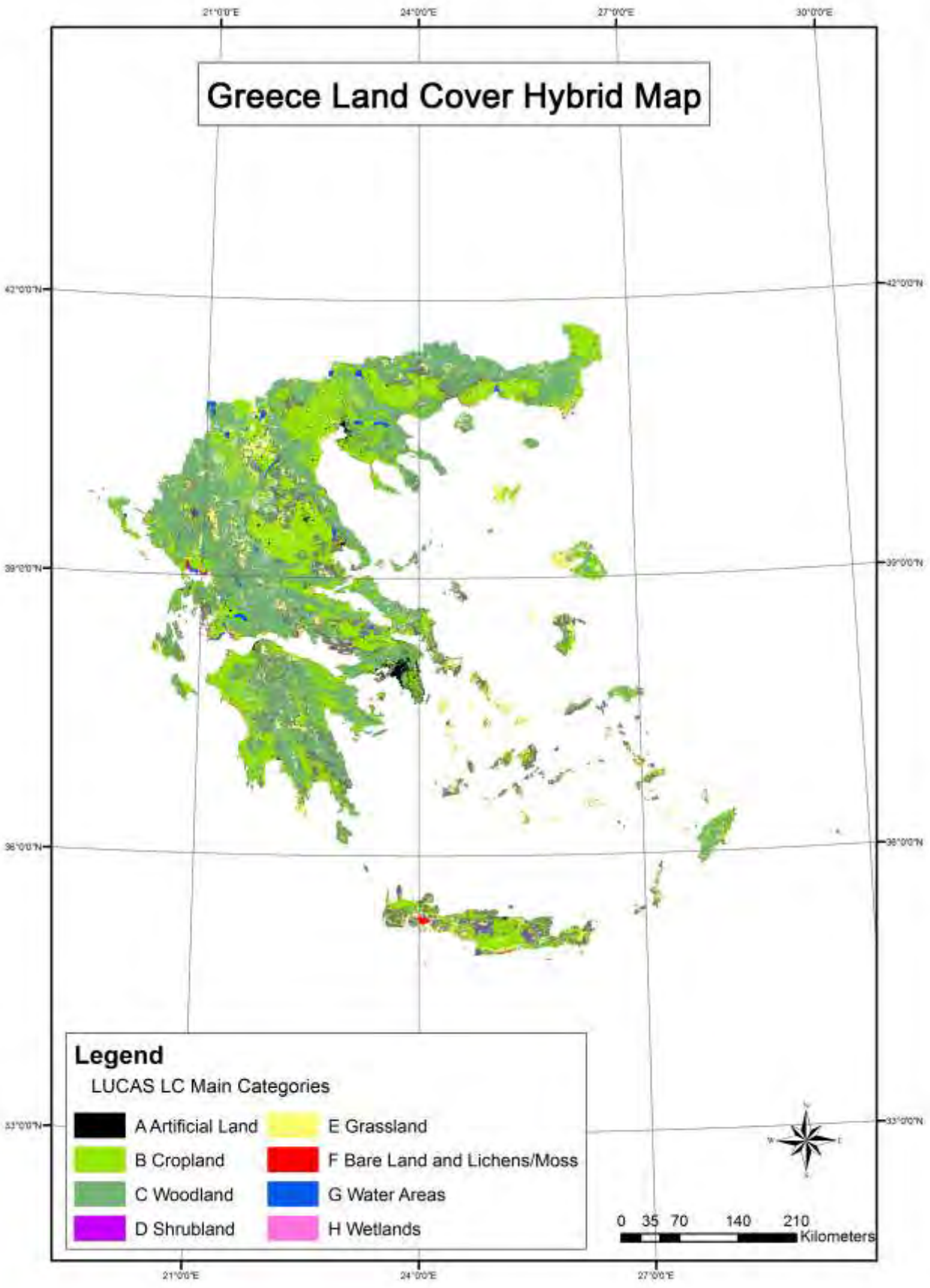


Figure 7.1. Land Cover Hybrid Map based mainly on existing National data sets.

Land Cover Main Categories

Main category A (ARTIFICIAL LAND)

The Urban Atlas set contains data from the 9 most populated Greek cities. The identification under LUCAS 2012 points reaches 71% of the total reference area. The “blocks and buildings” data set (ELSTAT) refers to settlements over 2000 inhabitants. Despite the fact that this data set is much more accurate than Urban Atlas’s, it is rather unacceptable to consider a dataset which sets such small limit on the number of residents excluding more multitudinous settlements. LPIS data set is the newest and the one that receives most frequently updates, but its identification under LUCAS 2012 points, as far as Main Category A is concerned, reaches 54% which is not satisfactory enough. The “forest archive” data set reaches 28% and CORINE Land Cover reaches 30%. In conclusion, in order to successfully identify the A10 (Build-up areas) class, we used the Urban Atlas dataset for the 9 major cities and LPIS dataset for the rest of the country. Regarding A20 (Artificial non built-up areas) class, we used the “road network” data set, which its identification with LUCAS 2012 points is 100%.

Main Category B (CROPLAND)

The LPIS data set and “Farmers’ Statements” data set manage a 95% matching/identification with LUCAS 2012 points. Both data sets are best suited to deliver values for the main category B. Corine Land Cover data set reaches 58%. The data set from the Special Secretariat of Forests reaches 88% (without specifying any further class or subclass except for the main category B). Urban Atlas data set fails to locate any of the points of the main category B. Possibly Urban Atlas has very accurately registered the rural plots located within the 9 major cities but perhaps they are not perceived by the LUCAS 2012 survey, probably due to the sampling distance (2x2 km).

Main Category C (WOODLAND)

Special Secretariat for Forest’s data set coincides at 57% with LUCAS 2012 survey main category C. The percentage succeeded is rather adequate considering the outdated dataset. The boundaries of forests have surely changed over the years, but the type of each forest (LUCAS subclasses) cannot be different from that referred in the “forests’ archive” data set. LPIS data set reaches a much more satisfactory coincidence at 80%, but does not contain the depth of information contained in the Forests Archive dataset. In order to export LUCAS

main category C from the National data sets, we combined the limits of LPIS data sets with the further characterization from the data of the Special Secretariat of Forests.

Main Category D (SHRUBLAND)

According to LPIS data set, main category D is classified either as agricultural or in-forest areas. CORINE Land Cover reaches a 10% identification, while the Special Secretariat of Forests dataset coincides 49%. Although recognition rate is rather low, it still remains the best solution identifying main category D.

Main Category E (GRASSLAND)

Main category E is the second most difficult category to be characterized and cannot be successfully identified from the National data sets. The highest identification percentage is derived from the Special Secretariat of Forests' data set (20%) and the second comes from CORINE Land Cover data set (16%).

Main Category F (BARE LAND AND LICHENS)

The most difficult main category under characterization is proven to be main category F. Indeed it cannot be successfully recognized and identified by any of the available National data sets. This occurs probably because main category F is not met in any of Greece's subclasses except for F20. It is also considered that main category F is contained in "Other" classes, which hold features that do not interest the researcher - land use / land cover survey in order to be further divided into subcategories. CORINE Land Cover coincides up to 4% with LUCAS 2012 survey in the main category F and the Special Secretariat of Forests data set coincides at 16%.

Main Category G (WATER)

Data sets provided by the geospatial portal Geodata.gov.gr are the most suitable among the other National data sets and are fully coincide with the main category G of LUCAS 2012 survey. Lakes' data set achieved a perfect match with LUCAS 2012 survey reaching the percentage of 60% (36 points). According to the project, more accurate data sets that are related to inland water bodies are currently not available. Due to the diversity on the width of river bodies, a mean amplitude value of 10 meters was considered at the combination phase of the 3 data sets provided by Geodata.gov.gr. The referring datasets are the "rivers", "rivers_eper" and "ydrografiko_diktyo". 14 out of 50 LUCAS 2012 points coincide with rivers' file. The remaining 36 are set in a distance longer than 1 km away from every polygon feature created from the combination of the 3 data sets. It is realized that as far as the

hydrographic network is concerned, an incorrect spatial registration on behalf of the relevant authorities might have occurred. Unfortunately, no other source of river dataset exists in Greece, except for the aforementioned. Subclass G30 (Coastal water bodies) is described only by the CORINE Land Cover data set and matches at 46% with LUCAS 2012 survey (13 points).

Main Category H (WETLAND)

The main category H, is represented only by the CORINE Land Cover data set, achieving a 26% identification. Unfortunately no other data set describes the wetlands.

7.3 Quality assessment for land cover

Comparison

According to LUCAS 2012, 7.821 sample points were considered nationwide. The percentage of matching of the available National data sets is presented in table 7.3.1. The largest matching percentage was achieved by main category B, where LPIS had every arable land registered in Farmers' Statements data set. Lower rates were achieved in the remaining classes with A, C, D and G reaching at about 50% and E, F, H getting rates lower than 25%.

Πίνακας 7.3.1. Matching Percentage of National data sources and LUCAS land cover 2012.

Classes	Number of points	Percentage of matching
A	232	43,34%
B	2080	94,23%
C	2082	49,38%
D	2005	48,48%
E	1030	20,00%
F	156	10,26%
G	105	50,48%
H	40	25,00%

The main categories with low matching percentage with LUCAS 2012 points, show the lowest reliabilities and accuracies. Especially Grassland (E), Bare Land and Lichens/Moss (F) and Wetland (H) main categories.

Table 7.3.2. Frequency of Main Categories mismatch with LUCAS 2012 survey points.

Main Categories Land Cover Hybrid Map	Main Category with Greatest Mismatches	Frequency of Mismatch
A	E	39/240
B	C	162/3,021
C	D	153/2,140
D	C	391/1,582
E	D	333/757
F	D	25/125
G	H	4/77
H	D	5/28

As it can easily been understood just by looking at the harmonization table of the available national data sets wits LUCAS LC (Table 7.1.1 and Table 7.1.2), all LC main categories, except the main categories B, and C, provide no depth of information except the first level. LC classes and subclasses could not be described in detail by the available national data sets. By comparing tables 7.3.1 and 7.3.2 one can realize that the percentage of matching even at the first level of identification is not large enough for further exploration. The subclasses that hold a serious amount of matching is B81 (Olive Yards) and B82 (Vineyards). They both constitute the greatest percentage of B main category area. These 2 subclasses were the only who show potentials on investigating deeper at the level of detail.

The following examples show some of the most regular mismatches between Greek Hybrid Land Cover Map and the LUCAS 2012 survey points. Each image depicts the Greek Hybrid Land Cover Map with on top the LUCAS survey point with LUCAS class (different color).

Figure 7.2. Mismatch between Cropland (B) and Woodland (C) Main Categories. LUCAS 2012 point was on the edge of a B82 polygon according to Land Cover Hybrid Map.

Figure 7.3. Mismatch between Artificial Land (A) and Grassland (E) Main Categories. LUCAS 2012 point taken land cover as it is (road) but on the other side Land Cover Hybrid Map did not include that information.

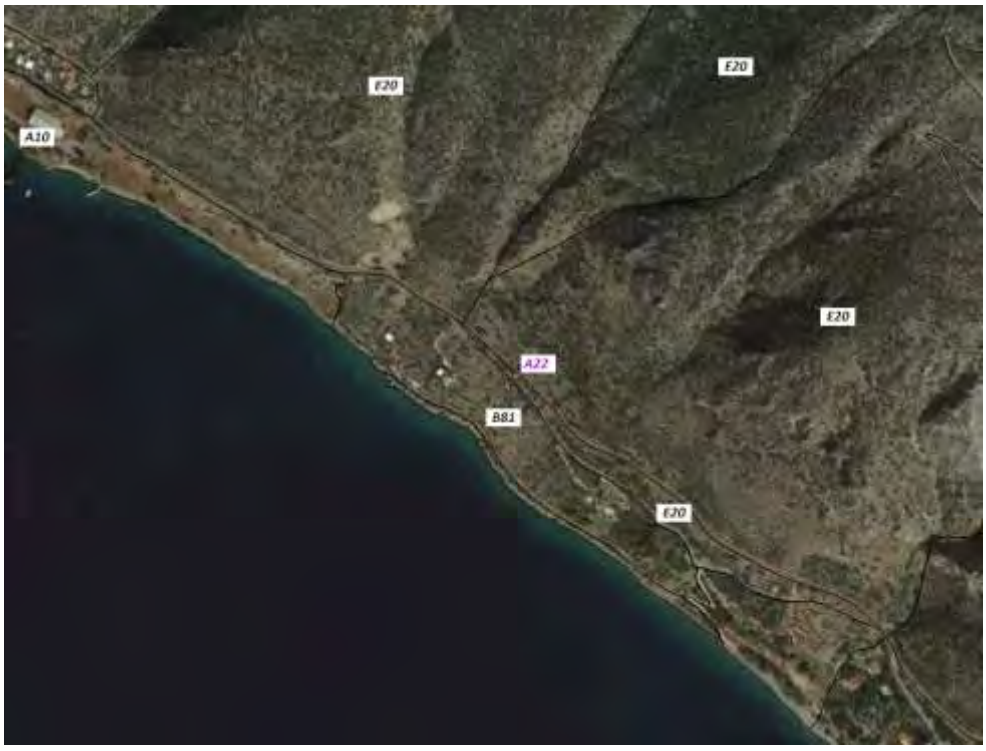


Figure 7.4. A classic mismatch between Woodland (C) and Grassland (E) Main Categories. LUCAS 2012 point (C23) is characterized as other coniferous woodland (C23) but it is in grassland without tree/shrub cover (E20) polygon.

Figure 7.5. Mismatch between Cropland (B) and Grassland (E) Main Categories. LUCAS 2012 point was shown B81 (olive grove) instead of E20 (grassland without tree cover) according to Land Cover Hybrid Map.

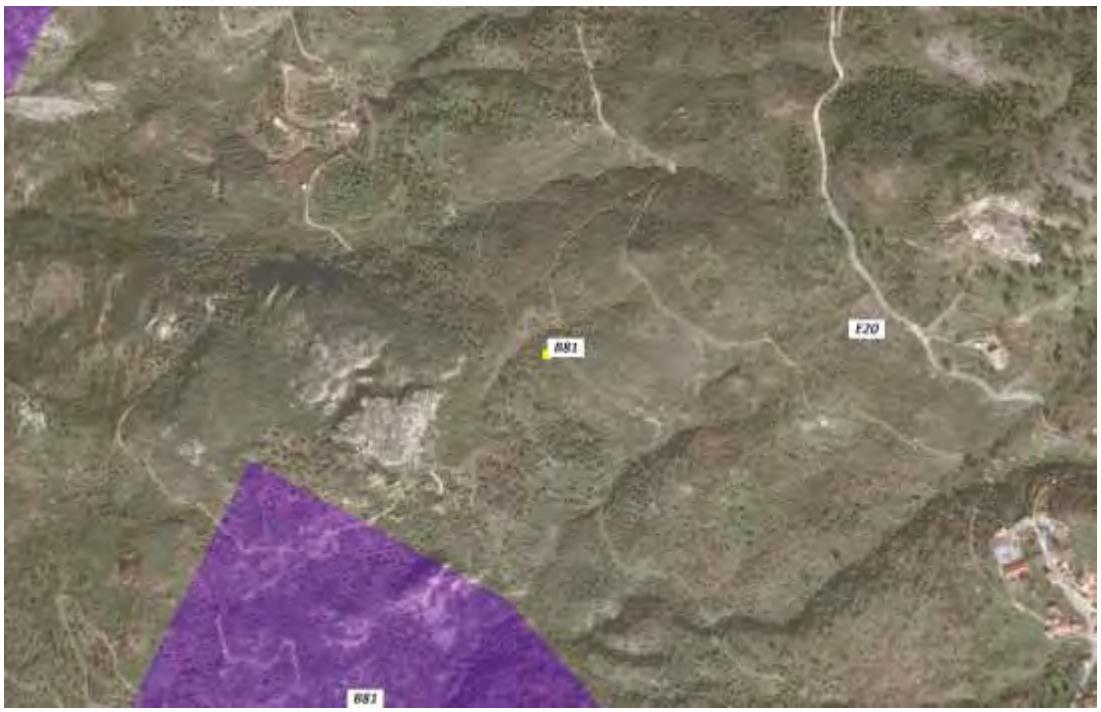


Figure 7.6. A classic mismatch between Shrubland (D) and Grassland (E) Main Categories. LUCAS 2012 point characterized as D20 (shrubland without tree cover) while the Land Cover Hybrid Map shown E20.

Figure 7.7. A mismatch between Woodland (C) and Shrubaland (D) Main Categories. LUCAS 2012 pointed a D20 (shrubland without tree cover) while the Land Cover Hybrid Map shown C.

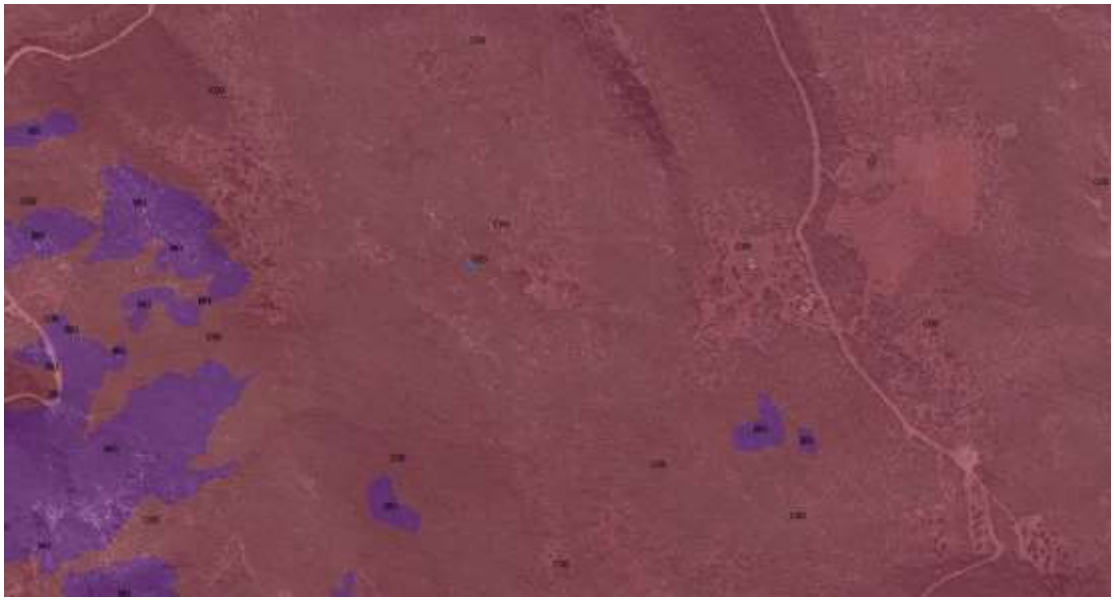


Figure 7.8. A detail that shows low detail on Land Cover Hybrid Map. LUCAS 2012 shows A21 (Non built-up area feature).

Figure 7.9. An image where a rushed judgment of LUCAS' 2012 surveyors is depicted. LUCAS point is on the land (C00- Woodland) while surveyor marks the inland water body (G10).

Most of the above figures reveal the difference between a point and a polygon survey/project. Even if most of the times LUCAS points are giving the right image of the ground, there are several cases where the surveyor ignored the environment of the point and clearly registered the land cover class of the point. In other cases it is profound that the surveyor got carried away by the environment of the point, that despite the size of the area surrounded the point, he registered a different land cover class.

The following examples show the precision of the Greek Hybrid Land Cover Map.

Figure 7.10. Lake Hylice and the surrounding area.

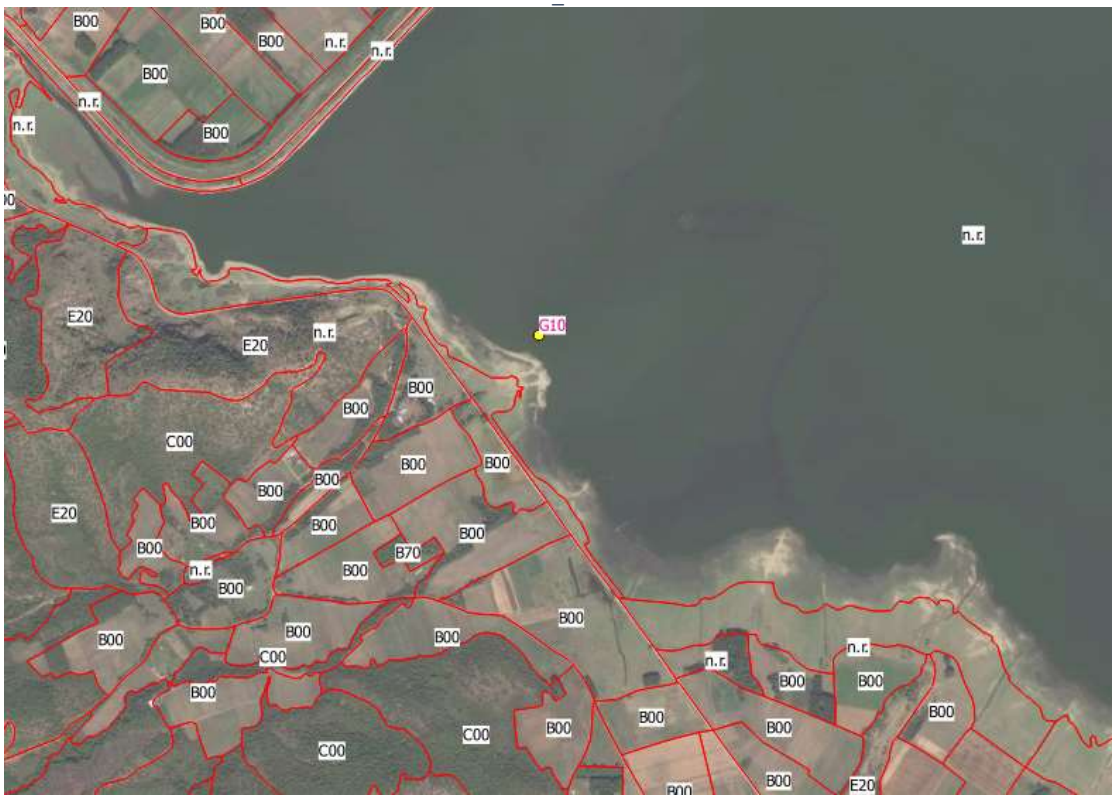
Figure 7.11. Semi-agricultural area in Klitoria.

Figure 7.12. Costal mixed landscape on Agios Vasilios.

Figure 7.13. An urban view of the Land Cover Hybrid Map.

Figure 7.14. A mixed agricultural area.

Figure 7.15. A mixed agricultural, forest and water area.



7.4 Land Use Harmonization Tables and Hybrid Map

Table 7.4.1 and Table 7.4.2 show the harmonisation between the available data sets' classes and LUCAS land use classes. The main role in the production of land use hybrid map was undertaken by CORINE Land Cover data set providing data for 9 of the LUCAS classes. Urban Atlas, LPIS and Forests' Archive data sets follows.

For the calculation of the land use main categories the same pattern with the land cover was followed. The majority of the classes of the available data sets directly matched the classes (at the main category level) of LUCAS, provided that they complied with the standards and the common description of each of the classes.

According to the developed ArcGIS toolbox a final Land Use Hybrid Map was prepared for LUCAS Main Land Use Categories (Figure 7.16).

Table 7.4.1. Harmonisation of available great data sets with LUCAS land use classification system.

LAND USE- Great Data Sets									
Land Use Classes	Description	Classes							
		CORINE	LPIS COVER ID	Farmers' Statements CROP CODE	Urban Atlas	GAEC	Special Secretariat for Forests	ELSTAT	Roads (NCMA)
U110	Agriculture				20000				
U111	Agriculture (excluding fallow land and kitchen gardens)	211,212,213,221,222,223,241	40, 41, 50, 51, 60, 61, 70, 71	1.1, 1.2, 2, 3, 4, 5, 6, 7, 7.1, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25.1, 25.2, 25.3, 26, 27, 28.1, 28.2, 29, 31, 32, 33, 34, 35, 36.1, 36.2, 36.3, 37, 38.1, 38.2, 39, 40, 41, 43 45.1, 45.2				Buildings	
U112	Fallow land					1, 2			
U113	Kitchen garden					11			
U120	Forestry	311, 312, 313, 321, 322, 323, 324	10, 11, 12, 30, 31, 32, 33		30000		All classes refer to forestry except ΟΙΚ, ΛΙΜ, ΛΧΡ		
U130	Aquaculture and Fishing								
U140	Mining and Quarrying	131			13100				
U150	Hunting								
U210	Energy production			16					
U220	Industry and Manufacturing				12100				
U221	Manufacturing of food, beverages and tobacco products								
U222	Manufacturing of textile products								
U223	Coal, oil and metal processing								
U224	Production of Non-metal mineral goods								
U225	Chemical and allied industries and manufacturing								
U226	Machinery and equipment								
U227	Wood based products								
U310	Transport, communication networks, storage, protective works	122							
U311	Railways				12230				
U312	Roads				12210, 12220				
U313	Water transport	123			12300				
U314	Air transport	124			12400				
U315	Transport via Pipelines								
U316	Telecommunication								
U317	Storage								
U318	Protection works					12			
U320	Water and Waste Treatment								
U321	Water supply and treatment								
U322	Waste treatment								
U330	Construction	133			13300				
U340	Commerce, Finance, Business								
U350	Community Services								
U360	Recreation, Leisure, Sport	142			14200				
U361	Amenities, museums, business								
U362	Sport								
U363	Holiday camps								
U364	Nature reserves								
U370	Residential	111, 112	20, 21		11100, 11210, 11220, 11230, 11240, 14100		ΟΙΚ	Blocks	
U400	Unused and Abandoned Areas								
U410	Abandoned Areas		92						
U412	Semi-natural and Natural areas not in use								
Non Compatible Classes		121, 132, 141, 231, 242, 243, 244, 311, 331, 332, 333, 334, 335, 411, 412, 421, 422, 423, 511, 512, 521, 522, 523	14, 91 (contains roads and water bodies), 90		50000, 13400, 11300	3, 4, 5, 6, 7, 8, 9, 10, 13	ΛΙΜ, ΛΧΡ		
Symbology	**Overlapping Datasets (they are produced by different services, they have different classes but they conern the same type of land use)**								

Table 7.4.2. Harmonization of available specific data sets with LUCAS land use classification system.

LAND USE- Specific Data Sets								
Land Use Classes	**Description**	KOSE 2012 ID Numbers						
		Ministry of Envinorment, Energy and Climate Change	Organisation of Cadastre and Mapping of Greece	Ministry of National Defense	Ministry of Labour and National Insurance	Hellenic Statistical Authotity	Ministry of Rural Development and Food	Special Secretariat for Forests
U110	Agriculture						1, 2, 3	
U111	Agriculture (excluding fallow land and kitchen gardens)							
U112	Fallow land							
U113	Kitchen garden							
U120	Forestry	26, 27, 28, 30						
U130	Aquaculture and Fishing	414						
U140	Mining and Quarrying	413		216, 217				
U150	Hunting							
U210	Energy production	11, 25, 287, 292, 293, 295, 297						
U220	Industry and Manufacturing	37		216, 217				
U221	Manufacturing of food, beverages and tobacco products							
U222	Manufacturing of textile products							
U223	Coal, oil and metal processing							
U224	Production of Non-metal mineral goods							
U225	Chemical and allied industries and manufacturing							
U226	Machinery and equipment							
U227	Wood based products							
U310	Transport, communication networks, storage, protective works							
U311	Railways							
U312	Roads							
U313	Water transport							
U314	Air transport			192				
U315	Transport via Pipelines							
U316	Telecommunication							
U317	Storage						5	
U318	Protection works							
U320	Water and Waste Treatment							
U321	Water supply and treatment						5	
U322	Waste treatment							
U330	Construction							
U340	Commerce, Finance, Business							
U350	Community Services							
U360	Recreation, Leisure, Sport							
U361	Amenities, museums, business							
U362	Sport							
U363	Holiday camps							
U364	Nature reserves		1495				28, 60, 61, 62, 63, 64, 66	
U370	Residential	167			54	61, 62, 63, 64, 66		
U400	Unused and Abandoned Areas							
U410	Abandoned Areas				55, 85			
U412	Semi-natural and Natural areas not in use							
Symbology	**Overlapping Datasets (they are produced by different services, they have different classes but they conern the same type of land use)**							

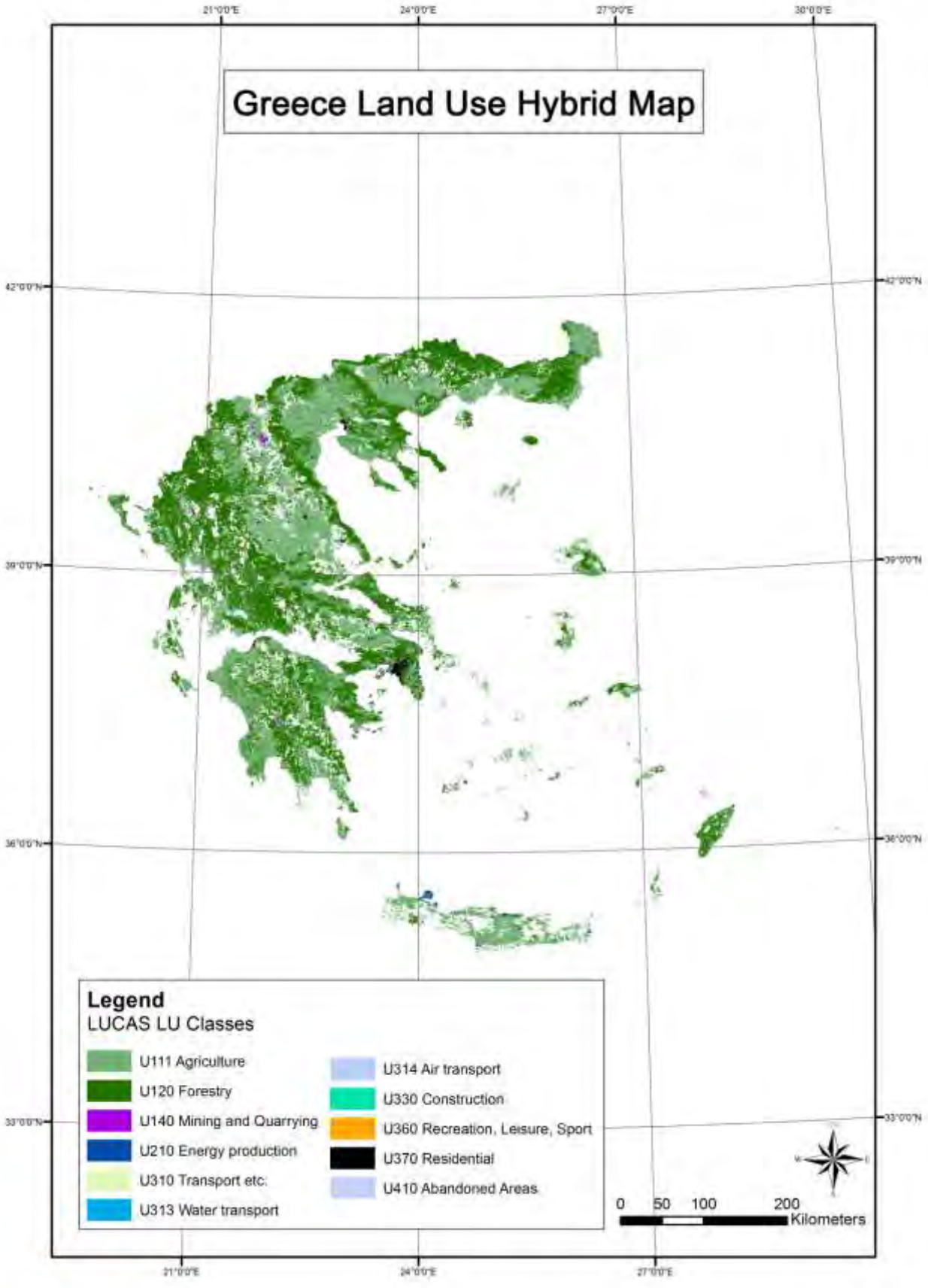


Figure 7.16. Land Use Hybrid Map based mainly on existing National data sets.

Table 7.4.3. The Land Use main categories statistics for the administrative regions (NUTS2) of Greece.

Administrative Regions of Greece	**Total Area (ha)**		**LUCAS Land Use Main Categories**								
			U111	U120	U140	U210	U310	U330	U360	U370	U410
East Macedonia and Thrace	1,416,781.70	Percentage	33.28%	50.13%	0.11%	0.15%	0.08%	0.09%	0.00%	1.15%	2.13%
		Area	471,507.77	710,171.33	1,559.90	2,179.12	1,164.78	1,327.75	26.15	16,292.71	30,207.89
Central Macedonia	1,881,852.16	Percentage	44.99%	41.47%	0.08%	0.42%	0.08%	0.08%	0.04%	2.70%	1.56%
		Area	846,636.80	780,316.78	1,475.46	7,991.13	1,464.09	1,429.30	749.56	50,801.16	29,281.24
West Macedonia	946,487.41	Percentage	27.65%	46.06%	1.09%	0.80%	0.07%	0.05%	0.01%	0.95%	1.37%
		Area	261,656.53	435,954.28	10,317.94	7,602.00	640.11	467.85	86.10	8,957.23	12,953.87
Epirus	916,575.72	Percentage	15.30%	64.31%	0.14%	0.08%	0.05%	0.13%	0.02%	1.55%	3.79%
		Area	140,261.18	589,469.03	1,251.25	765.66	444.47	1,178.86	143.99	14,178.68	34,718.10
Thessaly	2,077,918.56	Percentage	25.33%	23.38%	0.03%	1.22%	0.07%	0.04%	0.03%	1.38%	1.03%
		Area	526,336.76	485,811.18	549.53	25,354.15	1,393.85	749.57	615.95	28,713.15	21,500.25
Ionian Islands	230,578.51	Percentage	35.08%	39.13%	0.07%	0.01%	0.17%	0.00%	0.22%	0.03%	1.79%
		Area	80,892.36	90,215.98	160.97	25.37	400.00	0.00	517.53	63.16	4,126.59
West Greece	1,131,583.73	Percentage	33.61%	42.19%	0.02%	0.24%	0.11%	0.04%	0.05%	1.35%	4.32%
		Area	380,359.73	477,364.62	191.78	2,753.18	1,290.82	413.69	614.21	15,259.78	48,891.11
Central Greece	1,554,908.33	Percentage	27.38%	47.92%	0.29%	0.45%	0.11%	0.14%	0.05%	0.96%	2.01%
		Area	425,769.11	745,114.52	4,553.64	6,935.07	1,733.01	2,221.54	818.23	14,959.47	31,327.11
Attica	381,176.37	Percentage	25.05%	42.37%	0.43%	1.74%	0.72%	0.82%	0.51%	27.53%	0.92%
		Area	95,469.54	161,501.66	1,621.65	6,641.84	2,737.97	3,129.22	1,954.71	104,938.32	3,491.30
Peloponissos	1,548,874.45	Percentage	31.85%	48.17%	0.21%	0.44%	0.13%	0.05%	0.03%	0.99%	1.65%
		Area	493,372.92	746,104.58	3,188.91	6,770.72	2,082.82	753.55	520.37	15,291.41	25,522.59
South Aegean	531,202.17	Percentage	20.49%	20.92%	0.32%	0.30%	0.17%	0.11%	0.17%	1.21%	4.68%
		Area	108,824.68	111,125.10	1,682.37	1,596.76	894.43	563.70	888.26	6,416.42	24,882.38
North Aegean	383,661.64	Percentage	32.19%	22.44%	0.06%	0.85%	37.74%	0.00%	0.01%	0.89%	2.63%
		Area	123,515.51	86,090.64	243.95	3,256.60	144793.00	0.00	53.92	3424.01	10097.36
Krete	832,346.22	Percentage	37.97%	6.30%	0.05%	15.13%	0.05%	0.06%	0.13%	1.66%	3.02%
		Area	316,005.57	52,424.82	441.51	125,935.77	381.67	460.59	1,078.98	13,821.87	25,099.09
Greece	13,194,186.82		32.35%	40.96%	0.21%	1.50%	0.07%	0.10%	0.06%	2.26%	2.05%

Based on the Land Use Hybrid Map area, final results and statistics for the LUCAS main categories are presented for Greece in Table 7.4.4 and also for each administrative region (NUTS2 level) in Table 7.4.3. Area in hectares according to the requested LUCAS project classification system. Based on Table 7.4.4 the 81.4% of the total area of Greece is covered by the Land Use main categories.

Table 7.4.4. The rate and extent of coverage of the main land use categories through national datasets.

Main Categories	Total Area (ha)	Percentage of Total Greece Area
U111	4,270,608.44	32.37%
U120	5,471,664.52	41.47%
U140	27,238.86	0.21%
U210	197,807.38	1.50%
U310	159,421.01	1.21%
U330	12,695.61	0.10%
U360	8,067.95	0.06%
U370	293,117.39	2.22%
U410	302,098.87	2.29%
Total Area (National Data Sources)	10,742,720.02	81.42%
Greece	13,194,186.82	100.00%

7.5 Quality assessment for land use comparison

As shown in table 7.5.1 the matching, of the available national data sets with LUCAS 2012 survey points, was rather poor. More specifically, categories U120 and U370 were overestimated, while U310 and U330 did not manage to reach even the slightest rate of 1%. Moreover, U360 achieved a small percentage of matching, U140 was mediocre and U111 reached 70%. Lastly, U210 and U410 achieved a perfect matching.

Table 7.5.1. Matching Percentage of National data sources and LUCAS land use 2012.

Main Categories LUCAS	U111	U120	U140	U210	U310	U330	U360	U370	U410
Percentage of matching	70.89%	152.53%	42.11%	100.00%	0.56%	0.00%	12.77%	177.1%	100.00%

8 Integration of a national in-situ data collection survey with the LUCAS requirements for the reference year 2015.

The previous analysis has shown that there are major problems in some national data sets which hinder their use to cover LUCAS needs. These problems concern both the lack of matching of LC/LU classes with LUCAS classes and spatial matching problems of boundaries between the different data sources. For that reason and in order to integrate a national data collection system with LUCAS requirements some concrete steps should be followed.

8.1 LPIS approach to LUCAS

LPIS is the greatest most frequently updated data set of Greece, updating entirely every 3 years and specifically the agricultural land use categories (Farmers' Statements) each year, so we strongly believe that this data set should become the fellow tool for Eurostat, in order to produce the future LUCAS data and statistics. In order LPIS to become the main national land cover / land use several actions should be made.

As far as it concerns main category Artificial Land (A), class 20 (urban), 21 (urban mixed) and 91 (roads – water) of LPIS should evolve their characteristics and expand into LUCAS classes and subclasses. "Urban" can describe all A (artificial land) subclasses, by adding the features of buildings and the number of their floors. Greenhouses and roads are included in other categories of LPIS so they can be included and complete main category A.

Main category Cropland (B) is described in detail by the Farmers' Statement data set, which is a subset of LPIS, managed by OPEKEPE. As described in previous chapter, the Farmers' Statements dataset will be produced as long as European agricultural subsidies continue to exist. Certain species are not well expanded in subspecies (e.g. citrus fruits), but this can be easily changed if demanded. Main category B should contain a higher level of detail especially on non-permanent industrial crops (B30) and on fruit trees and berries (B70).

Main category Woodland (C) is just described by LPIS as forest and mixed forest areas. The depth of information concerning main category C, was provided be the Forests' Archive data set. For future connivance, LPIS data set should adopt a more detailed description of main

category C subclasses. C main category's needs could be realised by using orthophoto imagery and remote sensing supervised classification, avoiding expensive in situ surveys.

Main category Shrubland (D) is usually confused with main category E. A livestock farmers' sub set could be created in order to clarify the grassland areas, where no land cover changes are expected, because of the overgrazing. Shrubland is a common landscape in Greece for two main reasons, the anhydrous areas and seasons and the constant fires. Every summer, great forest areas are transformed into bare land or into shrubland. An annual fire extend data set provided by the national observatory of Athens could abet LPIS in discovering and successfully register shrubland and bare land after fire incidents.

Main category Grassland (E), as described above should be developed with the establishment of a livestock farmers' statements' data set.

Main category Bare Land and Lichens/Moss (F), as noted during this project, is included inside class 93 (others) of LPIS. Bare lands could be added as a separate category on LPIS and could be identified by remote sensing unsupervised classification. Lichens / moss are not so often met in Greece.

Inland water bodies (G10) and wetlands (H10) are also frequently confused, as witnessed during this project. The greatest proportion of water bodies is contained in geodata.gov.gr, geospatial data portal. The drawback in Greece is that during late summer and autumn, the majority of the steams, canals and rivers are withered. Due to this situation, no safe results could be extracted for the exact amount or size of the inland water bodies in Greece.

In order to conduct an in-situ LPIS survey according to LUCAS requirements, the adoption of all the following proposals should be made.

Compliance of every LPIS class to LUCAS requirements.

- Every main category should be developed in order to create a wider spectrum of data information as stated above.
- A new data base must be created, following the LUCAS data set environment. The IT Department of OPEKEPE will be required to refresh LPIS data base in order to include the new categories/classes, needed for the LPIS harmonisation with LUCAS. According to our experience at least a month is required for the transformation, harmonisation and testing of the new data base.
- The surveyors, who are responsible for the data collection, should be trained in accordance with LUCAS classification system. The training program should last at

least 2 weeks in order to clarify all the details and the differences between in class/category.

- Data operators at last should be trained also, in a program that differs from the surveyors, in order to use the utmost of the harmonized data set.

8.2 Farmers' Statements approach to LUCAS

Farmers' Statements is the most frequently updated data set of Greece, updating every year, including only agricultural land use classes.

Farmers' Statements data set is a subset of LPIS, managed by OPEKEPE. As described in previous chapter, the Farmers' Statements dataset will be produced as long as European agricultural subsidies continue to exist. Certain species are not well expanded in subspecies (e.g. citrus fruits), but this can be changed if demanded. Main category Cropland (B) should contain a higher level of detail, especially on non-permanent industrial crops (B30) and on fruit trees and berries (B70), as mentioned above.

In order to conduct the Farmers' Statements survey for the year 2015, according to LUCAS requirements, the adoption of all the following proposals are suggested.

- Compliance of every Farmers' Statement class to LUCAS main category Cropland (B) requirements. Every subclass of main category B should be developed/collapsed in order to create a wider spectrum of data information as specified above.
- An expanded database must be created, following the LUCAS main category B subclasses. The IT Department of OPEKEPE will have to update the Farmers' Statements database in order to include the new categories/classes, needed for the Farmers' Statements harmonisation with LUCAS. Probably a month is required for the transformation, harmonisation and testing of the new database.
- The surveyors, who are responsible for the data collection, should be trained in accordance with LUCAS classification system. The training program should last at least 1 week in order to clarify all the details and the differences between classes/categories.
- At last data operators should be trained also, in order to use effectively the harmonized data set.

8.3 Forests' Archive approach to LUCAS

Forests' Archive is the most detailed data set of Greece, including forestry land use classes.
Forests' Archive data set is a data set belongs to from the Special Secretariat for Forests of the Ministry of Environment Energy and Climate Change. As described in previous chapter, the Forests' Archive dataset was created by black & white or colored orthophotomaps dated from 1965 to 1991. The archive became available in digitized form in 1999. The National Cadastre & Mapping Agency S.A. has launched (2012) a new forest mapping program regarding almost the 80% of the total forest and forestlands area of Greece. These new data will be available in two years.
In order to conduct the next forest mapping program, according to LUCAS requirements, the adoption of the following proposal is suggested.

- Compliance of every Forests' Archive's subclass to LUCAS main category C requirements. Every subclass of main category C should be developed/collapsed in order to create a wider spectrum of data information as specified above.

8.4 ESYE Blocks and Buildings approach to LUCAS

ESYE Blocks and Buildings is the most detailed data set of Greece, concerning residential areas (over 2,000 inhabitants) updating every 10 years, including city blocks and buildings.
Latest update was conducted on 2011 and about the future update (on 2021) the adoption of all the following proposal are suggested, in order to keep up with LUCAS requirements.

- Specification on the number of floors of each building. LUCAS main category A requires the differentiation between the buildings with one to three floors and the buildings with more than three floors.
- Thus a new database must be created, accompanying the number of floors and the spatial information of every building.

8.5 General Information

No national data set describes wetlands. Most of these areas are either included in water bodies main category or in the "other" class of LPIS. A certain description and characterisation would assist wetlands' identification and isolation.

As far as it concerns land use categories, public authorities should adopt the Law 3882/2010 and release for free, managed by KOSE, data sets, that provide greater accuracy in "great" data sets such as the LPIS. Only 3 land use classes can be described with ease by extracting features from the LPIS dataset. These are the agricultural, residential and forest classes.

According to the Law 3882/2010 the geospatial data portals geodata.gov.gr and data.gov.gr were designed to be data collection points, distribution and display centers of free public geospatial information. Although from the time of their creation, not any significant addition has been made to the base data sets.

9 Feasibility and sustainability of possible subsequent data deliveries (update cycle)

9.1 Technology and system feasibility

Greek Land Use/Cover datasets can be distinguished in two categories concerning the compatibility of their classes with LUCAS classes: a) datasets that all their classes are compatible with LUCAS classes and b) datasets that one or more classes are not compatible with LUCAS. All Land use/cover data sets of Greece along with their classes separated into compatible and non-compatible are depicted in the Tables 7.1.1, 7.1.2, 7.4.1, 7.4.2 (“LAND COVER - Great Data Sets”, “LAND COVER - Specific data sets”, “LAND USE - Great Data Sets”, “LAND USE - Specific Data Sets”).

Concerning the datasets of the above first category (a) and the classes of the datasets of the second category (b) that are compatible with LUCAS classes it can be noted that by using the appropriate scripts (written in Python for ArcPy library), the production of national statistics based on the harmonization of national data is easily achievable. As long as the user chooses the same data field that was used to harmonize the initial data sets, he/she will easily produce class statistics or harmonized LUCAS classes on the desirable data set. In this way, converting compatible classes to LUCAS classes will be considerably faster and efficient.

Concerning the classes of the datasets of the above second (b) category that are not compatible with LUCAS a methodology concerning their feasibility study has been developed for the needs of the current project. The methodology was based on the analysis made for two major (big) land use and cover data sets: a) the Land Parcel Identification System (LPIS) and b) the Farmer Statements for the Single Payment Scheme. According to the results of

the analysis the variables that increase the total budget of the data set production in order to harmonize the non-compatible classes, are: a) the number of the non-compatible classes as percentage of the total classes of the data set (NNCC%), b) the average number of polygons that the non-compatible classes have as percentage of average of the number of polygons of all the classes of the data set (NPNCC%) and c) the average perimeter of the polygons of the non-compatible classes as percentage of the average perimeter of the polygons of the data set (PPNCC%).

9.2 Economic feasibility

Concerning the first category of data sets (a) and the classes of the second category (b) that are compatible with LUCAS classes, the scripts for applying the procedure for deriving national statistics are already available. Consequently, these scripts can be applied to a new data set, having the same format, at no cost. A rough estimation on the time needed for an update of statistics harmonised with national data is about 80 hours. No main constraints in terms of personnel, expertise and technological infrastructure are foreseen if capacity can be assigned and financial costs will be covered.

Concerning the classes of the second category that are not compatible with LUCAS and according to the methodology described above, the cost for harmonizing the non-compatible classes would increase the total cost of the data set production according to the equation: 0,5*(NNCC%* NPNCC%*SPNCC%)*TOTAL BUDGET. It must be mentioned that if the same data set contains land use as well as land cover classes, then the non-common non-compatible classes are only estimated once and further shall be added in the NNCC% indicator.

9.3 Legal feasibility

According to the Greek Law 3882/2010 which embodies the Inspire Directive (2007/2/EC) within the Greek Legislation, the Mapping and Cadastral Organization of Greece created a working group called ΚΟΣΕ (Focal Points of Contact) which:

a) Harmonizes standards and practices for the collection, production, procurement, management, sharing and distribution of geospatial data and

b) Allows automated sharing of geospatial data on the environment (e.g. NATURA 2000) as required by the Directive 2007/2/EC (INSPIRE) which provides a framework of interoperability and specifications.

As investigated by the working teams of the Project in Greece, the following results concerning the Legal Feasibility ought to be reported:

1. The total number of sources of Land use/cover in Greece reaches 95 , of which:
    i. No restrictions has been reported for 29 of them (30.5 %)
    ii. Fee for accessing their data has been reported for 13 of them (13.7%)
    iii. No reference on how data can been accessed has been reported for 23 of them (24.2%)
    iv. No rule establishment on how data can been accessed has been reported for 9 of them (9.5%)
    v. Access to authorized users only has been reported for 2 of them (2.1%)
    vi. Access limitations due to personal data protection has been reported for 19 of them (20 %)

    Access conditions concerning all Land use/cover are presented in ANNEX I

2. Geodata.gov.gr is one of the Greek Government's "*open government"* initiatives in the framework of the Open Government Partnership, providing an open data repository for the provision of geospatial information.

3. Especially for the Big Data Sets the access has been reported as follows:
    - Land Parcel Intensification Systems (LPIS): no restrictions to the data access
    - Farmers' statements for the Single Payment Scheme: Access limitations due to personal data protection
    - Good Agricultural and Environmental Condition (GAEC): no restrictions to the data access
    - Forestry data set: no restrictions to the data access

9.4 Operational feasibility

At the first steps of the project a careful collection of national spatial datasets was completed. Two 8-member teams were reaching several sources of data sets and were collecting their metadata. The data sets were evaluated according to their significance for Land use/cover based on relevant criteria. The selection and the collection of the most useful datasets along with the management of their use in providing land use/ land cover statistics into LUCAS compatible harmonized classes followed.

The catalogue of KOSE's concerning the geospatial data was useful concerning the metadata and the descriptive characteristics of the datasets whilst difficulties were faced in obtaining

the data. Additionally legal issues concerning access, communication and bureaucratic problems were revealed during data gathering.

Concerning the "great data sets" that are significant for producing land use / cover statistics for Greece are:

i. LPIS is the most frequently updated national dataset and the only one that covers entire Greece in detail. Initiatives should be taken to decline bureaucracy and legal issues and facilitate access to data.

ii. Farmers' statements dataset is focused on the agricultural land use. The farmers' statements dataset will be produced as long as European agricultural subsidies continue to exist. The weak point of this dataset is that it covers only the agricultural and animal breeding domain which cover about half the area of Greece.

iii. ElStat's datasets (blocks and buildings) are focused on the residential land use. The dataset is updated every 10 years but the exported data or statistics are not published for free.

iv. Good Agricultural and Environmental Condition (GAEC) covers specific areas of environmental interest such as retain terraces, draft stops etc. Its weak points is the limited area coverage and the sparse updating.

Several problems exist between the statistics coming from the LUCAS 2012 survey and the national datasets. Especially in class matching and harmonization there is a big change that should be done in Greek land use / land cover data sets. More specifically the techniques and methods followed by the biggest and most important data sets (ILOTS – Farmers' statements) should be harmonized to concur with LUCAS classes.

However, it is evidenced that the combinations of the spatial data coming from the national datasets will improve Land Use/Cover statistics if compared to the national LUCAS statistics as derive from the LUCAS survey data.

9.5 Schedule feasibility

LPIS is updating entirely every three years. The non-compatible classes of this data set will be eliminated during the next update since the new specifications change all non-compatible classes.

Every year statistics could be produced by the Farmers' statements as the update of the dataset is annual. The non-compatible classes that correspond to the 8,5% of all classes only for land cover (all land use classes are compatible) will be indicated to the Paying Agency (OPEKEPE.) which is responsible for the data set in order to address the problem.

ElStat's datasets (blocks and buildings) statistics can be produced annually since many but light changes are brought about every year.

Good Agricultural and Environmental Condition (GAEC) statistics are to be produced every 5 years which coincides with the dataset update.

Corine land cover data is not taken into consideration, as the last update of the dataset has not been completed during the last 8 years. Therefore the statistics can only be produced through Corine when it is completed.

As revealed by the attached tables, 98% of the land use and cover classes of all “great data sets” of Greece are compatible or has been “translated” into LUCAS class through the application developed for the purposes of the current project. Annual statistics can be produced two months after the main datasets are issued with relatively low cost.

The remaining 2% of the classes which are not directly or indirectly compatible with LUCAS have been indicated and the cost for gaining compatibility has been also estimated through the present study.

The results of the study concerning the source of the datasets will be officially published and technical assistance will be offered, if it is required, so that decisions will be taken on the feasibility and sustainability of possible subsequent data deliveries.

10 Action list of future activities

Public authorities ought to adopt the provisions of Law 3882/2010 and make freely available, those data sets (managed by KOSE) which provide greater accuracy in "great" data sets such as the LPIS, blocks and buildings of ELSTAT etc.

The geospatial data portal geodata.gov.gr was initially designed as a data collection point, distribution and display center of free public geospatial information. However starting from 2012 and onwards, no addition to the base data sets has been made.

11 ANNEX I National Land Use / Land Cover Data Sets

See attachment pdf file ANNEX I ---- NATIONAL LU & LC DATA SETS

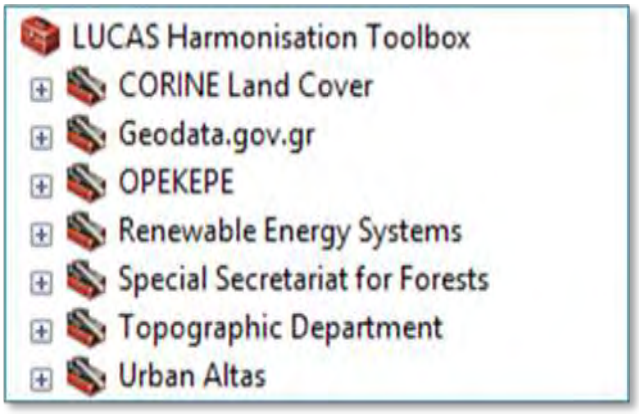
12. ANNEX II Presentation of the spatial tool that integrates different data sources to support the LUCAS land cover methodology and the results of this system.

Within the scope of this project, the LUCAS Harmonization Toolbox was developed, via which the user can automatically convert the authority's classification system into LUCAS classification system, just by selecting the authority responsible for the data.

12.1 The available national data sources harmonization toolbox.

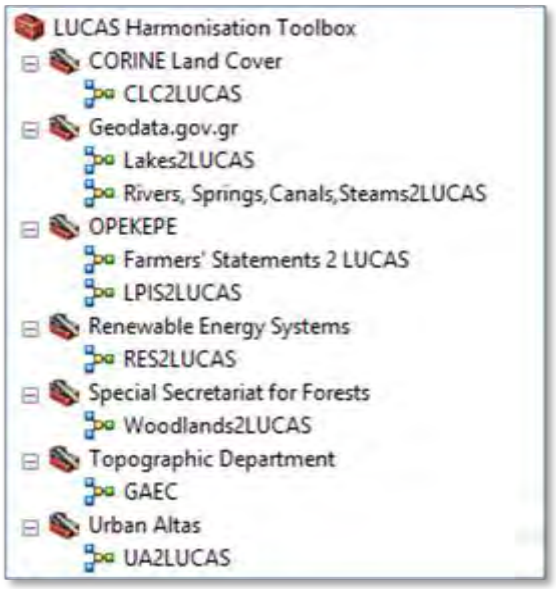
At the image below the harmonization model of national geospatial data bases developed for each of the authorities is presented. The models were created under the Model Builder Environment of ArcGIS.

Image 10.1. LUCAS Harmonisation Toolbox menu.



The following image shows the developed submenus of the toolboxes of each authority.

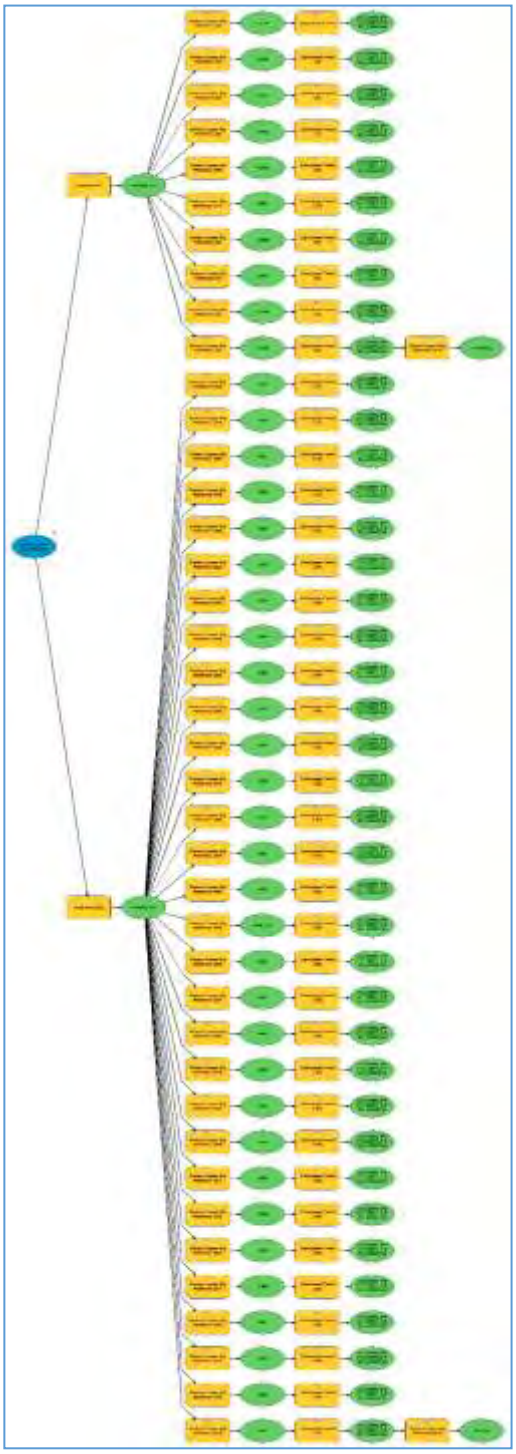
Image 10.21. Developed LUCAS Harmonisation Toolbox menu.

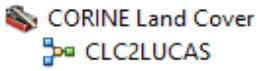


For each authority at least one tool– model is assigned serving the harmonization of its spatial data base with the LUCAS classification system.

12.2 Individual presentation of national spatial data bases and models' harmonization with LUCAS classification system.

CLC2LUCAS refers to the harmonization of CORINE Land Cover system to LUCAS classification system.





The Image on the left, schematically shows the process followed by the model, each time a user chooses to boot CLC2LUCAS tool for acquiring LUCAS classes.

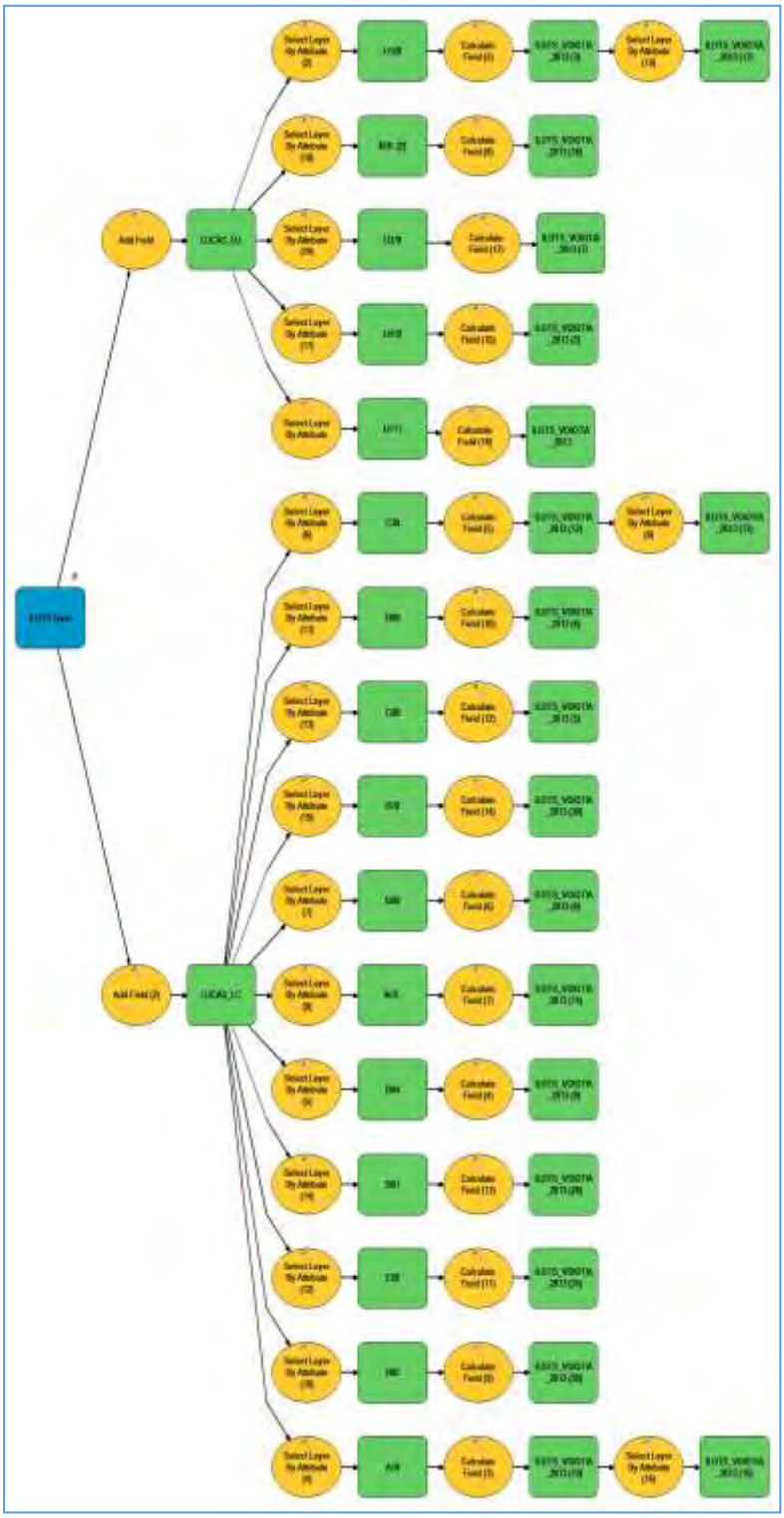
The model creates two fields at the already existing input file. One field called LUCAS_LC (text, 5 character length) and another called LUCAS_LU (text, 5 character length). Following, through the recognition of the classes of the imported file, the model proceeds with a separation and ultimately properly harmonizes according to the selected encoding (explained above in harmonization table) with LUCAS land use and/or land cover classes.

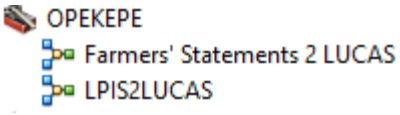
The script written in python programming language, according to which the harmonization model functions, can be found at the accompanying "CLC2LUCAS.py" file.

Warning: CLC2LUCAS will run only if the field "CODE_00" is found in the Corine Land Cover Shapefile, entered by the user.

LPIS2LUCAS and Farmers' Statements tools refer to the harmonization of the OPEKEPE database with LUCAS classification system.

The figure below shows the process followed by the model, each time a user chooses to boot LPIS2LUCAS tool for acquiring LUCAS classes.



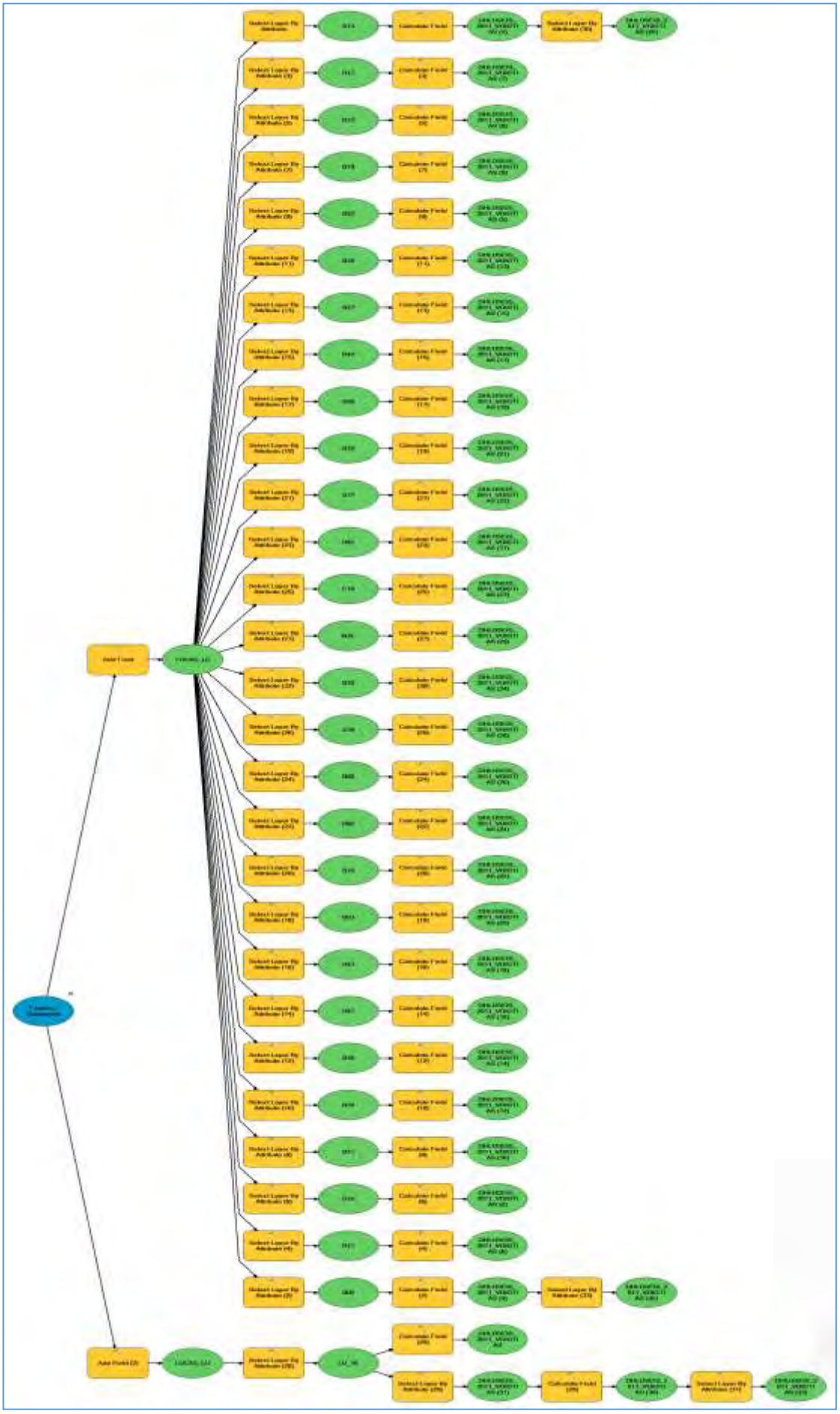


The model creates two fields at the already existing input file. One field called LUCAS_LC (text, 5 character length) and another called LUCAS_LU (text, 5 character length). Following, through the recognition of the classes of the imported file, the model proceeds with a separation and ultimately properly harmonises according to the selected encoding (explained above in harmonisation table) with LUCAS land use and/or land cover classes.

The script written in python programming language, according to which the harmonisation model functions, can be found at the accompanying “LPIS2LUCAS.py” file.

*Warning: CLC2LUCAS will run only if the field “***COVER_ID***” is found in the* **LPIS** *Shapefile, entered by the user.*

The figure below shows the process followed by the model, each time the user chooses to boot Farmers'Statements2LUCAS tool for a file that wants to acquire the LUCAS classes.

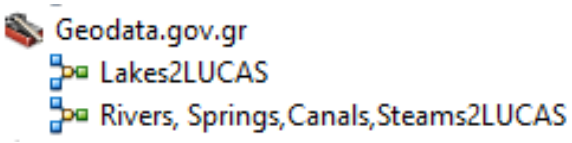


The model creates two fields at the already existing input file. One field called LUCAS_LC (text, 5 character length) and another called LUCAS_LU (text, 5 character length). Following, through the recognition of the classes of the imported file, the model proceeds with a separation and ultimately properly harmonises according to the selected encoding (explained above in harmonisation table) with LUCAS land use and/or land cover classes.

The script written in python programming language, according to which the harmonisation model functions, can be found at the *accompanying "***Farmers' Statements2LUCAS***.py" file.*

Warning: Farmers' Statements2LUCAS will run only if the field "EFY11_CROP" is found in the Farmers'Statements Shapefile, entered by the user.

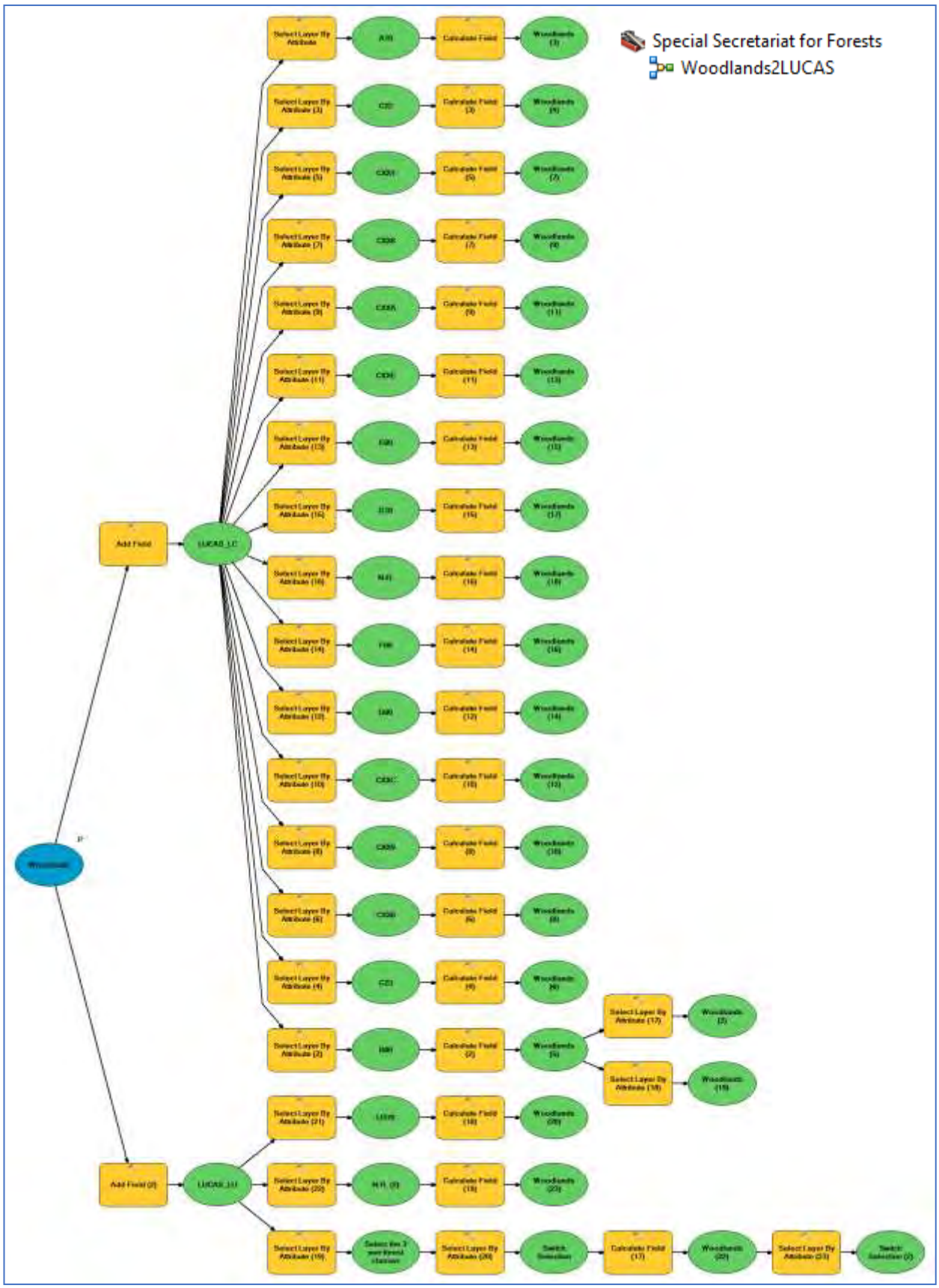
Lakes2LUCAS and Rivers, Springs, Canals, Steams2LUCAS refer to the harmonization of the lakes, rivers, springs, channels and streams database publicly available through the geospatial platform geodata.gov.gr with the LUCAS land use / land cover classification system. The following figures show the procedure followed by each model, each time a user initiates them in order to produce LUCAS classes.



The model creates two fields at the already existing input file. One field called LUCAS_LC (text, 5 character length), and one called LUCAS_LU (text, 5 character length).

Further, the model assigns the lake layer to G10 class and rivers, springs, canals and streams to the G20 class, according to the land cover classes of LUCAS.

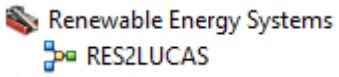
Woodlands2LUCAS refers to the harmonization of the database of Special Secretariat of Forests to the LUCAS classification system.



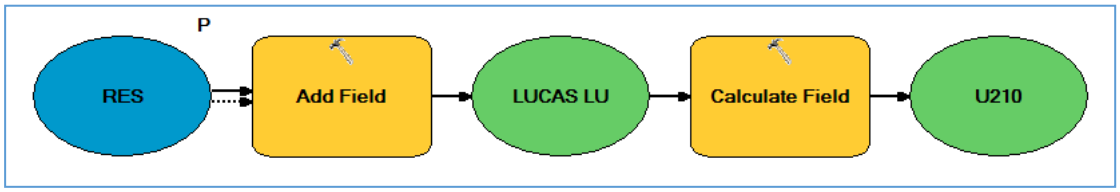
The model creates two fields at the already existing input file. One field called LUCAS_LC (text, 5 character length) and another called LUCAS_LU (text, 5 character length). Following, through the recognition of the classes of the imported file, the model proceeds with a separation and ultimately properly harmonises according to the selected encoding (explained above in harmonisation table) with LUCAS land use and/or land cover classes.
The script written in python programming language, according to which the harmonisation model functions, can be found at the accompanying "Woodlands2LUCAS.py" file.

*Warning: Woodlands2LUCAS will run only if the field "**A_VEG_TYPE**" is found in the* **Woodlands** *Shapefile, entered by the user.*

RES2LUCAS refers to the harmonization of the Regulatory Authority for Energy (RAE) on Renewable Energy Sources (Renewable Energy Sources - RES), provided free of charge via the geospatial platform www.rae.gr/geo, to the LUCAS classification system.



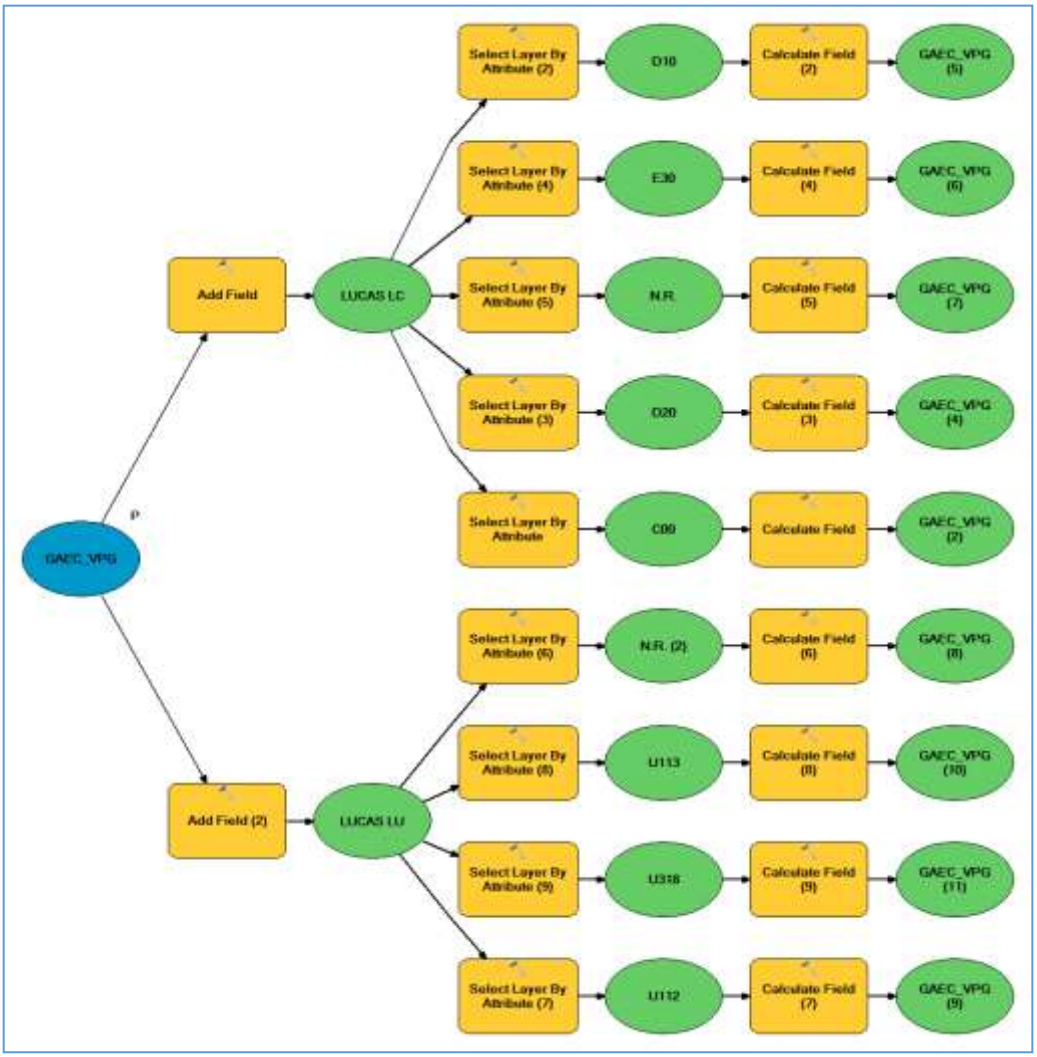
The following figures show the process followed by the model, each time a user whishes to acquire LUCAS classes for any of the data sets offered by RAE.



The model creates two fields at the already existing input file. One field called LUCAS_LC (text, 5 character length) and another called LUCAS_LU (text, 5 character length). Following, through the recognition of the classes of the imported file, the model proceeds with a separation and ultimately properly harmonises according to the selected encoding (explained above in harmonisation table) with LUCAS land use and/or land cover classes.
The script written in python programming language, according to which the harmonisation model functions, can be found at the accompanying "RES2LUCAS.py" file.

.

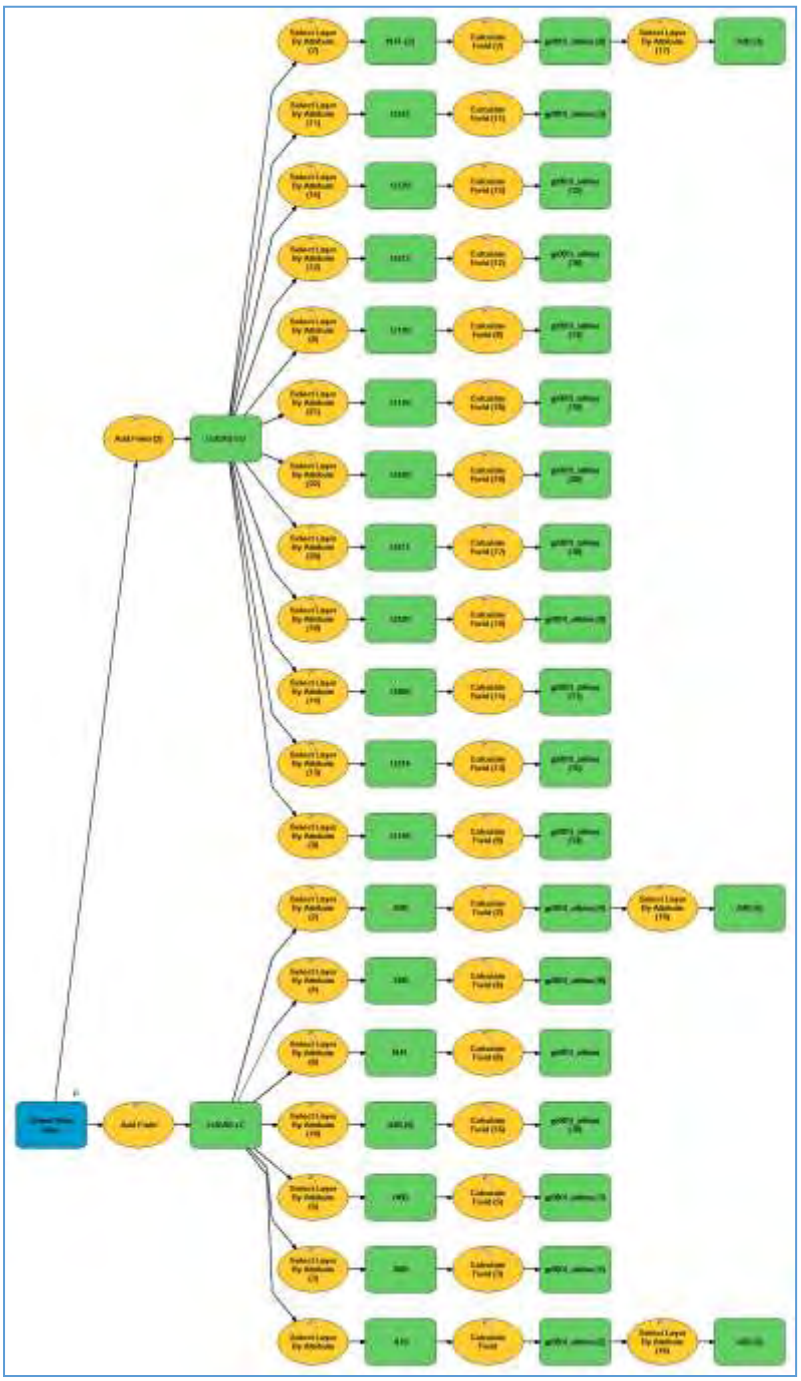
GAEC2LUCAS refers to the harmonization of the GAEC database of the Topographic Service of the Ministry of Rural Development and Food to the LUCAS classification system.

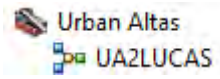


The model creates two fields at the already existing input file. One field called LUCAS_LC (text, 5 character length) and another called LUCAS_LU (text, 5 character length). Following, through the recognition of the classes of the imported file, the model proceeds with a separation and ultimately properly harmonises according to the selected encoding (explained above in harmonisation table) with LUCAS land use and/or land cover classes.
The script written in python programming language, according to which the harmonisation model functions, can be found at the accompanying "GAEC2LUCAS.py" file.

Warning: GAEC2LUCAS *will run only if the field "***GAEC_TYPE***" is found in the* **GAEC** *Shapefile, entered by the user.*

The **UA2LUCAS** refers to the harmonization of the Urban Atlas Data Set to the LUCAS classification system





The model creates two fields at the already existing input file. One field called LUCAS_LC (text, 5 character length) and another called LUCAS_LU (text, 5 character length). Following, through the recognition of the classes of the imported file, the model proceeds with a separation and ultimately properly harmonises according to the selected encoding (explained above in harmonisation table) with LUCAS land use and/or land cover classes.

The script written in python programming language, according to which the harmonisation model functions, can be found at the accompanying "**UA2LUCAS**.py" file.

Warning: GAEC2LUCAS *will run only if the field "***CODE***" is found in the* **Urban Atlas** *Shapefile, entered by the user.*

12.3 Creation of a geographical – geo-statistical tool for the creation of the final hybrid map – final product.

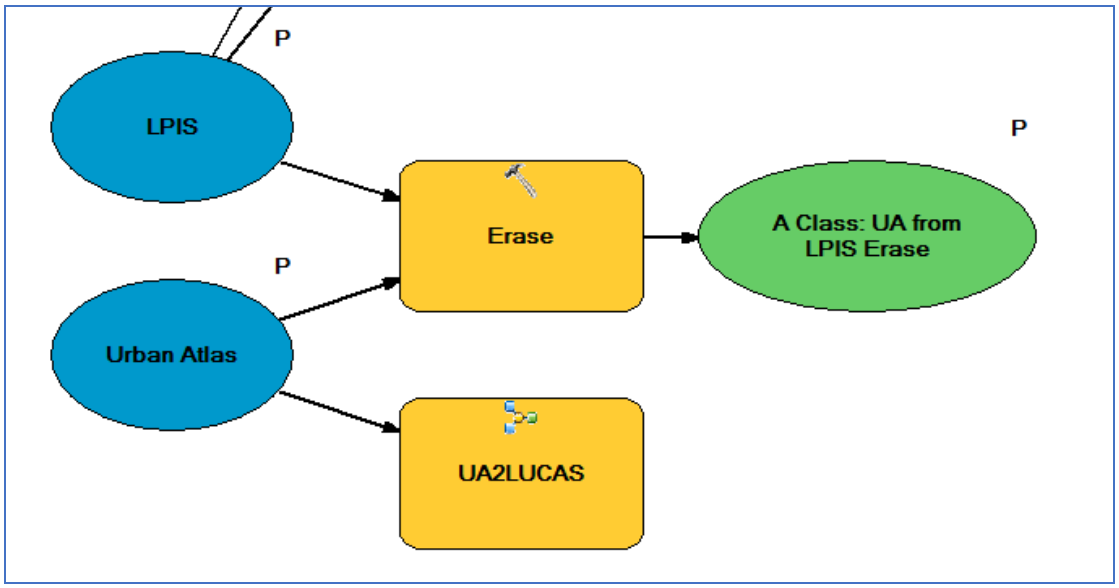
As mentioned on chapter 6.2 the geo-statistical model delivers land cover and land use values at the available national data sets and then produces a file with LUCAS land cover data, by integrating and combining the national data sets based on the largest weighting factors achieved in the identification with the LUCAS 2012 survey points.

The model is called "**National Sources Land Cover Integration**".
The final product is a combination of exported Raster files (size cell: 5 meters) of the 8 basic land cover main categories (A - H) of LUCAS classification system.
The model is presented in the next page.

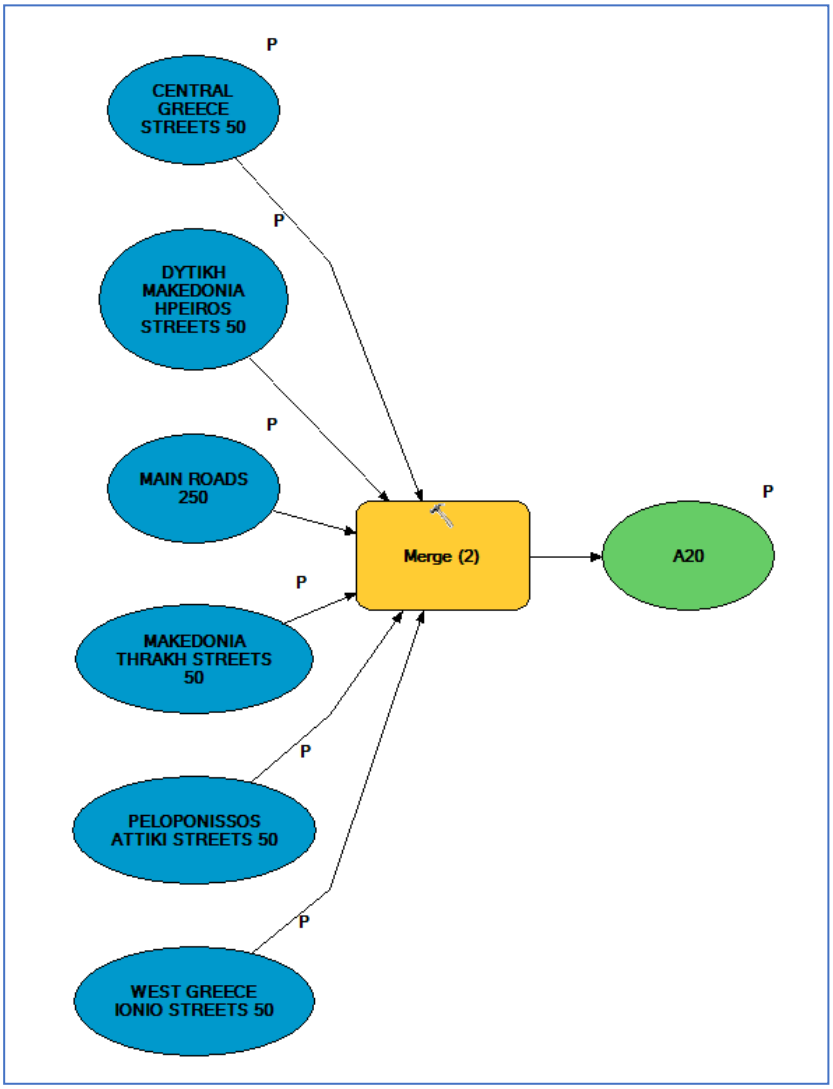
*The script written in python programming language, according to which the harmonisation model operates, can be found at the accompanying "*National Sources Land Cover Integration*.py" file.*

12.4 Subroutines presentation that constitute the geo-statistical tool.

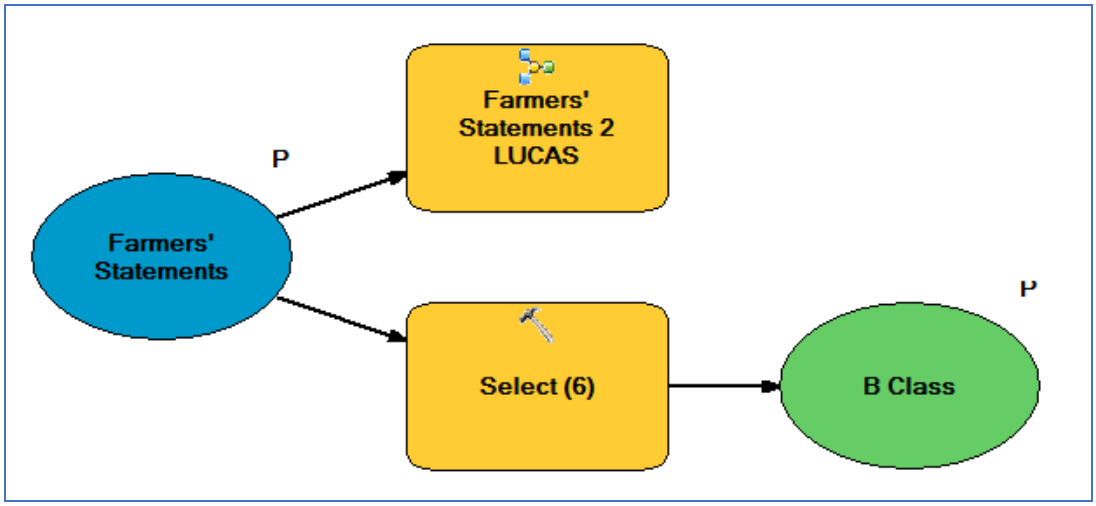
Main Category A is calculated first.
Through the Urban Atlas and the LPIS data A10 designation is given at the polygons that satisfy the conditions.



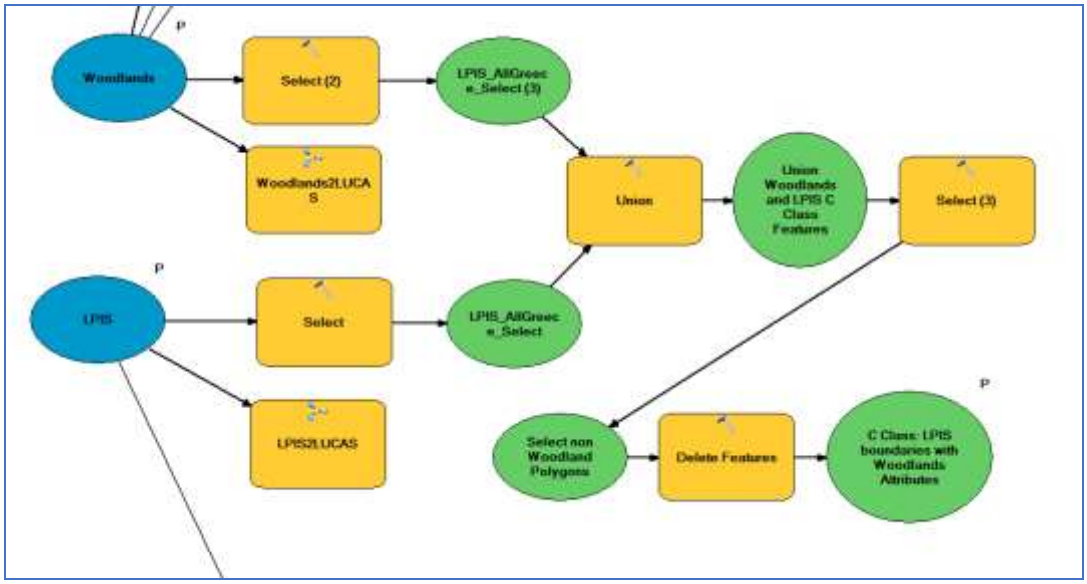
Through road network A20 (OKXE) is given at the polygons that satisfy the conditions.



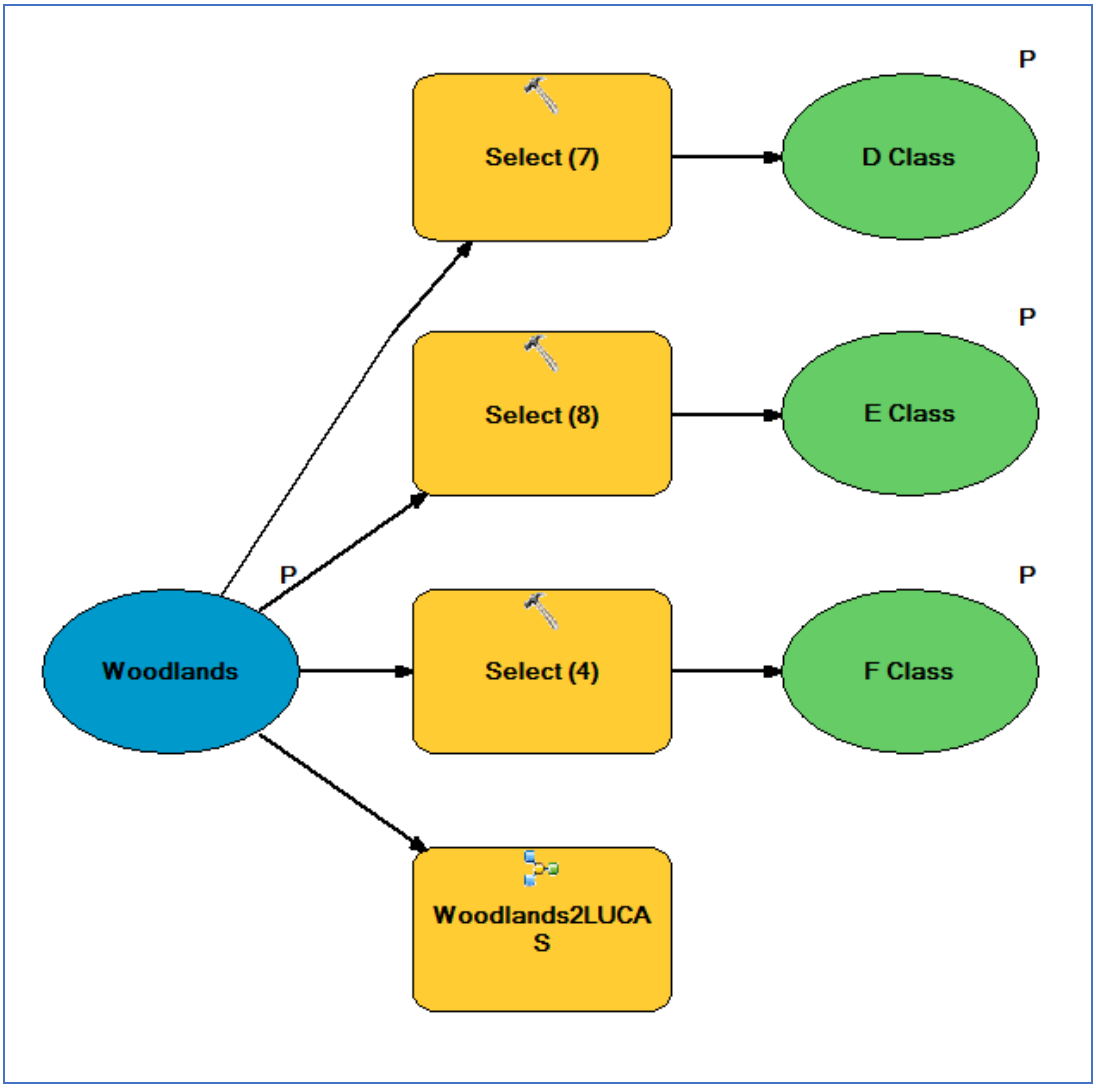
Through the Farmers' Statements class B is given at the polygons that satisfy the conditions.



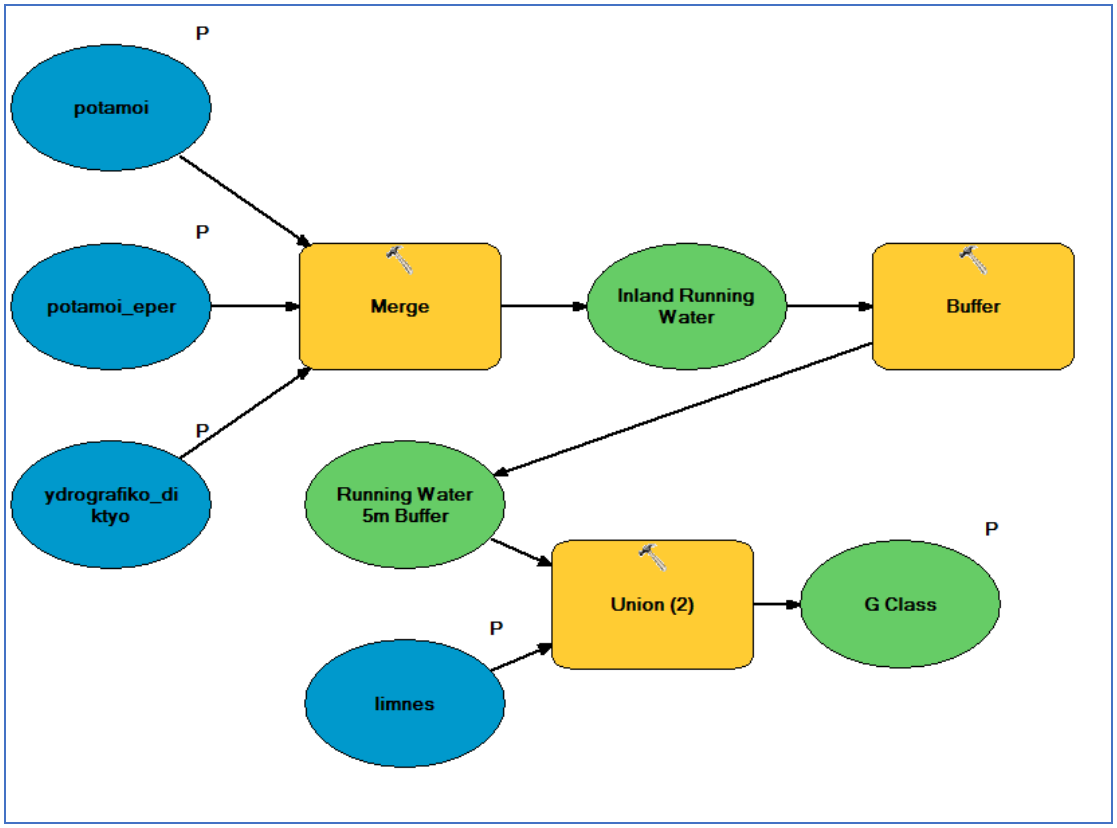
It was observed that while the ratings of polygons of Forests' Archive were accurate and coincided perfectly with LUCAS 2012 points, the limits were not so accurate. For this reason it was preferred to use the forest limits from the LPIS data system. LPIS does not contain in-depth information on the main category of forests, though, the use of the characteristics of Forestrs' Archive was given to the polygons and they have been "cut" at the limits that were defined by the LPIS data set.



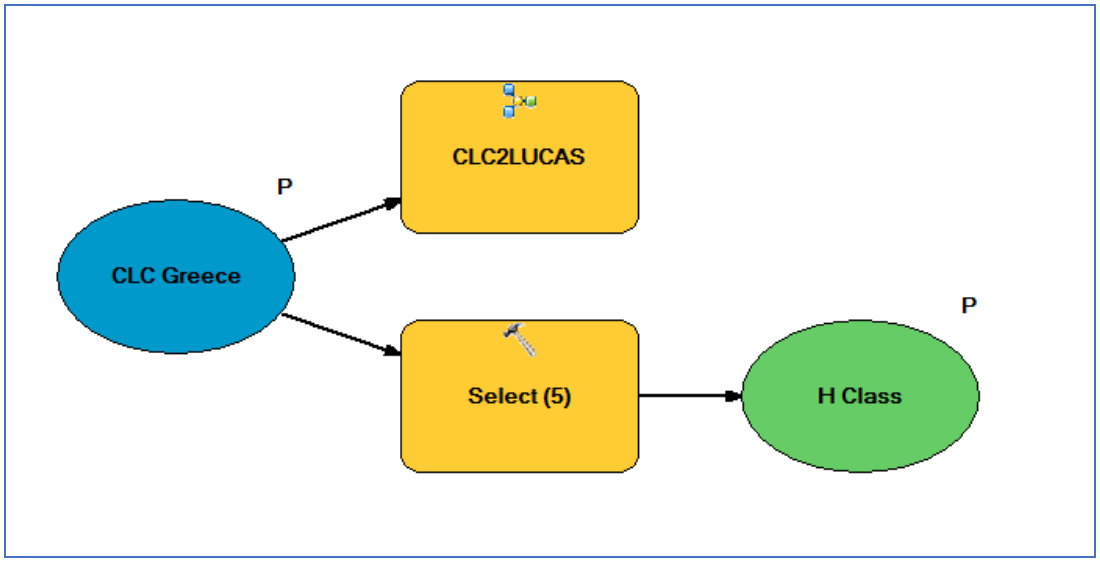
D, E and F classes extraction followed. The only data set that could give these 3 classes was the Forests' Archive.


P
Select (7)
D Class
P
Select (8)
E Class
P
P
Woodlands
Select (4)
F Class
Woodlands2LUCAS

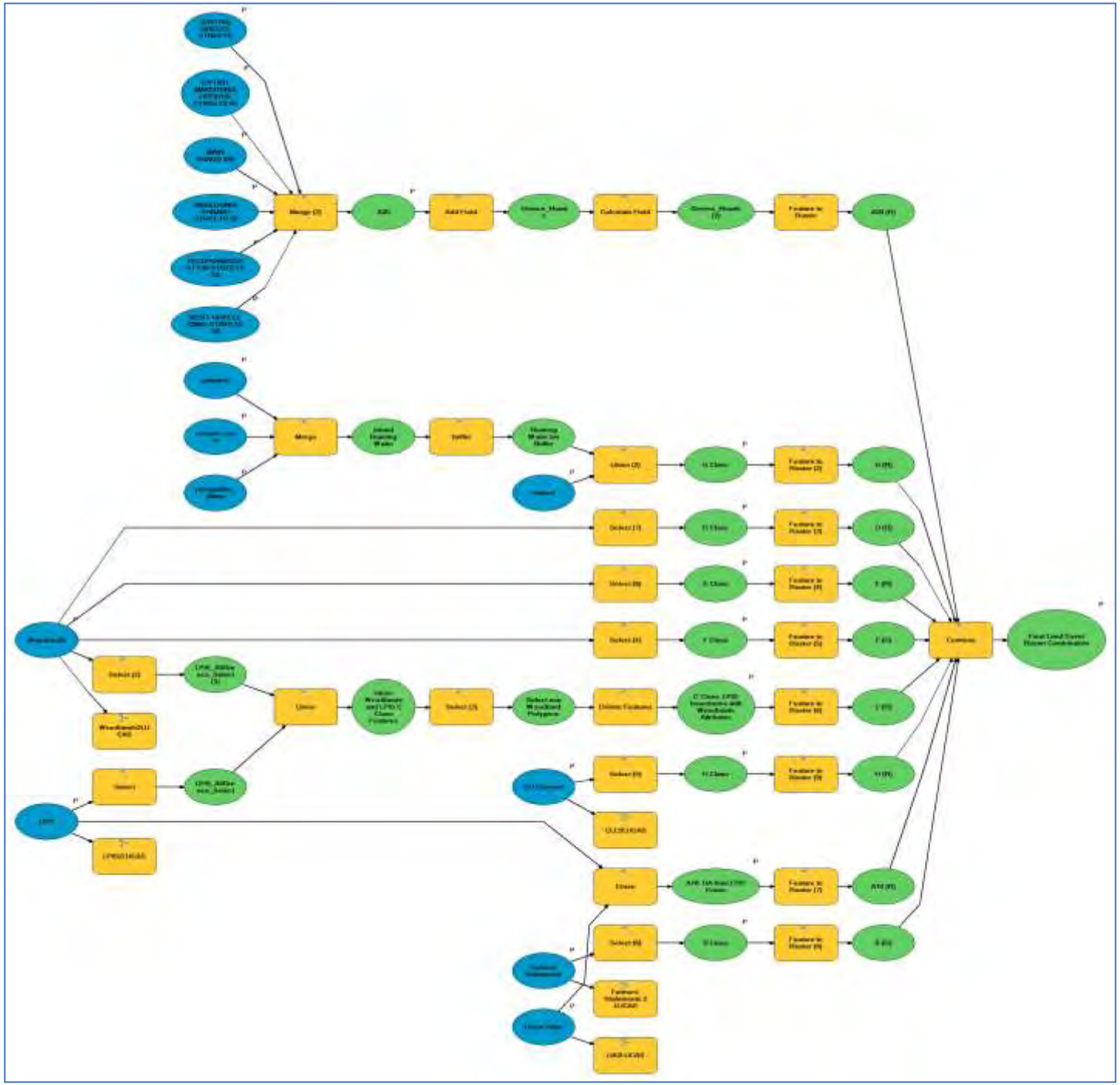
Main category G was extracted through the lakes, rivers and streams network of Greece files, available through Geodata.gov.gr.



Main category H was not represented by any of the available data sets. The only available data exctraction source was CORINE Land Cover.



The LUCAS land cover hybrid map tool.



TOOL 1 (geographical – harmonisation that integrates different data sources to support the LUCAS land cover methodology and the results of this system) AND TOOL 2 (geo-statistical model integrating different data sources in order to support LUCAS land-use statistics) SUBROUTINES

```
# -*- coding: utf-8 -*-
# ---------------------------------------------------------------------------
# CLC2LUCAS.py
# Geostatistical Model Developed by the GIS Research Unit of the Agricultural
University of Athens
# Description:
# Adds a column in existing CORINE Land Cover dataset, harmonising with LUCAS
Land Use / Land Cover classification system.
# ---------------------------------------------------------------------------

# Import arcpy module
import arcpy

# Script arguments
Corine_Land_Cover_layer = arcpy.GetParameterAsText(0)
if Corine_Land_Cover_layer == '#' or not Corine_Land_Cover_layer:
    Corine_Land_Cover_layer = "CLC2000_POLY_OK07_ES03_VOIOTIAS" # provide a
default value if unspecified

# Local variables:
LUCAS_LU = Corine_Land_Cover_layer
U111 = LUCAS_LU
CLC2000_POLY_OK07_ES03_VOIOTIAS__2_ = U111
U120 = LUCAS_LU
CLC2000_POLY_OK07_ES03_VOIOTIAS__4_ = U120
U120__2_ = CLC2000_POLY_OK07_ES03_VOIOTIAS__4_
U140 = LUCAS_LU
CLC2000_POLY_OK07_ES03_VOIOTIAS__5_ = U140
U310 = LUCAS_LU
CLC2000_POLY_OK07_ES03_VOIOTIAS__6_ = U310
U313 = LUCAS_LU
CLC2000_POLY_OK07_ES03_VOIOTIAS__7_ = U313
U314 = LUCAS_LU
CLC2000_POLY_OK07_ES03_VOIOTIAS__8_ = U314
U330 = LUCAS_LU
CLC2000_POLY_OK07_ES03_VOIOTIAS__9_ = U330
U360 = LUCAS_LU
CLC2000_POLY_OK07_ES03_VOIOTIAS__10_ = U360
U370 = LUCAS_LU
CLC2000_POLY_OK07_ES03_VOIOTIAS__11_ = U370
N_R_ = LUCAS_LU
CLC2000_POLY_OK07_ES03_VOIOTIAS__12_ = N_R_
LUCAS_LC = Corine_Land_Cover_layer
A10 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__42_ = A10
A21 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__3_ = A21
A21__2_ = CLC2000_POLY_OK07_ES03_VOIOTIAS__3_
A22 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__13_ = A22
B00 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__18_ = B00
B17 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__15_ = B17
B55 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__20_ = B55
B70 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__17_ = B70
B81 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__22_ = B81
```

```
B82 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__19_ = B82
C00 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__24_ = C00
C10 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__21_ = C10
C20 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__26_ = C20
C30 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__23_ = C30
CXX9 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__28_ = CXX9
D00 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__25_ = D00
D10 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__30_ = D10
E00 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__27_ = E00
F10 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__32_ = F10
F20 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__16_ = F20
F40 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__34_ = F40
G10 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__31_ = G10
G20 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__36_ = G20
G30 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__33_ = G30
G50 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__38_ = G50
H11 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__35_ = H11
H12 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__29_ = H12
H21 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__37_ = H21
H22 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__40_ = H22
H23 = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__39_ = H23
N_R___2_ = LUCAS_LC
CLC2000_POLY_OK07_ES03_VOIOTIAS__41_ = N_R___2_

# Process: Add Field
arcpy.AddField_management(Corine_Land_Cover_layer, "LUCAS_LU", "TEXT", "", "",
"", "", "NON_NULLABLE", "NON_REQUIRED", "")

# Process: Select Layer By Attribute (2)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE_00\" =
211 OR \"CODE_00\" = 212 OR \"CODE_00\" = 213 OR \"CODE_00\" = 221 OR \"CODE_00\"
= 222 OR \"CODE_00\" = 223 OR \"CODE_00\" = 241")

# Process: Calculate Field
arcpy.CalculateField_management(U111, "LUCAS_LU", "\"U111\"", "VB", "")

# Process: Select Layer By Attribute (4)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE_00\" =
131")

# Process: Calculate Field (3)
arcpy.CalculateField_management(U140, "LUCAS_LU", "\"U140\"", "VB", "")

# Process: Select Layer By Attribute (5)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE_00\" =
122")

# Process: Calculate Field (4)
arcpy.CalculateField_management(U310, "LUCAS_LU", "\"U310\"", "VB", "")

# Process: Select Layer By Attribute (6)
```

```
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE_00\" =
123")

# Process: Calculate Field (5)
arcpy.CalculateField_management(U313, "LUCAS_LU", "\"U313\"", "VB", "")

# Process: Select Layer By Attribute (7)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE_00\" =
124")

# Process: Calculate Field (6)
arcpy.CalculateField_management(U314, "LUCAS_LU", "\"U314\"", "VB", "")

# Process: Select Layer By Attribute (8)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE_00\" =
133")

# Process: Calculate Field (7)
arcpy.CalculateField_management(U330, "LUCAS_LU", "\"U330\"", "VB", "")

# Process: Select Layer By Attribute (9)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE_00\" =
142")

# Process: Calculate Field (8)
arcpy.CalculateField_management(U360, "LUCAS_LU", "\"U360\"", "VB", "")

# Process: Select Layer By Attribute (10)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE_00\" =
111 OR \"CODE_00\" = 112")

# Process: Calculate Field (9)
arcpy.CalculateField_management(U370, "LUCAS_LU", "\"U370\"", "VB", "")

# Process: Select Layer By Attribute (11)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE_00\" =
121 OR \"CODE_00\" = 132 OR \"CODE_00\" = 141 OR \"CODE_00\" = 231 OR \"CODE_00\"
= 242 OR \"CODE_00\" = 243 OR \"CODE_00\" = 244 OR \"CODE_00\" = 311 OR
\"CODE_00\" = 331 OR \"CODE_00\" = 332 OR \"CODE_00\" = 333 OR \"CODE_00\" = 334
OR \"CODE_00\" = 335 OR \"CODE_00\" = 411 OR \"CODE_00\" = 412 OR \"CODE_00\" =
421 OR \"CODE_00\" = 422 OR \"CODE_00\" = 423 OR \"CODE_00\" = 511 OR \"CODE_00\"
= 512 OR \"CODE_00\" = 521 OR \"CODE_00\" = 522 OR \"CODE_00\" = 523")

# Process: Calculate Field (10)
arcpy.CalculateField_management(N_R_, "LUCAS_LU", "\"n.r.\"", "VB", "")

# Process: Add Field (2)
arcpy.AddField_management(Corine_Land_Cover_layer, "LUCAS_LC", "TEXT", "", "",
"", "", "NON_NULLABLE", "NON_REQUIRED", "")

# Process: Select Layer By Attribute (12)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
111 OR \"CODE_00\" = 112 OR \"CODE_00\" = 121")

# Process: Calculate Field (11)
arcpy.CalculateField_management(A10, "LUCAS_LC", "\"A10\"", "VB", "")

# Process: Select Layer By Attribute (14)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
122")

# Process: Calculate Field (13)
arcpy.CalculateField_management(A22, "LUCAS_LC", "\"A22\"", "VB", "")

# Process: Select Layer By Attribute (15)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
211 OR \"CODE_00\" = 212")

# Process: Calculate Field (14)
arcpy.CalculateField_management(B00, "LUCAS_LC", "\"B00\"", "VB", "")

# Process: Select Layer By Attribute (16)
```

```
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
213")

# Process: Calculate Field (15)
arcpy.CalculateField_management(B17, "LUCAS_LC", "\"B17\"", "VB", "")

# Process: Select Layer By Attribute (17)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
231")

# Process: Calculate Field (16)
arcpy.CalculateField_management(B55, "LUCAS_LC", "\"B55\"", "VB", "")

# Process: Select Layer By Attribute (18)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
222")

# Process: Calculate Field (17)
arcpy.CalculateField_management(B70, "LUCAS_LC", "\"B70\"", "VB", "")

# Process: Select Layer By Attribute (19)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
223")

# Process: Calculate Field (18)
arcpy.CalculateField_management(B81, "LUCAS_LC", "\"B81\"", "VB", "")

# Process: Select Layer By Attribute (20)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
221")

# Process: Calculate Field (19)
arcpy.CalculateField_management(B82, "LUCAS_LC", "\"B82\"", "VB", "")

# Process: Select Layer By Attribute (21)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
334")

# Process: Calculate Field (20)
arcpy.CalculateField_management(C00, "LUCAS_LC", "\"C00\"", "VB", "")

# Process: Select Layer By Attribute (22)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
311")

# Process: Calculate Field (21)
arcpy.CalculateField_management(C10, "LUCAS_LC", "\"C10\"", "VB", "")

# Process: Select Layer By Attribute (23)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
312")

# Process: Calculate Field (22)
arcpy.CalculateField_management(C20, "LUCAS_LC", "\"C20\"", "VB", "")

# Process: Select Layer By Attribute (24)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
313")

# Process: Calculate Field (23)
arcpy.CalculateField_management(C30, "LUCAS_LC", "\"C30\"", "VB", "")

# Process: Select Layer By Attribute (25)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
323")

# Process: Calculate Field (24)
arcpy.CalculateField_management(CXX9, "LUCAS_LC", "\"CXX9\"", "VB", "")

# Process: Select Layer By Attribute (26)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
322")
```

```
# Process: Calculate Field (25)
arcpy.CalculateField_management(D00, "LUCAS_LC", "\"D00\"", "VB", "")

# Process: Select Layer By Attribute (27)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
324")

# Process: Calculate Field (26)
arcpy.CalculateField_management(D10, "LUCAS_LC", "\"D10\"", "VB", "")

# Process: Select Layer By Attribute (28)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
321")

# Process: Calculate Field (27)
arcpy.CalculateField_management(E00, "LUCAS_LC", "\"E00\"", "VB", "")

# Process: Select Layer By Attribute (29)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
332")

# Process: Calculate Field (28)
arcpy.CalculateField_management(F10, "LUCAS_LC", "\"F10\"", "VB", "")

# Process: Select Layer By Attribute (30)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
331")

# Process: Calculate Field (29)
arcpy.CalculateField_management(F20, "LUCAS_LC", "\"F200\"", "VB", "")

# Process: Select Layer By Attribute (31)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
334")

# Process: Calculate Field (30)
arcpy.CalculateField_management(F40, "LUCAS_LC", "\"F40\"", "VB", "")

# Process: Select Layer By Attribute (32)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
512")

# Process: Calculate Field (31)
arcpy.CalculateField_management(G10, "LUCAS_LC", "\"G10\"", "VB", "")

# Process: Select Layer By Attribute (33)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
511")

# Process: Calculate Field (32)
arcpy.CalculateField_management(G20, "LUCAS_LC", "\"G20\"", "VB", "")

# Process: Select Layer By Attribute (34)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
512 OR \"CODE_00\" = 522 OR \"CODE_00\" = 523 OR \"CODE_00\" = 521")

# Process: Calculate Field (33)
arcpy.CalculateField_management(G30, "LUCAS_LC", "\"G30\"", "VB", "")

# Process: Select Layer By Attribute (35)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
335")

# Process: Calculate Field (34)
arcpy.CalculateField_management(G50, "LUCAS_LC", "\"G50\"", "VB", "")

# Process: Select Layer By Attribute (36)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
411")

# Process: Calculate Field (35)
```

```
arcpy.CalculateField_management(H11, "LUCAS_LC", "\"H11\"", "VB", "")

# Process: Select Layer By Attribute (37)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
412")

# Process: Calculate Field (36)
arcpy.CalculateField_management(H12, "LUCAS_LC", "\"H12\"", "VB", "")

# Process: Select Layer By Attribute (38)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
421")

# Process: Calculate Field (37)
arcpy.CalculateField_management(H21, "LUCAS_LC", "\"H21\"", "VB", "")

# Process: Select Layer By Attribute (39)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
422")

# Process: Calculate Field (38)
arcpy.CalculateField_management(H22, "LUCAS_LC", "\"H22\"", "VB", "")

# Process: Select Layer By Attribute (40)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
423")

# Process: Calculate Field (39)
arcpy.CalculateField_management(H23, "LUCAS_LC", "\"H23\"", "VB", "")

# Process: Select Layer By Attribute (3)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE_00\" =
311 OR \"CODE_00\" = 312 OR \"CODE_00\" = 313 OR \"CODE_00\" = 321 OR \"CODE_00\"
= 322 OR \"CODE_00\" = 323 OR \"CODE_00\" = 324")

# Process: Calculate Field (2)
arcpy.CalculateField_management(U120, "LUCAS_LU", "\"U120\"", "VB", "")

# Process: Select Layer By Attribute (41)
arcpy.SelectLayerByAttribute_management(CLC2000_POLY_OK07_ES03_VOIOTIAS__4_,
"CLEAR_SELECTION", "\"CODE_00\" = 311 OR \"CODE_00\" = 312 OR \"CODE_00\" = 313
OR \"CODE_00\" = 321 OR \"CODE_00\" = 322 OR \"CODE_00\" = 323 OR \"CODE_00\" =
324")

# Process: Select Layer By Attribute (42)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
333 OR \"CODE_00\" = 244 OR \"CODE_00\" = 243 OR \"CODE_00\" = 241 OR \"CODE_00\"
= 242 OR \"CODE_00\" = 142 OR \"CODE_00\" = 141 OR \"CODE_00\" = 133")

# Process: Calculate Field (40)
arcpy.CalculateField_management(N_R___2_, "LUCAS_LC", "\"n.r.\"", "VB", "")

# Process: Select Layer By Attribute (13)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE_00\" =
131 OR \"CODE_00\" = 132 OR \"CODE_00\" = 133 OR \"CODE_00\" = 124 OR \"CODE_00\"
= 123")

# Process: Calculate Field (12)
arcpy.CalculateField_management(A21, "LUCAS_LC", "\"A21\"", "VB", "")

# Process: Select Layer By Attribute (43)
arcpy.SelectLayerByAttribute_management(CLC2000_POLY_OK07_ES03_VOIOTIAS__3_,
"CLEAR_SELECTION", "\"CODE_00\" = 131 OR \"CODE_00\" = 132 OR \"CODE_00\" = 133")
```

```
# -*- coding: utf-8 -*-
# ---------------------------------------------------------------------------
-
# LPIS2LUCAS.py
# Geostatistical Model Developed by the GIS Research Unit of the
Agricultural University of Athens
# Description:
# Adds a column in existing ILOTS (OPEKEPE) dataset, harmonising with LUCAS
Land Use / Land
# Cover classification system.

# ---------------------------------------------------------------------------
-

# Import arcpy module
import arcpy

# Script arguments
ILOTS_layer = arcpy.GetParameterAsText(0)
if ILOTS_layer == '#' or not ILOTS_layer:
    ILOTS_layer = "ILOTS_VOIOTIA_2013" # provide a default value if
unspecified

# Local variables:
LUCAS_LU = ILOTS_layer
U111 = LUCAS_LU
ILOTS_VOIOTIA_2013 = U111
U120 = LUCAS_LU
ILOTS_VOIOTIA_2013__3_ = U120
ILOTS_VOIOTIA_2013__17_ = ILOTS_VOIOTIA_2013__3_
U410 = LUCAS_LU
ILOTS_VOIOTIA_2013__2_ = U410
N_R___2_ = LUCAS_LU
ILOTS_VOIOTIA_2013__16_ = N_R___2_
U370 = LUCAS_LU
ILOTS_VOIOTIA_2013__7_ = U370
LUCAS_LC = ILOTS_layer
A10 = LUCAS_LC
ILOTS_VOIOTIA_2013__10_ = A10
ILOTS_VOIOTIA_2013__15_ = ILOTS_VOIOTIA_2013__10_
C30 = LUCAS_LC
ILOTS_VOIOTIA_2013__12_ = C30
ILOTS_VOIOTIA_2013__13_ = ILOTS_VOIOTIA_2013__12_
B82 = LUCAS_LC
ILOTS_VOIOTIA_2013__20_ = B82
B00 = LUCAS_LC
ILOTS_VOIOTIA_2013__4_ = B00
E20 = LUCAS_LC
ILOTS_VOIOTIA_2013__24_ = E20
C00 = LUCAS_LC
ILOTS_VOIOTIA_2013__5_ = C00
B81 = LUCAS_LC
ILOTS_VOIOTIA_2013__28_ = B81
B70 = LUCAS_LC
ILOTS_VOIOTIA_2013__30_ = B70
B84 = LUCAS_LC
ILOTS_VOIOTIA_2013__9_ = B84
G00 = LUCAS_LC
ILOTS_VOIOTIA_2013__8_ = G00
N_R_ = LUCAS_LC
ILOTS_VOIOTIA_2013__14_ = N_R_

# Process: Add Field (2)
arcpy.AddField_management(ILOTS_layer, "LUCAS_LC", "TEXT", "", "", "", "",
"NON_NULLABLE", "NON_REQUIRED", "")

# Process: Select Layer By Attribute (10)
```

```
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"COVER_ID\" = 70 OR \"COVER_ID\" = 71")

# Process: Calculate Field (9)
arcpy.CalculateField_management(B82, "LUCAS_LC", "\"B82\"", "VB", "")

# Process: Select Layer By Attribute (11)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"COVER_ID\" = 40 OR \"COVER_ID\" = 41 or \"COVER_ID\" = 51")

# Process: Calculate Field (10)
arcpy.CalculateField_management(B00, "LUCAS_LC", "\"B00\"", "VB", "")

# Process: Select Layer By Attribute (12)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"COVER_ID\" = 30 OR \"COVER_ID\" = 31 OR \"COVER_ID\" = 32 OR \"COVER_ID\"
= 33")

# Process: Calculate Field (11)
arcpy.CalculateField_management(E20, "LUCAS_LC", "\"E20\"", "VB", "")

# Process: Select Layer By Attribute (13)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"COVER_ID\" = 12 or \"COVER_ID\" = 10")

# Process: Calculate Field (12)
arcpy.CalculateField_management(C00, "LUCAS_LC", "\"C00\"", "VB", "")

# Process: Select Layer By Attribute (14)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"COVER_ID\" = 60 OR \"COVER_ID\" = 61")

# Process: Calculate Field (13)
arcpy.CalculateField_management(B81, "LUCAS_LC", "\"B81\"", "VB", "")

# Process: Select Layer By Attribute (15)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"COVER_ID\" = 50")

# Process: Calculate Field (14)
arcpy.CalculateField_management(B70, "LUCAS_LC", "\"B70\"", "VB", "")

# Process: Add Field
arcpy.AddField_management(ILOTS_layer, "LUCAS_LU", "TEXT", "", "", "", "",
"NON_NULLABLE", "NON_REQUIRED", "")

# Process: Select Layer By Attribute (17)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION",
"\"COVER_ID\" = 92")

# Process: Calculate Field (15)
arcpy.CalculateField_management(U410, "LUCAS_LU", "\"U410\"", "VB", "")

# Process: Select Layer By Attribute (5)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"COVER_ID\" = 51")

# Process: Calculate Field (4)
arcpy.CalculateField_management(B84, "LUCAS_LC", "\"B84\"", "VB", "")

# Process: Select Layer By Attribute (7)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"COVER_ID\" = 93")

# Process: Calculate Field (6)
arcpy.CalculateField_management(G00, "LUCAS_LC", "\"G00\"", "VB", "")

# Process: Select Layer By Attribute (6)
```

```
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"COVER_ID\" = 11")

# Process: Calculate Field (5)
arcpy.CalculateField_management(C30, "LUCAS_LC", "\"C30\"", "VB", "")

# Process: Select Layer By Attribute (8)
arcpy.SelectLayerByAttribute_management(ILOTS_VOIOTIA_2013__12_,
"CLEAR_SELECTION", "")

# Process: Select Layer By Attribute (9)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"COVER_ID\" = 14 OR \"COVER_ID\" = 90 OR \"COVER_ID\" = 91 or \"COVER_ID\"
= 92")

# Process: Calculate Field (7)
arcpy.CalculateField_management(N_R_, "LUCAS_LC", "\"n.r.\"", "VB", "")

# Process: Select Layer By Attribute (4)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"COVER_ID\" = 20 or \"COVER_ID\" = 21")

# Process: Calculate Field (3)
arcpy.CalculateField_management(A10, "LUCAS_LC", "\"A10\"", "VB", "")

# Process: Select Layer By Attribute (16)
arcpy.SelectLayerByAttribute_management(ILOTS_VOIOTIA_2013__10_,
"CLEAR_SELECTION", "")

# Process: Select Layer By Attribute (18)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION",
"\"COVER_ID\" = 14 OR \"COVER_ID\" = 90 OR \"COVER_ID\" = 91")

# Process: Calculate Field (8)
arcpy.CalculateField_management(N_R___2_, "LUCAS_LU", "\"n.r.\"", "VB", "")

# Process: Select Layer By Attribute (2)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION",
"\"COVER_ID\" = 10 or \"COVER_ID\" = 11 or \"COVER_ID\" = 12 or \"COVER_ID\"
= 30 or \"COVER_ID\" = 31 or \"COVER_ID\" = 32 or \"COVER_ID\" = 33")

# Process: Calculate Field (2)
arcpy.CalculateField_management(U120, "LUCAS_LU", "\"U120\"", "VB", "")

# Process: Select Layer By Attribute (19)
arcpy.SelectLayerByAttribute_management(ILOTS_VOIOTIA_2013__3_,
"CLEAR_SELECTION", "")

# Process: Select Layer By Attribute
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION",
"\"COVER_ID\" = 70 or \"COVER_ID\" = 71 or \"COVER_ID\" = 40 or \"COVER_ID\"
= 41 or \"COVER_ID\" = 50 or \"COVER_ID\" = 51 or \"COVER_ID\" = 60 or
\"COVER_ID\" = 61")

# Process: Calculate Field (16)
arcpy.CalculateField_management(U111, "LUCAS_LU", "\"U111\"", "VB", "")

# Process: Select Layer By Attribute (20)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION",
"\"COVER_ID\" = 21 OR \"COVER_ID\" = 20")

# Process: Calculate Field (17)
arcpy.CalculateField_management(U370, "LUCAS_LU", "\"U370\"", "VB", "")
```

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# -*- coding: utf-8 -*-
# ---------------------------------------------------------------------------
-
# FarmersStatement2LUCAS.py
# Geostatistical Model Developed by the GIS Research Unit of the
Agricultural University of Athens
# Description:
# Adds a column in existing Farmers' Statements (OPEKEPE) dataset,
harmonising with LUCAS Land Use / Land
# Cover classification system.

# ---------------------------------------------------------------------------
-

# Import arcpy module
import arcpy

# Script arguments
Farmers__Statements = arcpy.GetParameterAsText(0)
if Farmers__Statements == '#' or not Farmers__Statements:
    Farmers__Statements = "DHLOSEIS_2011_VOIOTIAS" # provide a default value
if unspecified

# Local variables:
LUCAS_LC = Farmers__Statements
A13 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__3_ = A13
DHLOSEIS_2011_VOIOTIAS__25_ = DHLOSEIS_2011_VOIOTIAS__3_
B00 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__4_ = B00
DHLOSEIS_2011_VOIOTIAS__35_ = DHLOSEIS_2011_VOIOTIAS__4_
B17 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__7_ = B17
B11 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__6_ = B11
B12 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__8_ = B12
B16 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__2_ = B16
B19 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__9_ = B19
B21 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__10_ = B21
B22 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__5_ = B22
B34 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__12_ = B34
B35 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__13_ = B35
B36 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__14_ = B36
B37 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__15_ = B37
B41 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__16_ = B41
B42 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__17_ = B42
B43 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__18_ = B43
B50 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__19_ = B50
B53 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__20_ = B53
B70 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__21_ = B70
B74 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__22_ = B74
B77 = LUCAS_LC
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DHLOSEIS_2011_VOIOTIAS__23_ = B77
B82 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__24_ = B82
B81 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__11_ = B81
B80 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__26_ = B80
E10 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__27_ = E10
E30 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__28_ = E30
N_R_ = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__29_ = N_R_
B10 = LUCAS_LC
DHLOSEIS_2011_VOIOTIAS__34_ = B10
LUCAS_LU = Farmers__Statements
LU_16 = LUCAS_LU
DHLOSEIS_2011_VOIOTIAS = LU_16
DHLOSEIS_2011_VOIOTIAS__31_ = LU_16
DHLOSEIS_2011_VOIOTIAS__30_ = DHLOSEIS_2011_VOIOTIAS__31_
DHLOSEIS_2011_VOIOTIAS__33_ = DHLOSEIS_2011_VOIOTIAS__30_

# Process: Add Field
arcpy.AddField_management(Farmers__Statements, "LUCAS_LC", "TEXT", "", "",
"", "", "NULLABLE", "NON_REQUIRED", "")

# Process: Select Layer By Attribute (3)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '7' OR \"EFY11_CROP\" = '7.1'")

# Process: Calculate Field (3)
arcpy.CalculateField_management(B17, "LUCAS_LC", "\"B17\"", "VB", "")

# Process: Select Layer By Attribute (4)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '1.2'")

# Process: Calculate Field (4)
arcpy.CalculateField_management(B11, "LUCAS_LC", "\"B11\"", "VB", "")

# Process: Select Layer By Attribute (5)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '1.1'")

# Process: Calculate Field (5)
arcpy.CalculateField_management(B12, "LUCAS_LC", "\"B12\"", "VB", "")

# Process: Select Layer By Attribute (6)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '3.1' OR \"EFY11_CROP\" = '3.2'")

# Process: Calculate Field (6)
arcpy.CalculateField_management(B16, "LUCAS_LC", "\"B16\"", "VB", "")

# Process: Select Layer By Attribute (7)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '2'")

# Process: Calculate Field (7)
arcpy.CalculateField_management(B19, "LUCAS_LC", "\"B19\"", "VB", "")

# Process: Select Layer By Attribute (8)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '24' OR \"EFY11_CROP\" = '31'")

# Process: Calculate Field (8)
arcpy.CalculateField_management(B21, "LUCAS_LC", "\"B21\"", "VB", "")
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# Process: Select Layer By Attribute (9)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '10'")

# Process: Calculate Field (9)
arcpy.CalculateField_management(B22, "LUCAS_LC", "\"B22\"", "VB", "")

# Process: Select Layer By Attribute (10)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '12'")

# Process: Calculate Field (10)
arcpy.CalculateField_management(B34, "LUCAS_LC", "\"B34\"", "VB", "")

# Process: Select Layer By Attribute (11)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '4' OR \"EFY11_CROP\" = '13' OR \"EFY11_CROP\" = '14'")

# Process: Calculate Field (11)
arcpy.CalculateField_management(B35, "LUCAS_LC", "\"B35\"", "VB", "")

# Process: Select Layer By Attribute (12)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '17'")

# Process: Calculate Field (12)
arcpy.CalculateField_management(B36, "LUCAS_LC", "\"B36\"", "VB", "")

# Process: Select Layer By Attribute (13)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '16.1' OR \"EFY11_CROP\" = '25.1' OR \"EFY11_CROP\" =
'25.2' OR \"EFY11_CROP\" = '25.3' OR \"EFY11_CROP\" = '33' OR \"EFY11_CROP\"
= '41'")

# Process: Calculate Field (13)
arcpy.CalculateField_management(B37, "LUCAS_LC", "\"B37\"", "VB", "")

# Process: Select Layer By Attribute (14)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '38' OR \"EFY11_CROP\" = '38.1' OR \"EFY11_CROP\" = '38.2'
OR \"EFY11_CROP\" = '39' OR \"EFY11_CROP\" = '40'")

# Process: Calculate Field (14)
arcpy.CalculateField_management(B41, "LUCAS_LC", "\"B41\"", "VB", "")

# Process: Select Layer By Attribute (15)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '18'")

# Process: Calculate Field (15)
arcpy.CalculateField_management(B42, "LUCAS_LC", "\"B42\"", "VB", "")

# Process: Select Layer By Attribute (16)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '11' OR \"EFY11_CROP\" = '22'")

# Process: Calculate Field (16)
arcpy.CalculateField_management(B43, "LUCAS_LC", "\"B43\"", "VB", "")

# Process: Select Layer By Attribute (17)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '8'")

# Process: Calculate Field (17)
arcpy.CalculateField_management(B50, "LUCAS_LC", "\"B50\"", "VB", "")

# Process: Select Layer By Attribute (18)
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arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '43'")

# Process: Calculate Field (18)
arcpy.CalculateField_management(B53, "LUCAS_LC", "\"B53\"", "VB", "")

# Process: Select Layer By Attribute (19)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '19' OR \"EFY11_CROP\" = '20' OR \"EFY11_CROP\" = '27' OR
\"EFY11_CROP\" = '29' OR \"EFY11_CROP\" = '34' OR \"EFY11_CROP\" = '37' OR
\"EFY11_CROP\" = '45.1' OR \"EFY11_CROP\" = '45.2'")

# Process: Calculate Field (19)
arcpy.CalculateField_management(B70, "LUCAS_LC", "\"B70\"", "VB", "")

# Process: Select Layer By Attribute (20)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '21'")

# Process: Calculate Field (20)
arcpy.CalculateField_management(B74, "LUCAS_LC", "\"B74\"", "VB", "")

# Process: Select Layer By Attribute (21)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '37'")

# Process: Calculate Field (21)
arcpy.CalculateField_management(B77, "LUCAS_LC", "\"B77\"", "VB", "")

# Process: Select Layer By Attribute (22)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '28.1' OR \"EFY11_CROP\" = '28.2' OR \"EFY11_CROP\" = '32'
OR \"EFY11_CROP\" = '36.1' OR \"EFY11_CROP\" = '36.2' OR \"EFY11_CROP\" =
'36.3'")

# Process: Calculate Field (22)
arcpy.CalculateField_management(B82, "LUCAS_LC", "\"B82\"", "VB", "")

# Process: Select Layer By Attribute (23)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '15' OR \"EFY11_CROP\" = '15.1' OR \"EFY11_CROP\" = '15.2'
OR \"EFY11_CROP\" = '15.3'")

# Process: Calculate Field (23)
arcpy.CalculateField_management(B81, "LUCAS_LC", "\"B81\"", "VB", "")

# Process: Select Layer By Attribute (24)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '45.1' OR \"EFY11_CROP\" = '41'")

# Process: Calculate Field (24)
arcpy.CalculateField_management(B80, "LUCAS_LC", "\"B80\"", "VB", "")

# Process: Select Layer By Attribute (25)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '9'")

# Process: Calculate Field (25)
arcpy.CalculateField_management(E10, "LUCAS_LC", "\"E10\"", "VB", "")

# Process: Select Layer By Attribute (26)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '42'")

# Process: Calculate Field (26)
arcpy.CalculateField_management(E30, "LUCAS_LC", "\"E30\"", "VB", "")

# Process: Select Layer By Attribute (27)
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arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '26' OR \"EFY11_CROP\" = '35' OR \"EFY11_CROP\" = '44' OR
\"EFY11_CROP\" = '46.1' OR \"EFY11_CROP\" = '46.2' OR \"EFY11_CROP\" =
'46.3'")

# Process: Calculate Field (27)
arcpy.CalculateField_management(N_R_, "LUCAS_LC", "\"n.r.\"", "VB", "")

# Process: Add Field (2)
arcpy.AddField_management(Farmers__Statements, "LUCAS_LU", "TEXT", "", "",
"", "", "NULLABLE", "NON_REQUIRED", "")

# Process: Select Layer By Attribute (28)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION",
"\"EFY11_CROP\" = '16'")

# Process: Calculate Field (28)
arcpy.CalculateField_management(LU_16, "LUCAS_LU", "\"U210\"", "VB", "")

# Process: Select Layer By Attribute
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '39'")

# Process: Calculate Field
arcpy.CalculateField_management(A13, "LUCAS_LC", "\"A13\"", "VB", "")

# Process: Select Layer By Attribute (30)
arcpy.SelectLayerByAttribute_management(DHLOSEIS_2011_VOIOTIAS__3_,
"CLEAR_SELECTION", "")

# Process: Select Layer By Attribute (29)
arcpy.SelectLayerByAttribute_management(LU_16, "SWITCH_SELECTION", "")

# Process: Calculate Field (29)
arcpy.CalculateField_management(DHLOSEIS_2011_VOIOTIAS__31_, "LUCAS_LU",
"\"U111\"", "VB", "")

# Process: Select Layer By Attribute (31)
arcpy.SelectLayerByAttribute_management(DHLOSEIS_2011_VOIOTIAS__30_,
"CLEAR_SELECTION", "")

# Process: Select Layer By Attribute (32)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '1'")

# Process: Calculate Field (30)
arcpy.CalculateField_management(B10, "LUCAS_LC", "\"B10\"", "VB", "")

# Process: Select Layer By Attribute (2)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"EFY11_CROP\" = '4' OR \"EFY11_CROP\" = '5' OR \"EFY11_CROP\" = '6' OR
\"EFY11_CROP\" = '16' OR \"EFY11_CROP\" = '23'")

# Process: Calculate Field (2)
arcpy.CalculateField_management(B00, "LUCAS_LC", "\"B00\"", "VB", "")

# Process: Select Layer By Attribute (33)
arcpy.SelectLayerByAttribute_management(DHLOSEIS_2011_VOIOTIAS__4_,
"CLEAR_SELECTION", "")
```

```
# -*- coding: utf-8 -*-
# ---------------------------------------------------------------------------
-
# LPIS2LUCAS.py
# Geostatistical Model Developed by the GIS Research Unit of the
Agricultural University of Athens
# Description:
# Adds a column in existing Lakes (El.Stat.) dataset, harmonising with LUCAS
Land Cover classification system.
# ---------------------------------------------------------------------------
-

# Import arcpy module
import arcpy

# Script arguments
Lakes = arcpy.GetParameterAsText(0)
if Lakes == '#' or not Lakes:
    Lakes = "limnes" # provide a default value if unspecified

# Local variables:
G10 = Lakes
limnes__3_ = G10

# Process: Add Field
arcpy.AddField_management(Lakes, "LUCAS_LC", "TEXT", "", "", "", "",
"NON_NULLABLE", "NON_REQUIRED", "")

# Process: Calculate Field
arcpy.CalculateField_management(G10, "LUCAS_LC", "\"G10\"", "VB", "")
```

```
# -*- coding: utf-8 -*-
# ---------------------------------------------------------------------------
-
# RES2LUCAS.py
# Created on: 2014-11-27 21:01:43.00000
#   (generated by ArcGIS/ModelBuilder)
# Usage: RES2LUCAS <RES>
# Description:
# Renewable Energy Sources to LUCAS Harmonisation
# ---------------------------------------------------------------------------
-

# Import arcpy module
import arcpy

# Script arguments
RES = arcpy.GetParameterAsText(0)
if RES == '#' or not RES:
    RES = "WT2" # provide a default value if unspecified

# Local variables:
LUCAS_LU = RES
U210 = LUCAS_LU

# Process: Add Field
arcpy.AddField_management(RES, "LUCAS_LU", "TEXT", "", "", "", "",
"NULLABLE", "NON_REQUIRED", "")

# Process: Calculate Field
arcpy.CalculateField_management(LUCAS_LU, "LUCAS_LU", "\"U210\"", "VB", "")
```

```
# -*- coding: utf-8 -*-
# ---------------------------------------------------------------------------
-
# GAEC2LUCAS.py
# Geostatistical Model Developed by the GIS Research Unit of the
Agricultural University of Athens
# Description:
# Adds a column in existing GAEC (Topographic Department) dataset,
harmonising with LUCAS Land Use / Land Cover classification system.
# ---------------------------------------------------------------------------
-

# Import arcpy module
import arcpy

# Script arguments
GAEC_VPG = arcpy.GetParameterAsText(0)
if GAEC_VPG == '#' or not GAEC_VPG:
    GAEC_VPG = "GAEC_VPG" # provide a default value if unspecified

# Local variables:
LUCAS_LC = GAEC_VPG
C00 = LUCAS_LC
GAEC_VPG__2_ = C00
D10 = LUCAS_LC
GAEC_VPG__5_ = D10
D20 = LUCAS_LC
GAEC_VPG__4_ = D20
E30 = LUCAS_LC
GAEC_VPG__6_ = E30
N_R_ = LUCAS_LC
GAEC_VPG__7_ = N_R_
LUCAS_LU = GAEC_VPG
N_R___2_ = LUCAS_LU
GAEC_VPG__8_ = N_R___2_
U112 = LUCAS_LU
GAEC_VPG__9_ = U112
U113 = LUCAS_LU
GAEC_VPG__10_ = U113
U318 = LUCAS_LU
GAEC_VPG__11_ = U318

# Process: Add Field
arcpy.AddField_management(GAEC_VPG, "LUCAS_LC", "TEXT", "", "", "5", "",
"NULLABLE", "NON_REQUIRED", "")

# Process: Select Layer By Attribute
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"GAEC_TYPE_\" = 4")

# Process: Calculate Field
arcpy.CalculateField_management(C00, "LUCAS_LC", "\"C00\"", "VB", "")

# Process: Select Layer By Attribute (2)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"GAEC_TYPE_\" = 5")

# Process: Calculate Field (2)
arcpy.CalculateField_management(D10, "LUCAS_LC", "\"D10\"", "VB", "")

# Process: Select Layer By Attribute (3)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"GAEC_TYPE_\" = 3")

# Process: Calculate Field (3)
arcpy.CalculateField_management(D20, "LUCAS_LC", "\"D20\"", "VB", "")
```

```
# Process: Select Layer By Attribute (4)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"GAEC_TYPE_\" = 7")

# Process: Calculate Field (4)
arcpy.CalculateField_management(E30, "LUCAS_LC", "\"E30\"", "VB", "")

# Process: Select Layer By Attribute (5)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION",
"\"GAEC_TYPE_\" <> 3 AND \"GAEC_TYPE_\" <> 4 AND \"GAEC_TYPE_\" <> 5 AND
\"GAEC_TYPE_\" <> 7")

# Process: Calculate Field (5)
arcpy.CalculateField_management(N_R_, "LUCAS_LC", "\"n.r.\"", "VB", "")

# Process: Add Field (2)
arcpy.AddField_management(GAEC_VPG, "LUCAS_LU", "TEXT", "", "", "5", "",
"NULLABLE", "NON_REQUIRED", "")

# Process: Select Layer By Attribute (6)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION",
"\"GAEC_TYPE_\" <> 1 AND \"GAEC_TYPE_\" <> 2 AND \"GAEC_TYPE_\" <> 11 AND
\"GAEC_TYPE_\" <> 12")

# Process: Calculate Field (6)
arcpy.CalculateField_management(N_R___2_, "LUCAS_LU", "\"n.r.\"", "VB", "")

# Process: Select Layer By Attribute (7)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION",
"\"GAEC_TYPE_\" = 1 OR \"GAEC_TYPE_\" = 2")

# Process: Calculate Field (7)
arcpy.CalculateField_management(U112, "LUCAS_LU", "\"U112\"", "VB", "")

# Process: Select Layer By Attribute (8)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION",
"\"GAEC_TYPE_\" = 11")

# Process: Calculate Field (8)
arcpy.CalculateField_management(U113, "LUCAS_LU", "\"U113\"", "VB", "")

# Process: Select Layer By Attribute (9)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION",
"\"GAEC_TYPE_\" = 12")

# Process: Calculate Field (9)
arcpy.CalculateField_management(U318, "LUCAS_LU", "\"U318\"", "VB", "")
```

```
# -*- coding: utf-8 -*-
# ---------------------------------------------------------------------------
```

 # UA2LUCAS.py

```
# Geostatistical Model Developed by the GIS Research Unit of the Agricultural
University of Athens
# Description:
# Adds a column in existing Urban Atlas dataset, harmonising with LUCAS Land Use
/ Land Cover classification system.
# ---------------------------------------------------------------------------

# Import arcpy module
import arcpy

# Script arguments
Urban_Atlas_layer = arcpy.GetParameterAsText(0)
if Urban_Atlas_layer == '#' or not Urban_Atlas_layer:
    Urban_Atlas_layer = "gr001l_athina" # provide a default value if unspecified

# Local variables:
LUCAS_LC = Urban_Atlas_layer
A10 = LUCAS_LC
gr001l_athina__2_ = A10
A20__2_ = gr001l_athina__2_
A20 = LUCAS_LC
gr001l_athina__4_ = A20
A20__5_ = gr001l_athina__4_
B00 = LUCAS_LC
gr001l_athina__5_ = B00
C00 = LUCAS_LC
gr001l_athina__6_ = C00
H00 = LUCAS_LC
gr001l_athina__7_ = H00
N_R_ = LUCAS_LC
gr001l_athina = N_R_
A20__4_ = LUCAS_LC
gr001l_athina__10_ = A20__4_
LUCAS_LU = Urban_Atlas_layer
N_R___2_ = LUCAS_LU
gr001l_athina__8_ = N_R___2_
A20__3_ = gr001l_athina__8_
U120 = LUCAS_LU
gr001l_athina__13_ = U120
U140 = LUCAS_LU
gr001l_athina__14_ = U140
U220 = LUCAS_LU
gr001l_athina__9_ = U220
U312 = LUCAS_LU
gr001l_athina__3_ = U312
U313 = LUCAS_LU
gr001l_athina__16_ = U313
U314 = LUCAS_LU
gr001l_athina__15_ = U314
U360 = LUCAS_LU
gr001l_athina__11_ = U360
U370 = LUCAS_LU
gr001l_athina__12_ = U370
U311 = LUCAS_LU
gr001l_athina__18_ = U311
U110 = LUCAS_LU
gr001l_athina__19_ = U110
U330 = LUCAS_LU
gr001l_athina__20_ = U330

# Process: Add Field
arcpy.AddField_management(Urban_Atlas_layer, "LUCAS_LC", "TEXT", "", "", "", "",
"NULLABLE", "NON_REQUIRED", "")

# Process: Select Layer By Attribute (3)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE\" =
'13400'")
```

```
# Process: Calculate Field (3)
arcpy.CalculateField_management(B00, "LUCAS_LC", "\"B00\"", "VB", "")

# Process: Select Layer By Attribute (4)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE\" =
'30000'")

# Process: Calculate Field (4)
arcpy.CalculateField_management(C00, "LUCAS_LC", "\"C00\"", "VB", "")

# Process: Select Layer By Attribute (5)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE\" =
'50000'")

# Process: Calculate Field (5)
arcpy.CalculateField_management(H00, "LUCAS_LC", "\"H00\"", "VB", "")

# Process: Select Layer By Attribute (6)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE\" =
'20000' OR \"CODE\" = '12100' OR \"CODE\" = '12200' OR \"CODE\" = '13300' OR
\"CODE\" = '14100' OR \"CODE\" = '14200' OR \"CODE\" = '12220'")

# Process: Calculate Field (6)
arcpy.CalculateField_management(N_R_, "LUCAS_LC", "\"n.r.\"", "VB", "")

# Process: Add Field (2)
arcpy.AddField_management(Urban_Atlas_layer, "LUCAS_LU", "TEXT", "", "", "", "",
"NULLABLE", "NON_REQUIRED", "")

# Process: Select Layer By Attribute (8)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE\" =
'30000'")

# Process: Calculate Field (8)
arcpy.CalculateField_management(U120, "LUCAS_LU", "\"U120\"", "VB", "")

# Process: Select Layer By Attribute (9)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE\" =
'13100'")

# Process: Calculate Field (9)
arcpy.CalculateField_management(U140, "LUCAS_LU", "\"U140\"", "VB", "")

# Process: Select Layer By Attribute (10)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE\" =
'12100'")

# Process: Calculate Field (10)
arcpy.CalculateField_management(U220, "LUCAS_LU", "\"U220\"", "VB", "")

# Process: Select Layer By Attribute (11)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE\" =
'12210' OR \"CODE\" = '12220' ")

# Process: Calculate Field (11)
arcpy.CalculateField_management(U312, "LUCAS_LU", "\"U312\"", "VB", "")

# Process: Select Layer By Attribute (12)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE\" =
'12300'")

# Process: Calculate Field (12)
arcpy.CalculateField_management(U313, "LUCAS_LU", "\"U313\"", "VB", "")

# Process: Select Layer By Attribute (13)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE\" =
'12400'")

# Process: Calculate Field (13)
arcpy.CalculateField_management(U314, "LUCAS_LU", "\"U314\"", "VB", "")
```

```
# Process: Select Layer By Attribute (14)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE\" =
'14200'")

# Process: Calculate Field (14)
arcpy.CalculateField_management(U360, "LUCAS_LU", "\"U360\"", "VB", "")

# Process: Select Layer By Attribute (15)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE\" = '11100'
OR \"CODE\" = '11210' OR \"CODE\" = '11220' OR \"CODE\" = '11230' OR \"CODE\" =
'11240' OR \"CODE\" = '14100'")

# Process: Calculate Field (15)
arcpy.CalculateField_management(U370, "LUCAS_LU", "\"U370\"", "VB", "")

# Process: Select Layer By Attribute
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE\" = '11100'
OR \"CODE\" = '11210' OR \"CODE\" = '11220' OR \"CODE\" = '11230' OR \"CODE\" =
'11240' OR \"CODE\" = '11300' OR \"CODE\" = '12100' OR \"CODE\" = '12300' OR \"CODE\"
= '12400'")

# Process: Calculate Field
arcpy.CalculateField_management(A10, "LUCAS_LC", "\"A10\"", "VB", "")

# Process: Select Layer By Attribute (16)
arcpy.SelectLayerByAttribute_management(gr001l_athina__2_, "CLEAR_SELECTION", "")

# Process: Select Layer By Attribute (7)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE\" = '50000'
OR \"CODE\" = '13400' OR \"CODE\" = '11300'")

# Process: Calculate Field (7)
arcpy.CalculateField_management(N_R___2_, "LUCAS_LU", "\"n.r.\"", "VB", "")

# Process: Select Layer By Attribute (17)
arcpy.SelectLayerByAttribute_management(gr001l_athina__8_, "CLEAR_SELECTION", "")

# Process: Select Layer By Attribute (18)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE\" = '12210'
OR \"CODE\" = '12230' ")

# Process: Calculate Field (16)
arcpy.CalculateField_management(A20__4_, "LUCAS_LC", "\"A20\"", "VB", "")

# Process: Select Layer By Attribute (2)
arcpy.SelectLayerByAttribute_management(LUCAS_LC, "NEW_SELECTION", "\"CODE\" =
'13100'")

# Process: Calculate Field (2)
arcpy.CalculateField_management(A20, "LUCAS_LC", "\"A20\"", "VB", "")

# Process: Select Layer By Attribute (19)
arcpy.SelectLayerByAttribute_management(gr001l_athina__4_, "CLEAR_SELECTION", "")

# Process: Select Layer By Attribute (20)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE\" =
'12230'")

# Process: Calculate Field (17)
arcpy.CalculateField_management(U311, "LUCAS_LU", "\"U311\"", "VB", "")

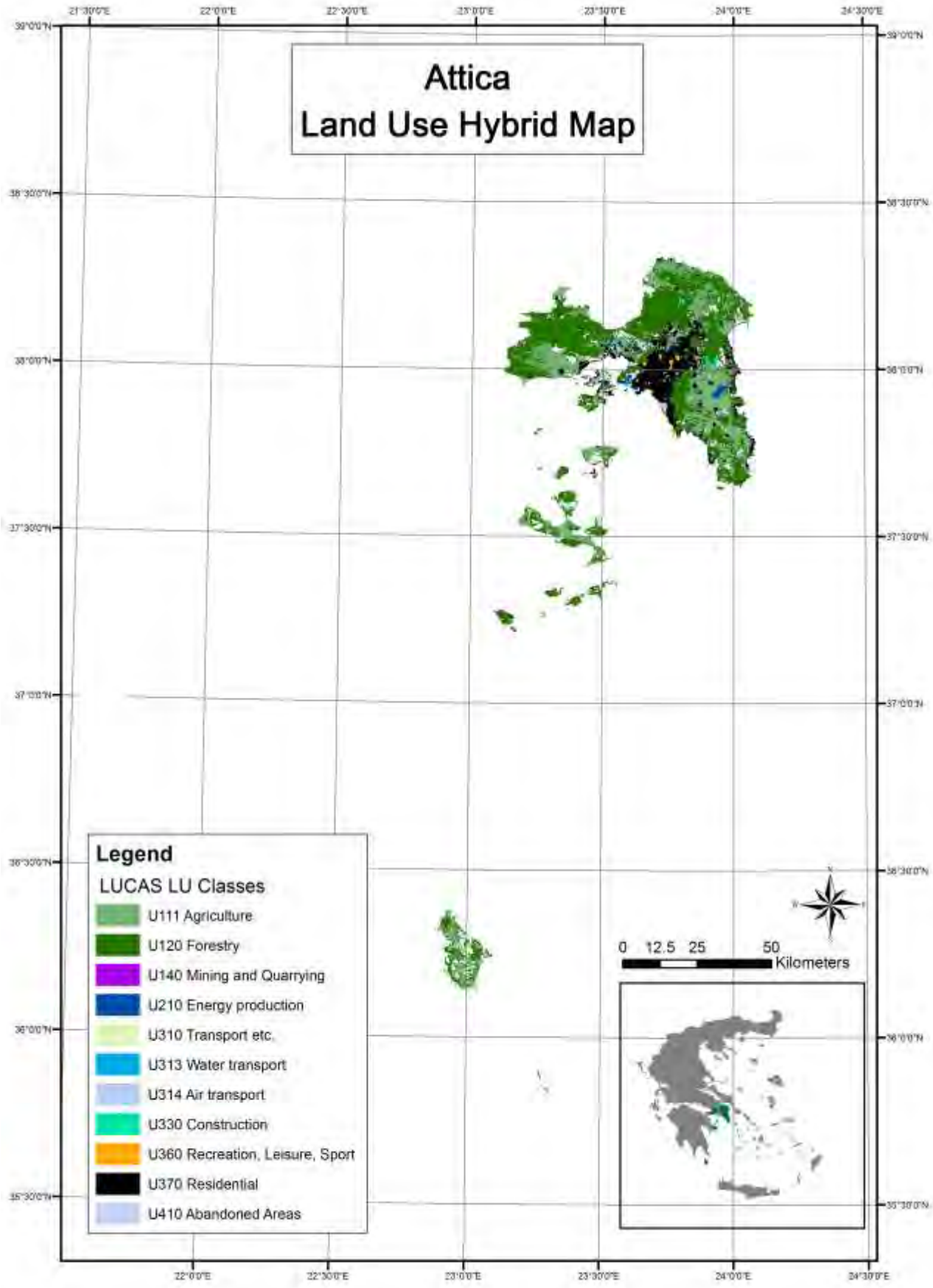
# Process: Select Layer By Attribute (21)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE\" =
'20000'")

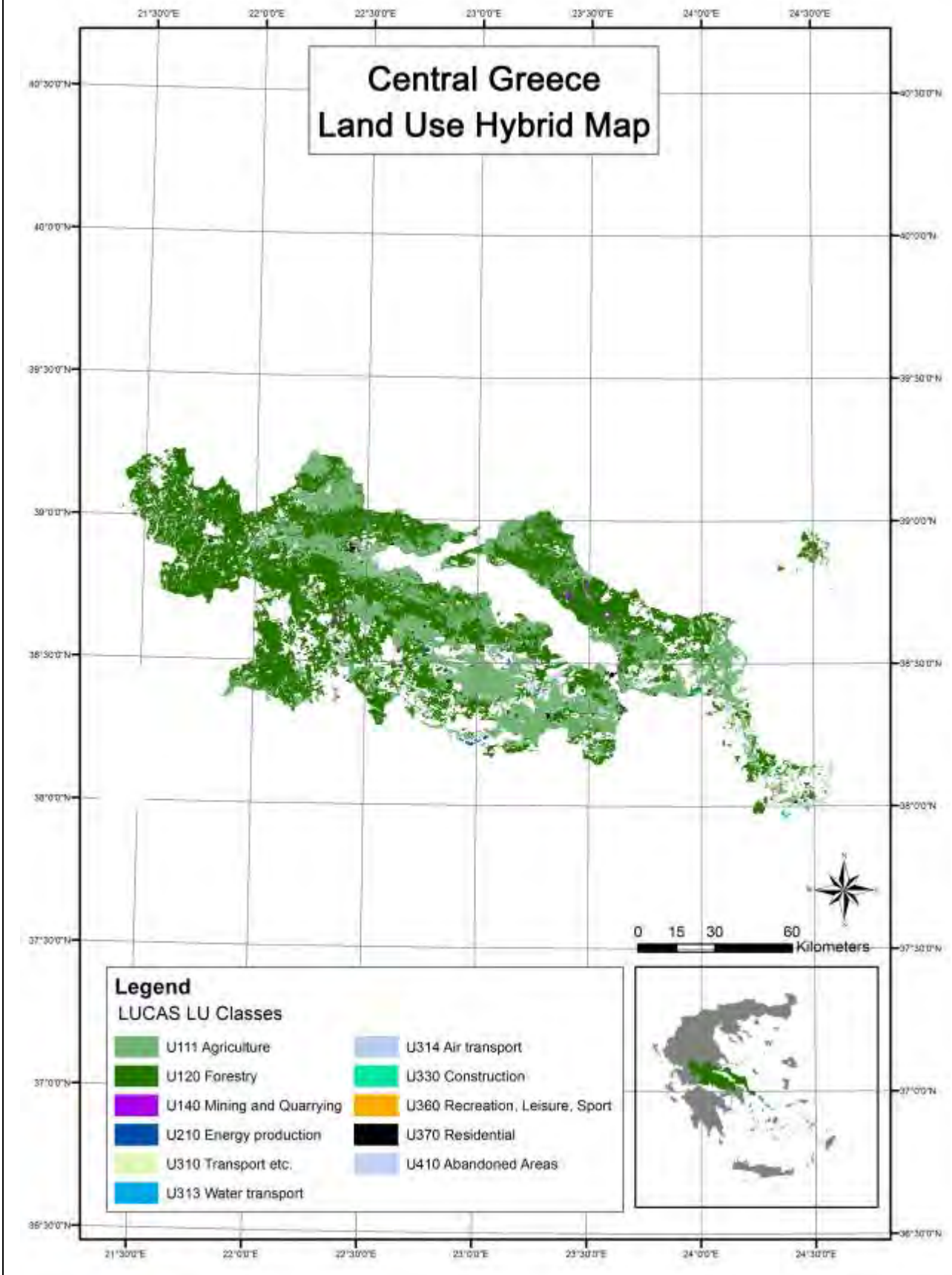
# Process: Calculate Field (18)
arcpy.CalculateField_management(U110, "LUCAS_LU", "\"U110\"", "VB", "")

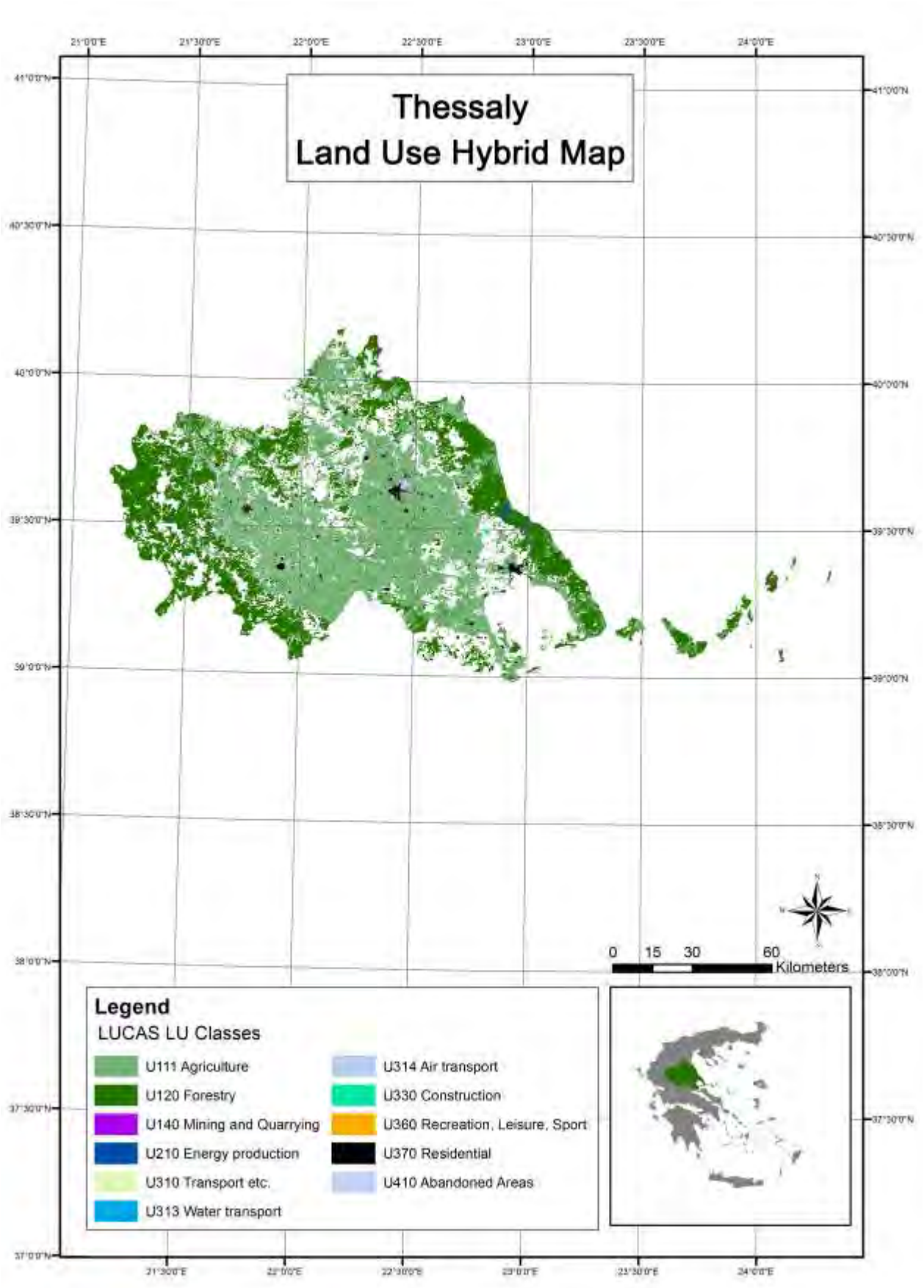
# Process: Select Layer By Attribute (22)
arcpy.SelectLayerByAttribute_management(LUCAS_LU, "NEW_SELECTION", "\"CODE\" =
'13300'")

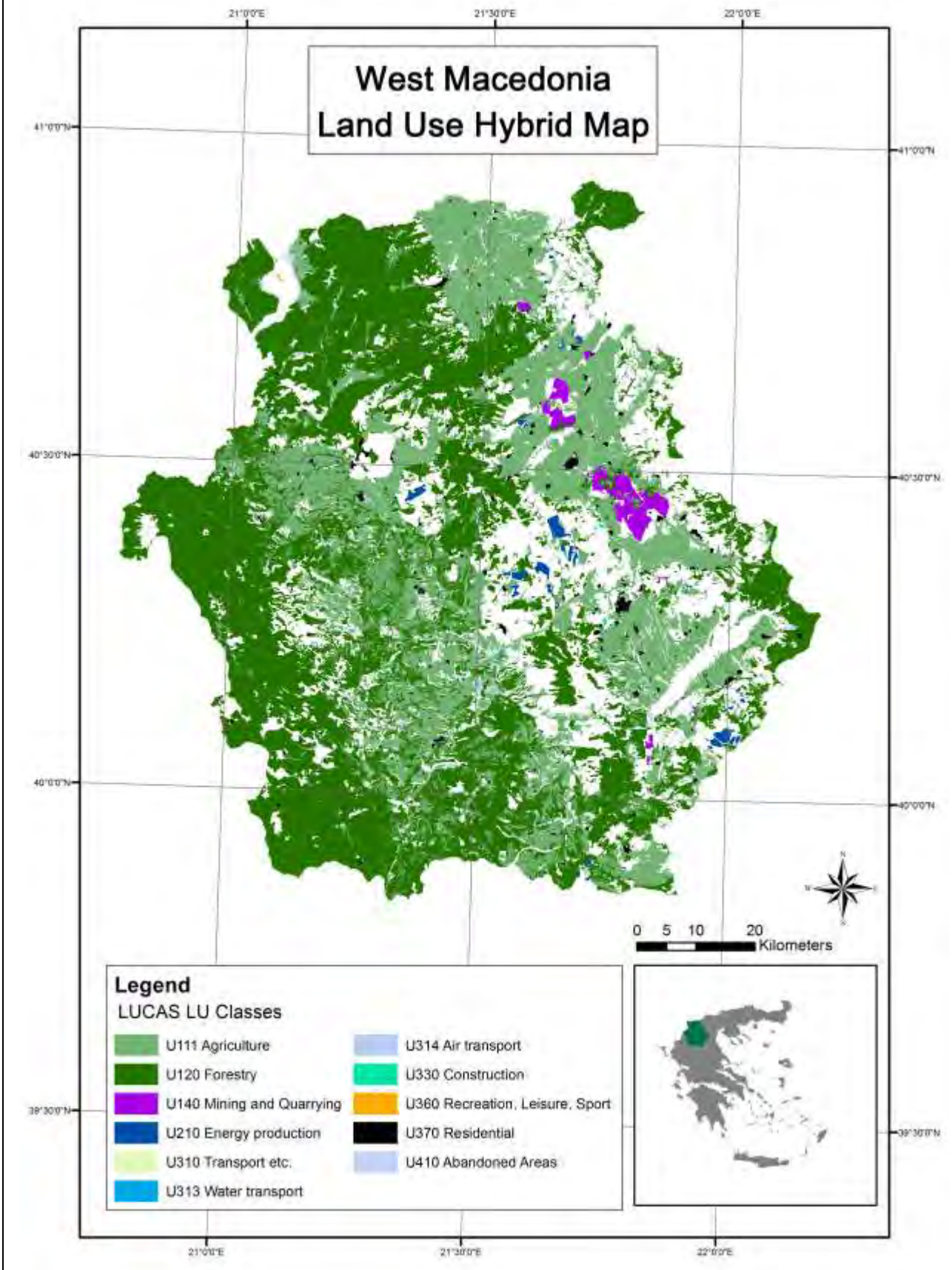
# Process: Calculate Field (19)
arcpy.CalculateField_management(U330, "LUCAS_LU", "\"U330\"", "VB", "")
```

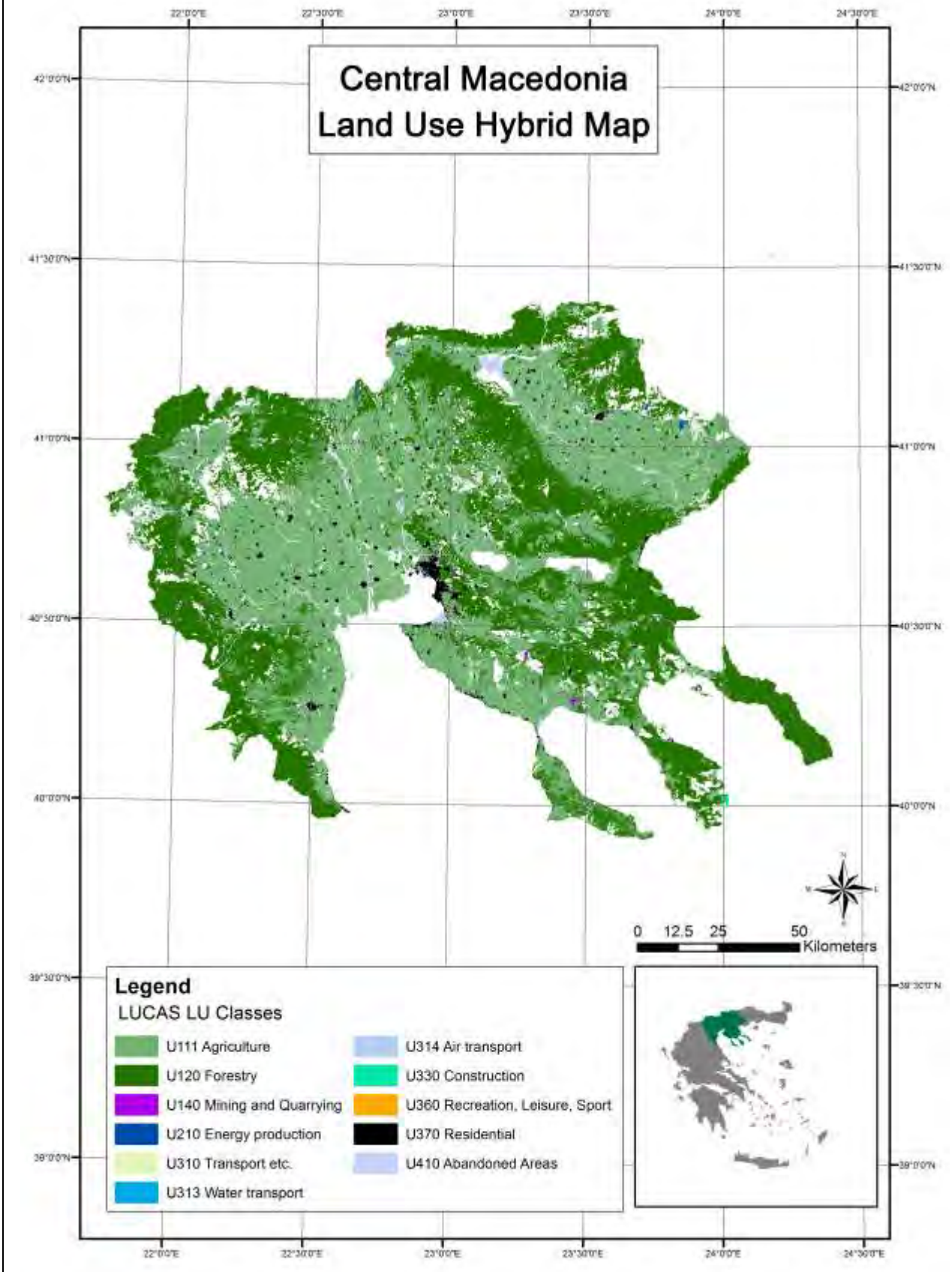
13 ANNEX III – Land Cover and Land Use Maps at NUTS2 Level

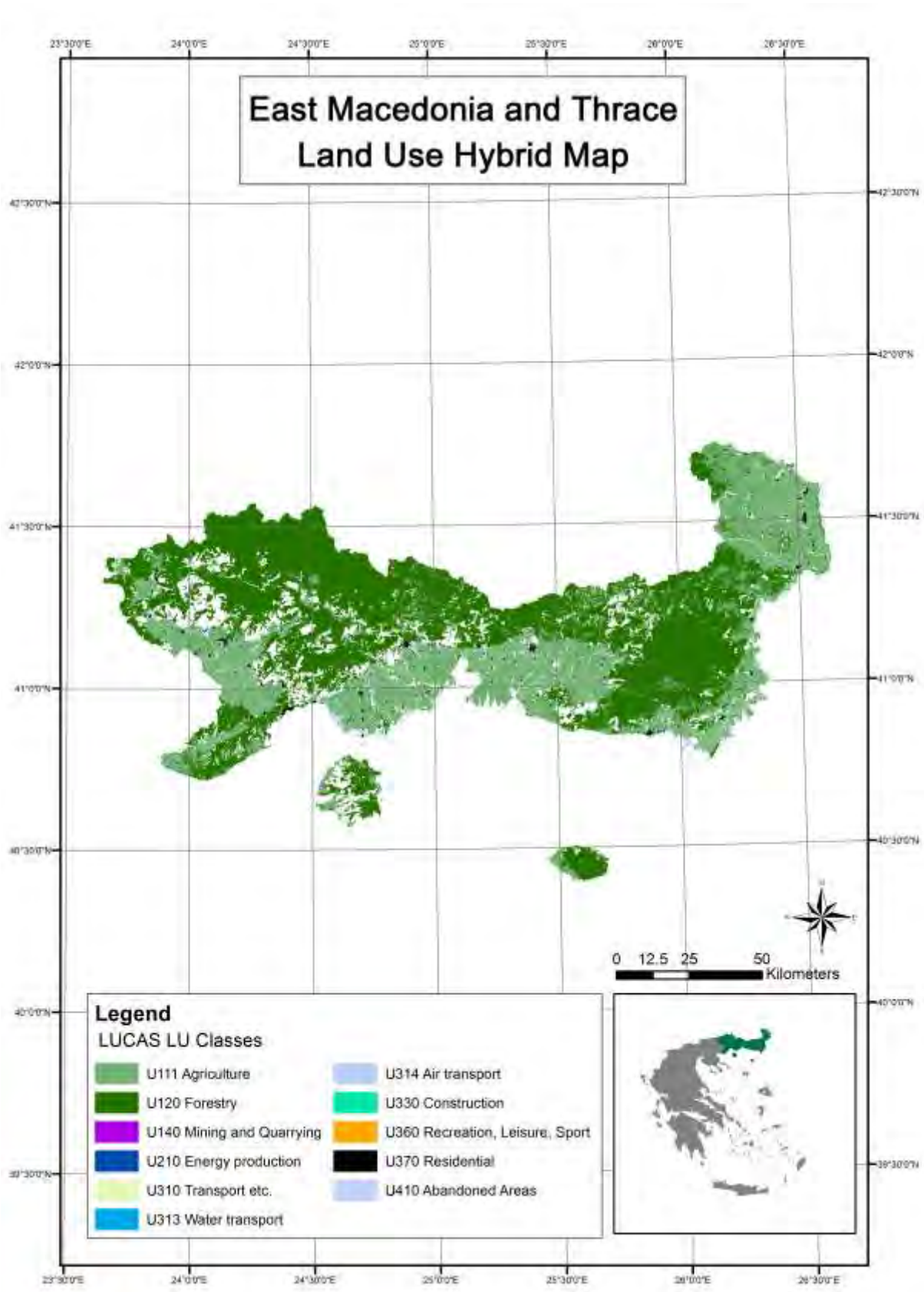

Attica
Land Use Hybrid Map
Legend
LUCAS LU Classes
U111 Agriculture
U120 Forestry
U140 Mining and Quarrying
U210 Energy production
U310 Transport etc.
U313 Water transport
U314 Air transport
U330 Construction
U360 Recreation, Leisure, Sport
U370 Residential
U410 Abandoned Areas
0 12.5 25 50
Kilometers

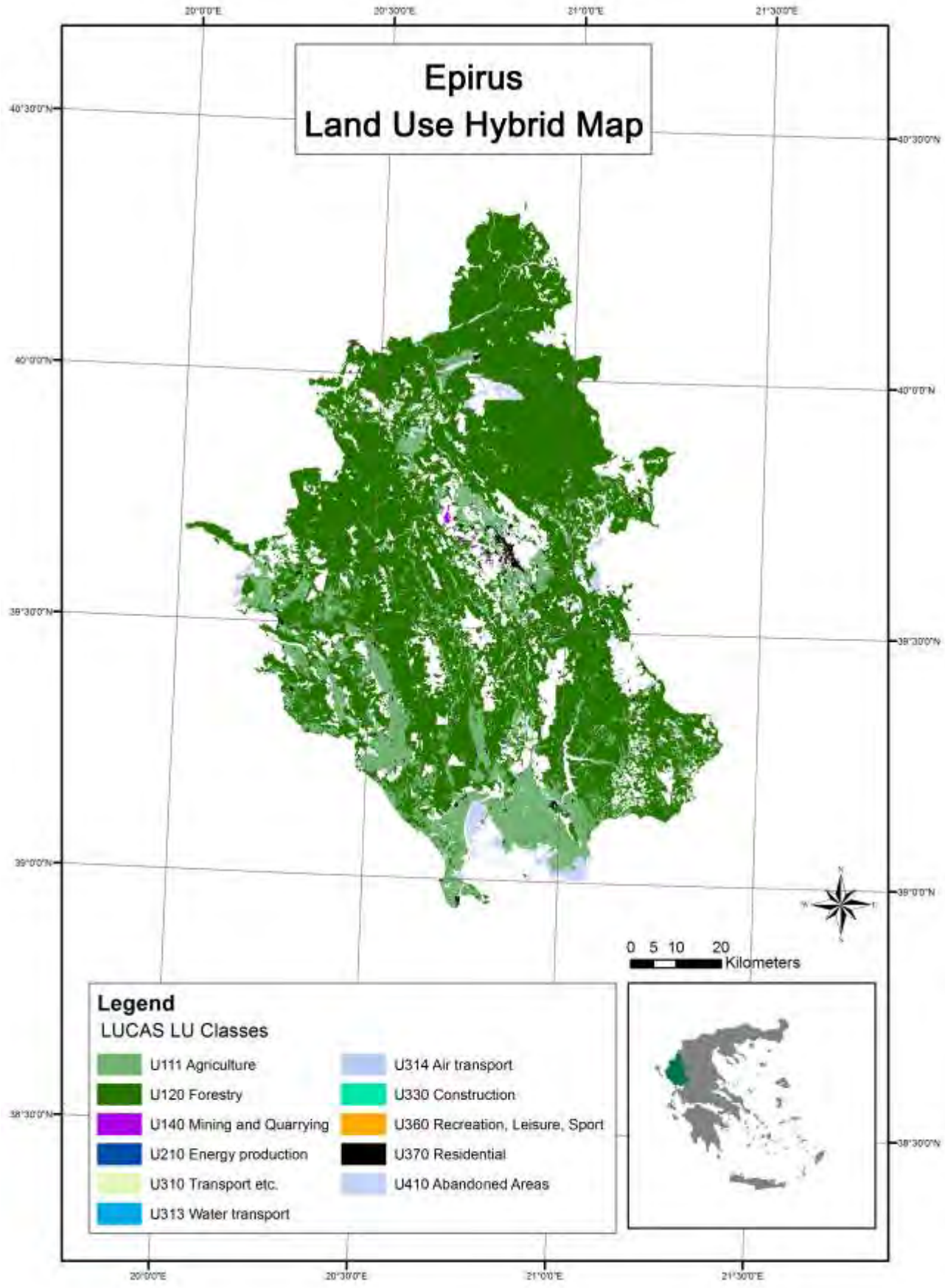

Central Greece
Land Use Hybrid Map
21°30'0"E
22°0'0"E
22°30'0"E
23°0'0"E
23°30'0"E
24°0'0"E
24°30'0"E
40°30'0"N
40°0'0"N
39°30'0"N
39°0'0"N
38°30'0"N
38°0'0"N
37°30'0"N
37°0'0"N
36°30'0"N
0 15 30 60
Kilometers
Legend
LUCAS LU Classes
U111 Agriculture
U120 Forestry
U140 Mining and Quarrying
U210 Energy production
U310 Transport etc.
U313 Water transport
U314 Air transport
U330 Construction
U360 Recreation, Leisure, Sport
U370 Residential
U410 Abandoned Areas

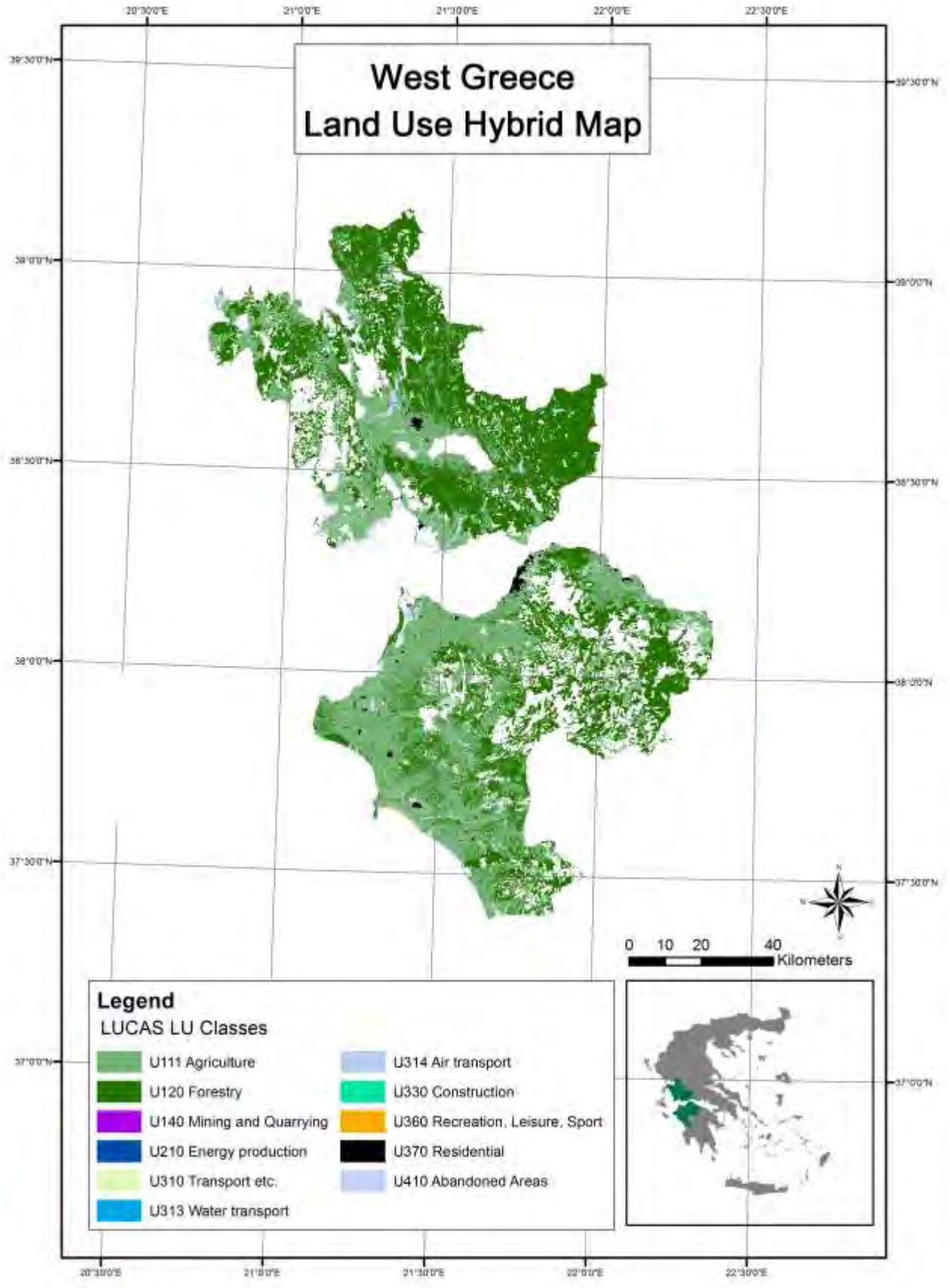

Thessaly
Land Use Hybrid Map
21°0'0"E
21°30'0"E
22°0'0"E
22°30'0"E
23°0'0"E
23°30'0"E
24°0'0"E
41°0'0"N
40°30'0"N
40°0'0"N
39°30'0"N
39°0'0"N
38°30'0"N
38°0'0"N
37°30'0"N
37°0'0"N
0 15 30 60
Kilometers
Legend
LUCAS LU Classes
U111 Agriculture
U120 Forestry
U140 Mining and Quarrying
U210 Energy production
U310 Transport etc.
U313 Water transport
U314 Air transport
U330 Construction
U360 Recreation, Leisure, Sport
U370 Residential
U410 Abandoned Areas

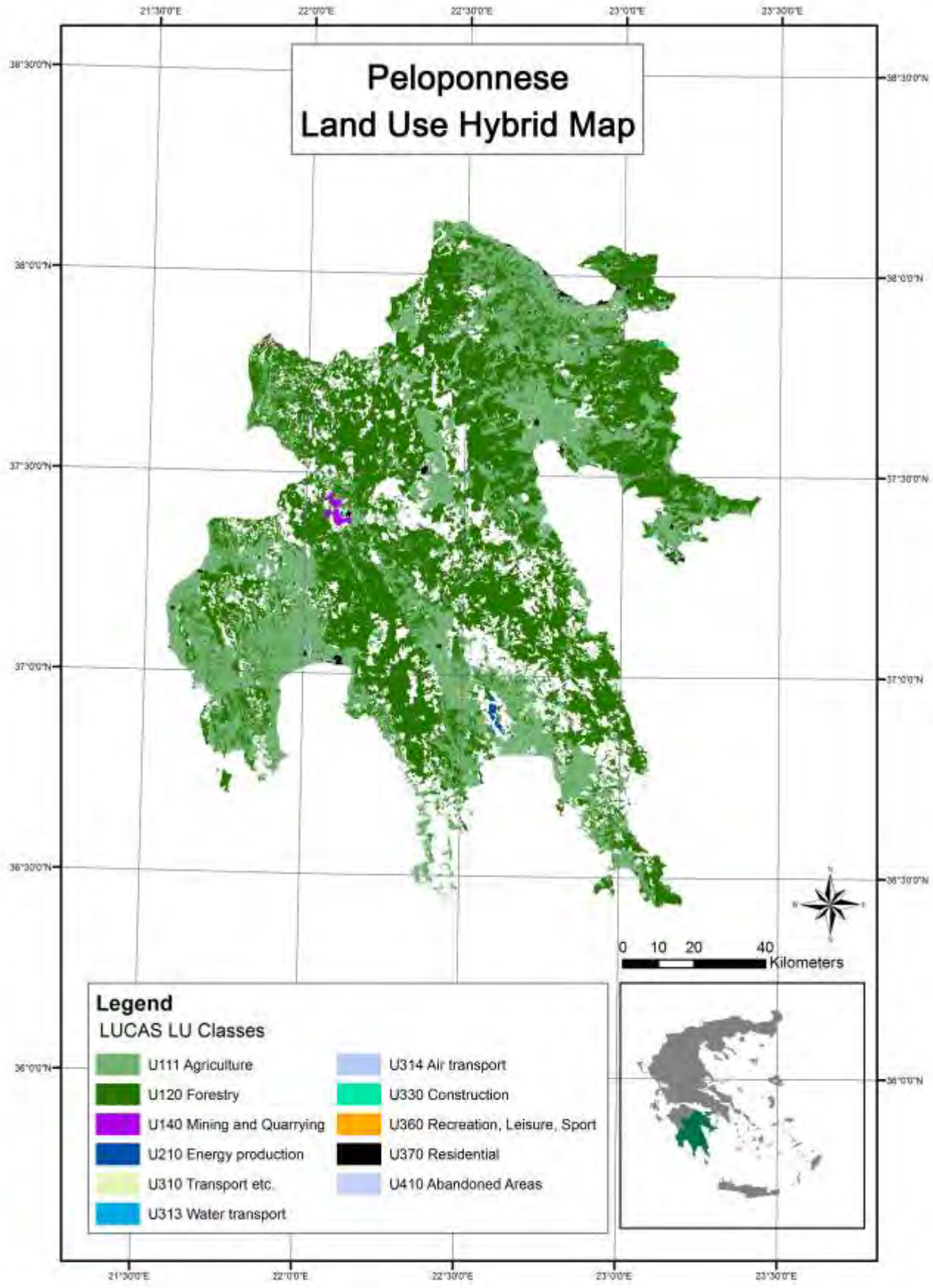

West Macedonia
Land Use Hybrid Map
21°0'0"E
21°30'0"E
22°0'0"E
41°0'0"N
40°30'0"N
40°0'0"N
39°30'0"N
0 5 10 20
Kilometers
Legend
LUCAS LU Classes
U111 Agriculture
U120 Forestry
U140 Mining and Quarrying
U210 Energy production
U310 Transport etc.
U313 Water transport
U314 Air transport
U330 Construction
U360 Recreation, Leisure, Sport
U370 Residential
U410 Abandoned Areas

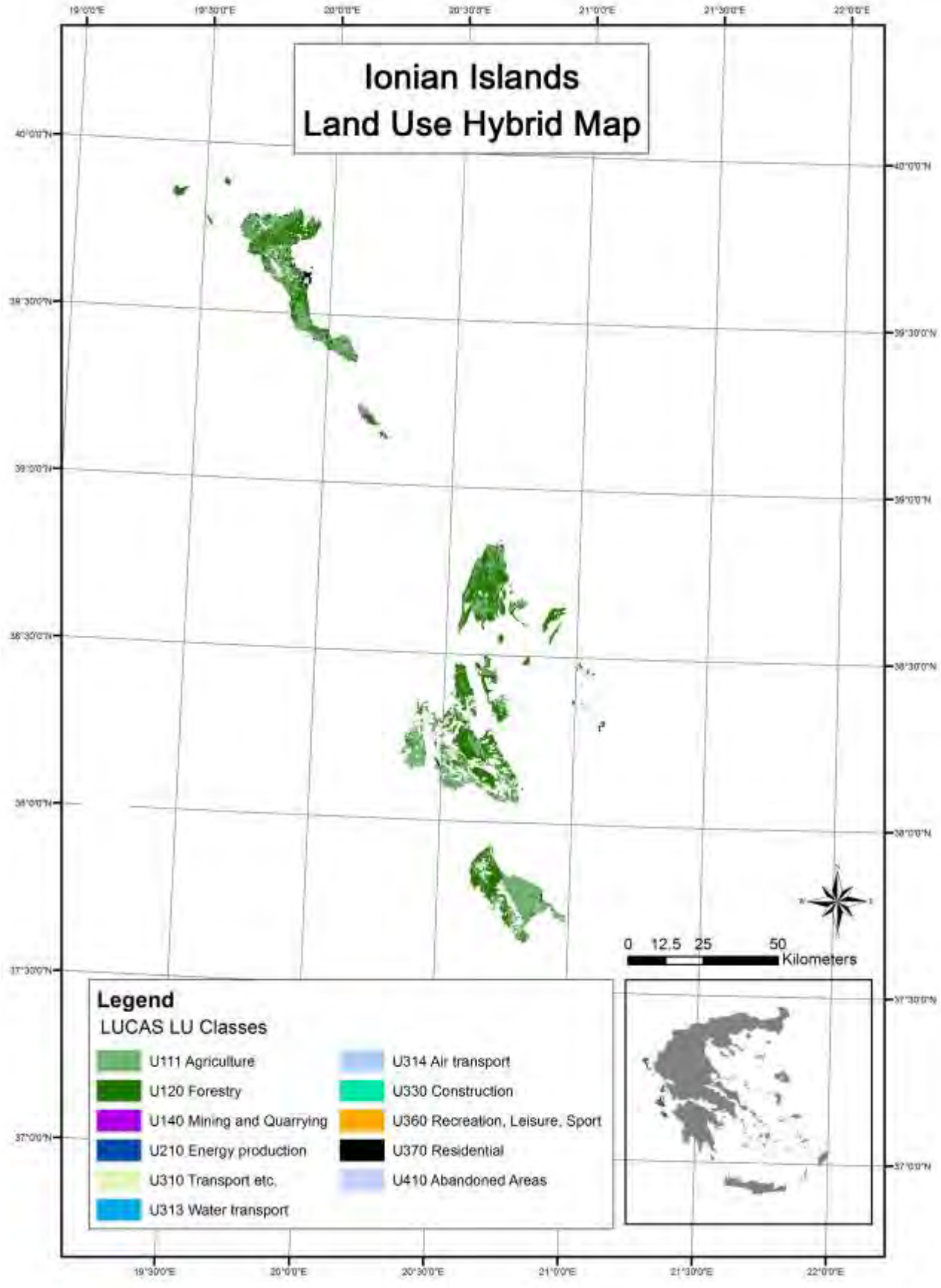

Central Macedonia
Land Use Hybrid Map
22°0'0"E
22°30'0"E
23°0'0"E
23°30'0"E
24°0'0"E
24°30'0"E
42°0'0"N
41°30'0"N
41°0'0"N
40°30'0"N
40°0'0"N
39°30'0"N
39°0'0"N
0 12.5 25 50
Kilometers
Legend
LUCAS LU Classes
U111 Agriculture
U120 Forestry
U140 Mining and Quarrying
U210 Energy production
U310 Transport etc.
U313 Water transport
U314 Air transport
U330 Construction
U360 Recreation, Leisure, Sport
U370 Residential
U410 Abandoned Areas

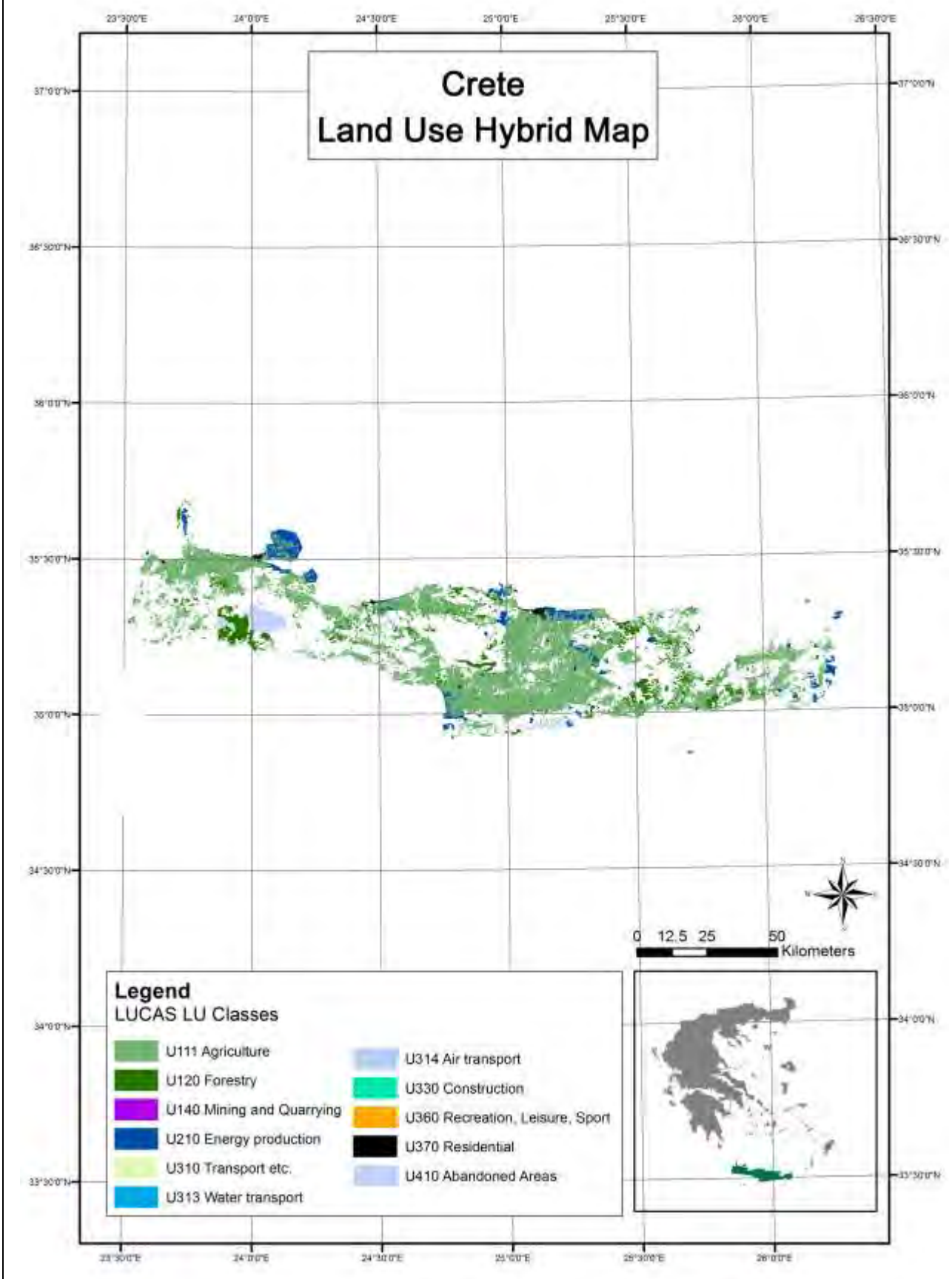

East Macedonia and Thrace
Land Use Hybrid Map
23°30'0"E
24°0'0"E
24°30'0"E
25°0'0"E
25°30'0"E
26°0'0"E
26°30'0"E
42°30'0"N
42°0'0"N
41°30'0"N
41°0'0"N
40°30'0"N
40°0'0"N
39°30'0"N
0 12.5 25 50
Kilometers
Legend
LUCAS LU Classes
U111 Agriculture
U120 Forestry
U140 Mining and Quarrying
U210 Energy production
U310 Transport etc.
U313 Water transport
U314 Air transport
U330 Construction
U360 Recreation, Leisure, Sport
U370 Residential
U410 Abandoned Areas

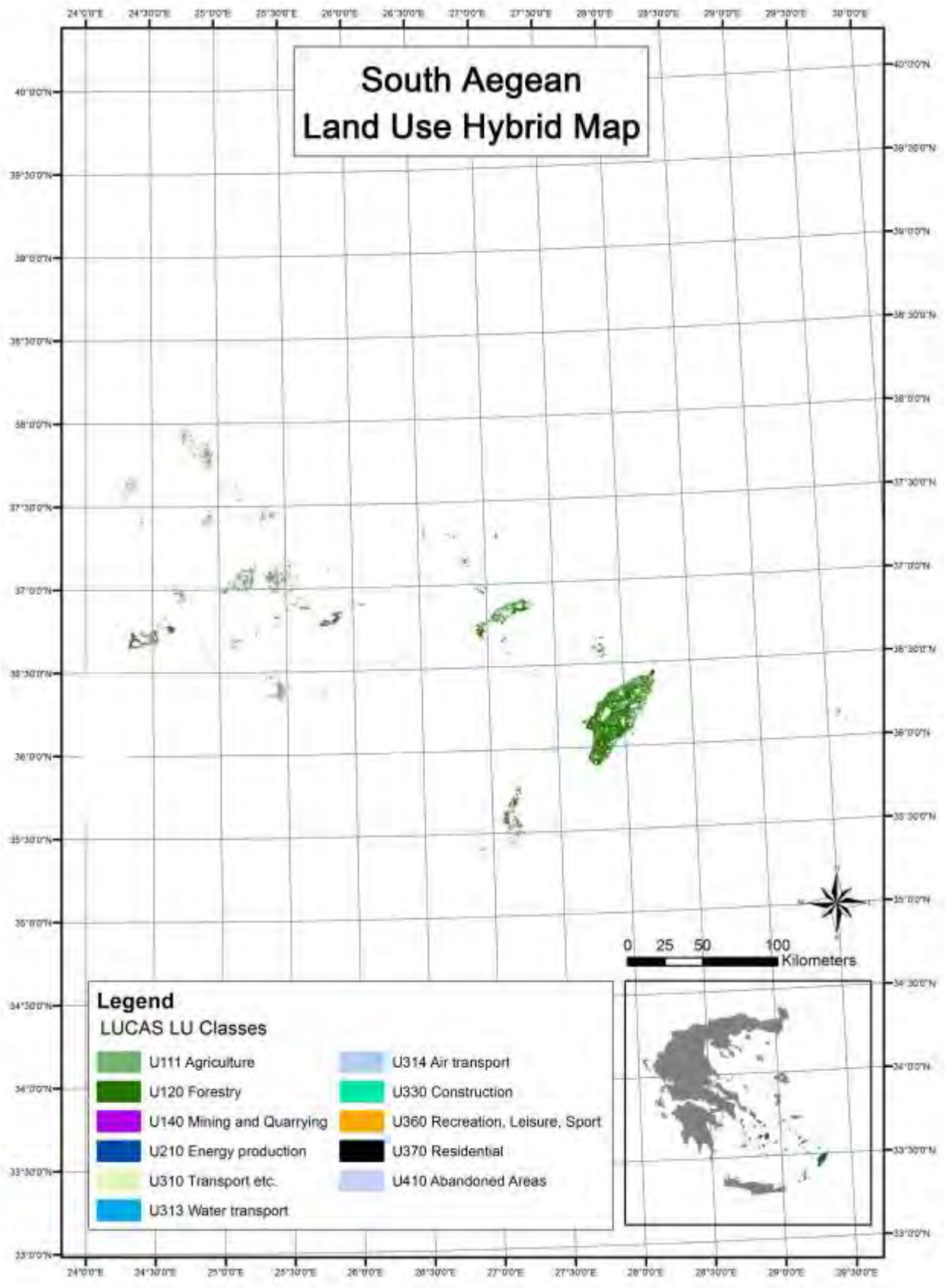

Epirus
Land Use Hybrid Map
20°0'0"E
20°30'0"E
21°0'0"E
21°30'0"E
40°30'0"N
40°0'0"N
39°30'0"N
39°0'0"N
38°30'0"N
0 5 10 20
Kilometers
Legend
LUCAS LU Classes
U111 Agriculture
U120 Forestry
U140 Mining and Quarrying
U210 Energy production
U310 Transport etc.
U313 Water transport
U314 Air transport
U330 Construction
U360 Recreation, Leisure, Sport
U370 Residential
U410 Abandoned Areas

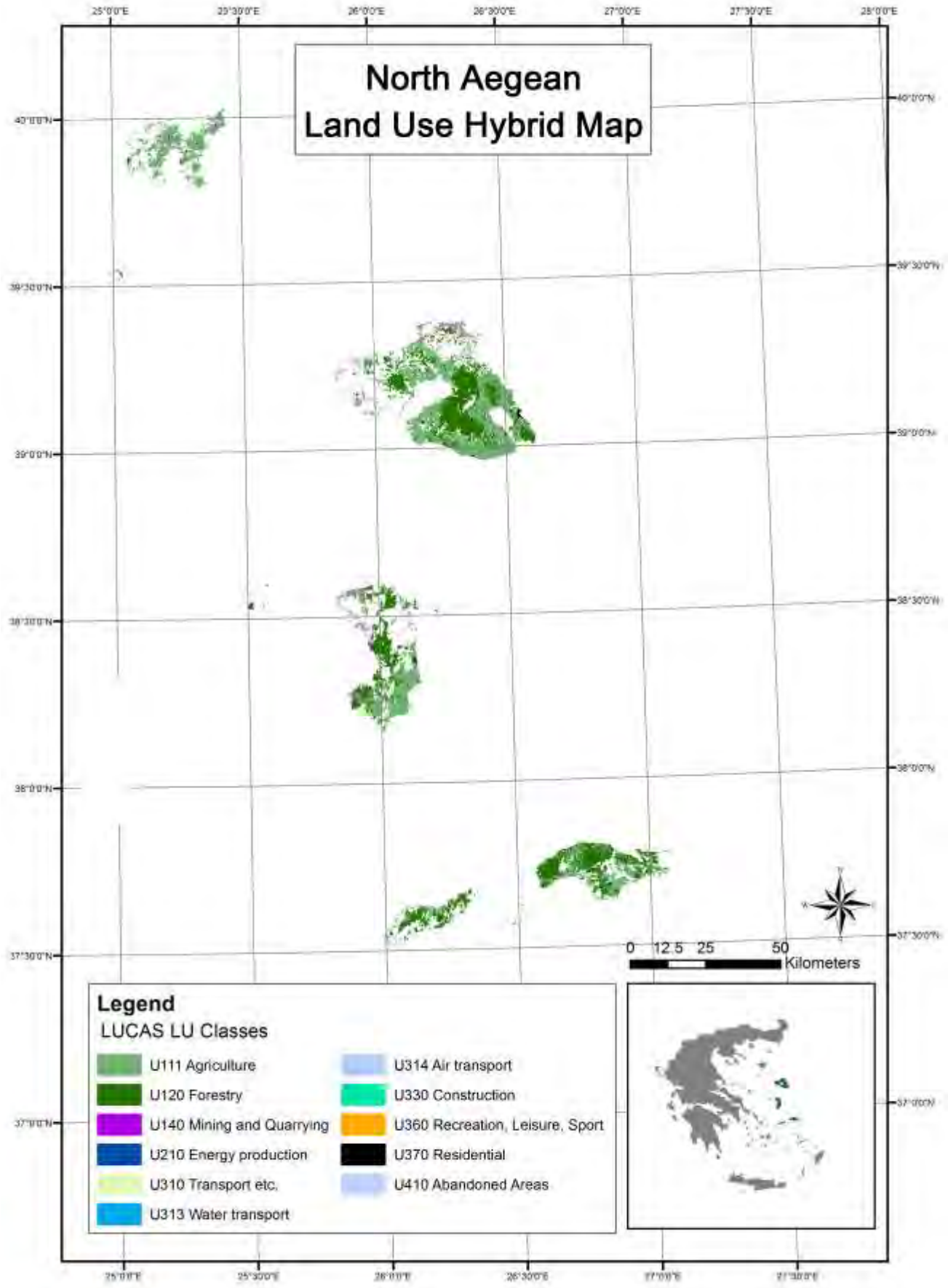

West Greece
Land Use Hybrid Map
20°30'0"E
21°0'0"E
21°30'0"E
22°0'0"E
22°30'0"E
39°30'0"N
39°0'0"N
38°30'0"N
38°0'0"N
37°30'0"N
37°0'0"N
0 10 20 40
Kilometers
Legend
LUCAS LU Classes
U111 Agriculture
U120 Forestry
U140 Mining and Quarrying
U210 Energy production
U310 Transport etc.
U313 Water transport
U314 Air transport
U330 Construction
U360 Recreation, Leisure, Sport
U370 Residential
U410 Abandoned Areas


Peloponnese
Land Use Hybrid Map
21°30'0"E
22°0'0"E
22°30'0"E
23°0'0"E
23°30'0"E
38°30'0"N
38°0'0"N
37°30'0"N
37°0'0"N
36°30'0"N
36°0'0"N
0 10 20 40
Kilometers
Legend
LUCAS LU Classes
U111 Agriculture
U120 Forestry
U140 Mining and Quarrying
U210 Energy production
U310 Transport etc.
U313 Water transport
U314 Air transport
U330 Construction
U360 Recreation, Leisure, Sport
U370 Residential
U410 Abandoned Areas


Ionian Islands
Land Use Hybrid Map
19°0'0"E
19°30'0"E
20°0'0"E
20°30'0"E
21°0'0"E
21°30'0"E
22°0'0"E
40°0'0"N
39°30'0"N
39°0'0"N
38°30'0"N
38°0'0"N
37°30'0"N
37°0'0"N
0 12.5 25 50
Kilometers
Legend
LUCAS LU Classes
U111 Agriculture
U120 Forestry
U140 Mining and Quarrying
U210 Energy production
U310 Transport etc.
U313 Water transport
U314 Air transport
U330 Construction
U360 Recreation, Leisure, Sport
U370 Residential
U410 Abandoned Areas


Crete
Land Use Hybrid Map
23°30'0"E
24°0'0"E
24°30'0"E
25°0'0"E
25°30'0"E
26°0'0"E
26°30'0"E
37°0'0"N
36°30'0"N
36°0'0"N
35°30'0"N
35°0'0"N
34°30'0"N
34°0'0"N
33°30'0"N
0 12.5 25 50
Kilometers
Legend
LUCAS LU Classes
U111 Agriculture
U120 Forestry
U140 Mining and Quarrying
U210 Energy production
U310 Transport etc.
U313 Water transport
U314 Air transport
U330 Construction
U360 Recreation, Leisure, Sport
U370 Residential
U410 Abandoned Areas


South Aegean
Land Use Hybrid Map
0 25 50 100
Kilometers
Legend
LUCAS LU Classes
U111 Agriculture
U120 Forestry
U140 Mining and Quarrying
U210 Energy production
U310 Transport etc.
U313 Water transport
U314 Air transport
U330 Construction
U360 Recreation, Leisure, Sport
U370 Residential
U410 Abandoned Areas


North Aegean
Land Use Hybrid Map
25°0'0"E
25°30'0"E
26°0'0"E
26°30'0"E
27°0'0"E
27°30'0"E
28°0'0"E
40°0'0"N
39°30'0"N
39°0'0"N
38°30'0"N
38°0'0"N
37°30'0"N
37°0'0"N
0 12.5 25 50
Kilometers
Legend
LUCAS LU Classes
U111 Agriculture
U120 Forestry
U140 Mining and Quarrying
U210 Energy production
U310 Transport etc.
U313 Water transport
U314 Air transport
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U360 Recreation, Leisure, Sport
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