

## VERIFICATION OF VERY HIGH RESOLUTION LOCAL COMPONENT PRODUCTS WITH THE LACO-WIKI OPEN ACCESS ONLINE PORTAL

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### Abstract

Very High Resolution local component products provide information on specific land cover characteristics, which are necessary for land cover/land use mapping. The main objectives of this study are the Natura 2000 areas on the territories of the Natural Park Rusenski Lom and the protected area Lomovete. A Dataset and a Sample collection are created and a Validation exercise is provided, using the open access online portal LACO-Wiki. A specific land cover/land use nomenclature is used which is fully compatible with the MAES (Mapping and Assessment of Ecosystems and their Services) nomenclature.

**Key words:** LACO-Wiki software, land cover/land use, Natura 2000 nomenclature, Mapping and Assessment of Ecosystems and their Services.

### Introduction

The aim of the network Natura 2000 (N2K) is to assure the long-term survival of Europe's most valuable and threatened species and habitats. Extracted through Very High Resolution (VHR) satellite images information for land cover/land use (LC/LU) of selected N2K sites is applied for supporting biodiversity monitoring and mapping and assessment of ecosystems and their services. The classes follow the pre-defined nomenclature on the basis of the Mapping and Assessment of Ecosystems and their Services (MAES) typology of ecosystems (Level 1 to Level 4) (Richter et al. 2015) and Corine Land Cover (CLC)

nomenclature (Bossard et al. 2000, Büttner and Kosztra 2007). The production of the Natura 2000 updates is coordinated by the European Environment Agency (EEA) in the frame of the EU Copernicus program (Anonymous 2017).

The main aim of this study is to present the verification methodology for very high resolution local component product Natura 2000 on the territory of the Natural Park Rusenski Lom and the protected area Lomovete. As validation method the visual semi-automatic classification of VHR satellite data is used (Anonymous 2015a). The methodology is applied by means of the open access online portal LACO-Wiki (Anonymous 2016b).

## Very High Resolution Local Component Products

The VHR local component products 2012, finalized by the end of 2015 are available at <http://land.copernicus.eu/local> portal.

The local component products do not cover the complete Pan-European territory, but only selected areas of interest, with a specific challenge in terms of either environmental pressures and problems or spatial management (Table 1). Examples are: cities above a given number of inhabitants (Urban Atlas 2012) (Anonymous 2016), protected areas under the Natura 2000 instrument (N2K 2006–2012), Riparian zones along the hydrographic network or coastal zones etc. (Riparian Zones 2012) (Anonymous 2015). The products are based on very high resolution imagery (2.5 × 2.5 m pixels).

**Table 1. Total area covered by the Very High Resolution local component products.**

Product	Total Area, km <sup>2</sup>
Urban Atlas 2012	1,015,000
Riparian Zones 2012	525,000
N2K 2006–2012	160,000

The Natura 2000 product offers a detailed land cover/land use map for a selection of Natura 2000 sites and a surrounding 2 km buffer zone. The mapping was conducted for 2006 and 2012 and change analysis is available.

In general this layer is designed for the needs of biodiversity monitoring as developments within N2K can be traced reliably. The nomenclature is designed according to feasibility of production and MAES ecosystem types, a high degree of comparability with other LC/LU products, such as the Urban Atlas and the Riparian zones is ensured.

The LC/LU classification is based on the MAES typology of ecosystems (lev-

el 1–4) and includes grassland-rich sites (5 grassland habitats types 6210, 6240, 6250, 6510 and 6520). The mapping extends 2 km beyond site boundaries. The Minimum Mapping Unit (MMU) is 0.5 ha, the Minimum Mapping Width (MMW) is 10 m (Anonymous 2016a).

## Verification of Local Component Data

The aims of the country verification of local component data are to provide complementary information to the systematic quantitative validation results provided by the European scale validation exercise and support the best possible familiarization with the VHR land cover data by national actors while performing systematic technical and thematic quality assessment on the dataset. Verification includes 4 steps: Data preparation; Stratified random sampling of LC/LU polygons; Visual inspection of selected samples, including the possibility to provide comments / feedback and Evaluation of results.

## The LACO-Wiki Software

The LACO-Wiki Online Tool (Fig. 1) is an open access online portal for land cover validation.

This software allows data management and sharing functionality because every data uploaded or generated in LACO-Wiki can be managed by the owner and shared with other users which could provide a valuable resource for building improved hybrid land cover maps. (Anonymous 2016b).

Features:

- LACO-Wiki offers a single online access point for the complete map validation



Fig. 1. The LACO-Wiki Online Tool.

process;

- a user-friendly environment to upload new maps and create sampling designs;
- state-of-the-art accuracy reports generated with just a few clicks;
- easy access to shared datasets and validations sessions, allowing users to share the workload with other people in their team and have multiple people validate datasets at once.

### Natura 2000 LC/LU Nomenclature

In the frame of the Natura 2000 project, a specific LC/LU nomenclature was used which is fully compatible with the MAES nomenclature on Level 1 and as far as possible compatible to the Riparian Zones

project's MAES nomenclature on Levels 1–3, but tailored to the particular needs of a biodiversity monitoring on Level 4 (Richter et al. 2015).

Of special interest is a discrimination of semi-natural/species-rich grassland classes in terms of decrease/increase as well as qualitative changes, which shall be reflected in the class definition on Level 4.

This LC/LU nomenclature ensures compatibility to other European established LC/LU products such as CLC and Urban Atlas as well as Riparian Zones, to a high degree. Natura 2000 LC/LU nomenclature contents the following MAES Level 4 classes (Table 2).

This Nomenclature for the LC/LU dataset is in accordance with the MAES levels 1 (Table 3).

**Table 2. MAES Level 4 classes.**

<b>Level 2</b>	<b>Level 4</b>
1.1 Urban fabric, industrial, commercial, public, military and private units	1.1.1.1 Urban fabric 1.1.1.3. Industrial or commercial units
1.2 Transport infrastructure	1.2.1.1 Road network and associated land 1.2.1.2 Railways and associated land 1.2.1.3 Port areas 1.2.1.4 Airports
1.3 Mineral extraction, dump and construction sites, land without current use	1.3.1.1 Mineral extraction, dump and construction sites 1.3.2.1 Land without current use
1.4 Green urban areas, sports and leisure facilities	1.4.1.1 Green urban areas and leisure facilities
2.1 Arable land	2.1.1.1 Arable irrigated and non-irrigated land 2.1.2.1 Greenhouses
2.2 Permanent crops	2.2.1.1 Vineyards 2.2.2.1 Fruit trees and berry plantations 2.2.3.1 Olive groves
2.3 Heterogeneous agricultural area	2.3.1.1 Annual crops associated with permanent crops 2.3.2.1 Complex cultivation patterns 2.3.3.1 Land principally occupied by agriculture with significant areas of natural vegetation 2.3.4.1 Agro-forestry
3.1 Broadleaved forest	3.1.2.1 Broadleaved swamp forest 3.1.3.1 Other natural & semi-natural broadleaved forest 3.1.4.1 Broadleaved evergreen forest 3.1.5.1 Highly artificial broadleaved plantations
3.2 Coniferous forest	3.2.2.1 Coniferous swamp forest 3.2.3.1 Other natural & semi-natural coniferous forest 3.2.4.1 Highly artificial coniferous plantations
3.3 Mixed forest	3.3.2.1 Mixed swamp forest 3.3.3.1 Other natural & semi-natural mixed forest 3.3.4.1 Highly artificial mixed plantations
3.4 Transitional woodland and scrub	3.4.1.1 Transitional woodland and scrub 3.4.1.2 Lines of trees and scrub
3.5 Damaged forest	3.5.1.1 Damaged forest
4.1 Managed grassland	4.1.1.1 Managed grassland

<b>Level 2</b>	<b>Level 4</b>
4.2 Natural & semi-natural grassland	4.2.1.1 Semi-natural grassland with trees (T.C.D. $\geq$ 30 %)
	4.2.1.2 Semi-natural grassland without trees (T.C.D. $\leq$ 30 %)
4.2.2 Alpine and sub-alpine natural grassland	4.2.2.1 Alpine and sub-alpine natural grassland
5.1 Moors and heathland	5.1.1.1 Heathland and moorlands
	5.1.1.2 Other scrub land
5.2 Sclerophyllous vegetation	5.2.1.1 Sclerophyllous vegetation
6.1 Sparsely vegetated areas	6.1.1.1 Sparsely vegetated areas
	6.2.1.1 Beaches
6.2 Bare soil, rock, perennial snow and ice	6.2.1.2 Dunes
	6.2.1.3 River banks
	6.2.2.1 Bare rocks and rocks debris
	6.2.2.2 Burnt areas (except burnt forest)
	6.2.2.3 Glaciers and perpetual snow
7.1 Inland marshes	7.1.1.1 Inland freshwater marshes
	7.1.2.1 Inland saline marshes
7.2 Peat bogs	7.2.1.1 Exploited peat bog
	7.2.1.2 Unexploited peat bog
8.1 Maritime wetlands	8.1.1.1 Salt marshes
	8.1.1.2 Salines
8.2 Marine waters	8.1.2.1 Intertidal flats
	8.2.1.1 Coastal lagoons
	8.2.2.1 Estuaries
9.1 Water courses	9.1.1.1 Interconnected running water courses
	9.1.1.3 Highly modified natural water courses and canals
	9.1.2.1 Separated water bodies belonging to the river system
9.2 Lakes and reservoirs	9.2.1.1 Natural water bodies
	9.2.1.3 Ponds and lakes with completely man-made structure
	9.2.1.4 Intensively managed fish ponds
	9.2.1.5 Standing water bodies of extractive industrial sites
	9.2.1.5 Standing water bodies of extractive industrial sites
10.1 Marine (other)	10.1.1.1 Marine (other)

Table 3. MAES Levels 1 Description.

MAES level 1	Description
1. Urban	<p>The definition of urban areas in general is according to the Urban Atlas guidelines.</p> <p>The MAES level 2 separates the urban fabric from transportation network, construction &amp; dump sites and green urban areas (including sports facilities).</p> <p>On MAES level 3, Industrial, commercial and military units are separated from urban fabric as well as land without current use from construction and dump sites.</p> <p>The MAES level 4 further differentiates the urban fabric (urban fabric or industrial, commercial and military units) and transport infrastructures (road network, port areas and airports), extraction mine, dump and construction sites and land without current use.</p>
2. Croplands	<p>On MAES Level 2, classes are defined according to the CORINE nomenclature. Three main classes are separated:</p> <ul style="list-style-type: none"> <li>– Arable Land: Land under a rotation system used for annually harvested plants and fallow lands, which are permanently or not irrigated. It includes flooded crops, such as rice fields and other inundated croplands.</li> <li>– Permanent crops: All surfaces occupied by permanent crops, not under a rotation system. They include ligneous crops of standard cultures for fruit production, such as extensive fruit orchards, olive groves, chestnut groves, walnut groves, shrub orchards, vineyards and some other specific low-system orchard plantation, espaliers and climbers.</li> <li>– Heterogeneous agricultural areas: Areas of annual crops associated with permanent crops on the same parcel, annual crops cultivated under forest trees, areas of annual crops, meadows and/or permanent crops which are juxtaposed, landscapes in which crops and pastures are intimately mixed with natural vegetation or natural areas.</li> </ul> <p>Class definitions on Level 3 are CORINE level 3 classes extended by the class 'Greenhouses'. The CLC classes 'Rice fields', 'Irrigated arable land' and 'Non-Irrigated arable land' are merged to one single class: 'Arable irrigated and non-irrigated land'.</p>
3. Woodland and forest	<p>MAES 2 differentiates main types of forests:</p> <ul style="list-style-type: none"> <li>– Broadleaved forest: Vegetation composed mainly of trees, including shrub and understories, where broadleaved species predominate and represent more than 75 % of the pattern.</li> <li>– Coniferous forest: Vegetation composed mainly of trees, including shrub and understories, where coniferous species predominate and represent more than 75 % of the pattern.</li> <li>– Mixed forest: Vegetation composed mainly of trees, including shrub and understories, where neither broadleaved nor coniferous species predominate. The share of coniferous or broadleaved species does not exceed 25 % in the canopy closure.</li> </ul> <p>Transitional woodlands scrub and damaged forest by fire are also included in MAES 2.</p> <p>The differentiation of Woodland and Forest on Level 3–4 is mainly oriented along aggregated EUNIS (the European Nature Information System habitat classes). Main classes are swamp forest, other natural and semi-natural forest and highly artificial forest (e.g. plantations), following the EUNIS classification scheme.</p>

MAES level 1	Description
4. Grassland	<p>MAES level 2 differentiates managed grasslands and natural grasslands.</p> <ul style="list-style-type: none"> <li>– Managed or agricultural grasslands are intensively managed areas (selection of grasses, intensive cutting and grazing, fertilization, etc.) for the production of grass. From a land use point of view, in this case, grass is a crop in the same way as cereals or others.</li> <li>– Natural grasslands include alpine meadows and other semi-natural grasslands included in Habitat Directive (except mountain and lowland hay meadows).</li> </ul> <p>Semi-natural grasslands are frequently associated with trees and scrubs (MAES 3 main differentiation). A distinction between semi-natural grasslands and alpine grasslands are included in MAES 4.</p>
5. Heathland and scrub	<p>The MAES level 2–3 separates Moors and Heathland from areas with sclerophyllous vegetation, following the CORINE Land Cover guidelines.</p> <p>The MAES level 4 further distinguishes Heathlands and Moorlands from Other scrub land.</p>
6. Sparsely vegetated land	<p>Differentiation of MAES Level 2 into two categories: 'Sparsely vegetated areas' and 'Bare soil, rock, perennial snow and ice' in order to separate vegetation classes from non-vegetated surfaces.</p> <p>On Level 3, a further split of non-vegetated surfaces into class 6.2.1 Beaches, dunes, sands and 6.2.2 Bare rocks, burnt areas, glaciers and perpetual snow is performed.</p> <p>Further differentiation in MAES level 4 into the classes 6.2.2.1 Bare rocks and rock debris, 6.2.2.2 Burnt Areas (except burnt forest) and 6.2.2.3 Glaciers and perpetual snow.</p>
7. Wetland	<p>Inland marshes and peat bogs are included in MAES Level 2.</p> <p>MAES Level 3 differentiates between inland freshwater marshes and inland saline marshes.</p> <p>On MAES Level 4 peat bogs are divided in exploited and unexploited peat bog.</p>
8. Lagoons, coastal wetlands and estuaries	<p>On MAES Level 2 Coastal waters are distinguished into maritime wetlands (coastal salt marshes according to the EUNIS habitat classification, salines and intertidal flats) and marine waters (coastal lagoons and estuaries).</p> <p>Maritime wetlands are divided in salt marshes and salines and intertidal flats in MAES level 3. Coastal lagoons and estuaries are also distinguished.</p>
9. Rivers and lakes	<p>'Water courses' (fresh running waters and constructed inland freshwater) and 'Lakes and reservoirs' is the division of MAES Level 2.</p> <p>On MAES Level 3 water courses are separated according to their morphology into interconnected running water courses and separated water bodies belonging to the river systems (oxbow lakes or dead side-arms, flood ponds, etc.)</p> <p>MAES Level 4 is based on:</p> <ul style="list-style-type: none"> <li>– Identification of highly modified natural water courses and canals (navigation, irrigation, water regulation, flood protection and land drainage);</li> <li>– Identification of main artificial or highly transformed water bodies: ponds and lakes with completely man-made structure for irrigation and water supply, intensively managed fish ponds and pools associated with extractive sites.</li> </ul>
10. Marine (Other)	<p>The coastal areas refer to coastal, shallow, marine systems that experience significant land-based influences (MAES Level 2, 3 and 4 Marine – other) not included in lagoons, coastal wetlands or estuaries.</p>

The mapping of land cover and land use of selected areas has as main objective to support the MAES, as part of the EU Biodiversity Strategy to 2020.

## Creating a Dataset and Sample Collection

LACO-Wiki currently supports three different land cover types for Dataset:

### Categorical

Categorical data, also called thematic, discrete, or classified data, are used both for vector and raster data to represent discrete information. Examples of categorical data are land cover or land use maps like Pan-European CORINE land cover, Urban Atlas GlobCover etc.

### Continuous

Continuous data, representing phenomena such as percentage, elevation data or density such as the Copernicus high resolution layers of imperviousness degree and forest density or population (density) maps.

### Background

Background layers can be used additionally to Google and Bing maps base imagery in the validation step. Examples of such datasets would be an orthophoto of the study area.

Through LACO-Wiki software a new dataset named Lomovete is specified (Fig. 2). It covers entirely the Natura 2000 sites and a surrounding 2 km buffer zone in the Natural Park Rusenski Lom and the protected area Lomovete. The legend includes all MAES Level 4 classes.

The next step in the process is creating a sample collection based on the Dataset Lomovete.

There are different sampling methods for the collection. Depending on dataset's land cover type and the uploaded data type (vector or raster file) different sampling methods are available:

### Random point

This approach creates a sample dataset with a definable number of points, which will be randomly distributed over the reference dataset.

### Random pixel

This approach creates a sample dataset with a definable number of pixels which will be randomly selected from the reference dataset. Duplicates are not possible.

### Random polygon

This approach creates a sample dataset with a definable number of polygons which will be randomly selected from the reference dataset. Duplicates are not possible.

### Polygon at random point

This approach creates a sample dataset with a definable number of polygons, which will be randomly selected from the reference dataset, whereby the probability for selection will be influenced by the size of the polygons (i.e. higher probability of large polygons to be selected). Duplicates are not possible.

### Stratified random point

This approach creates a sample data-



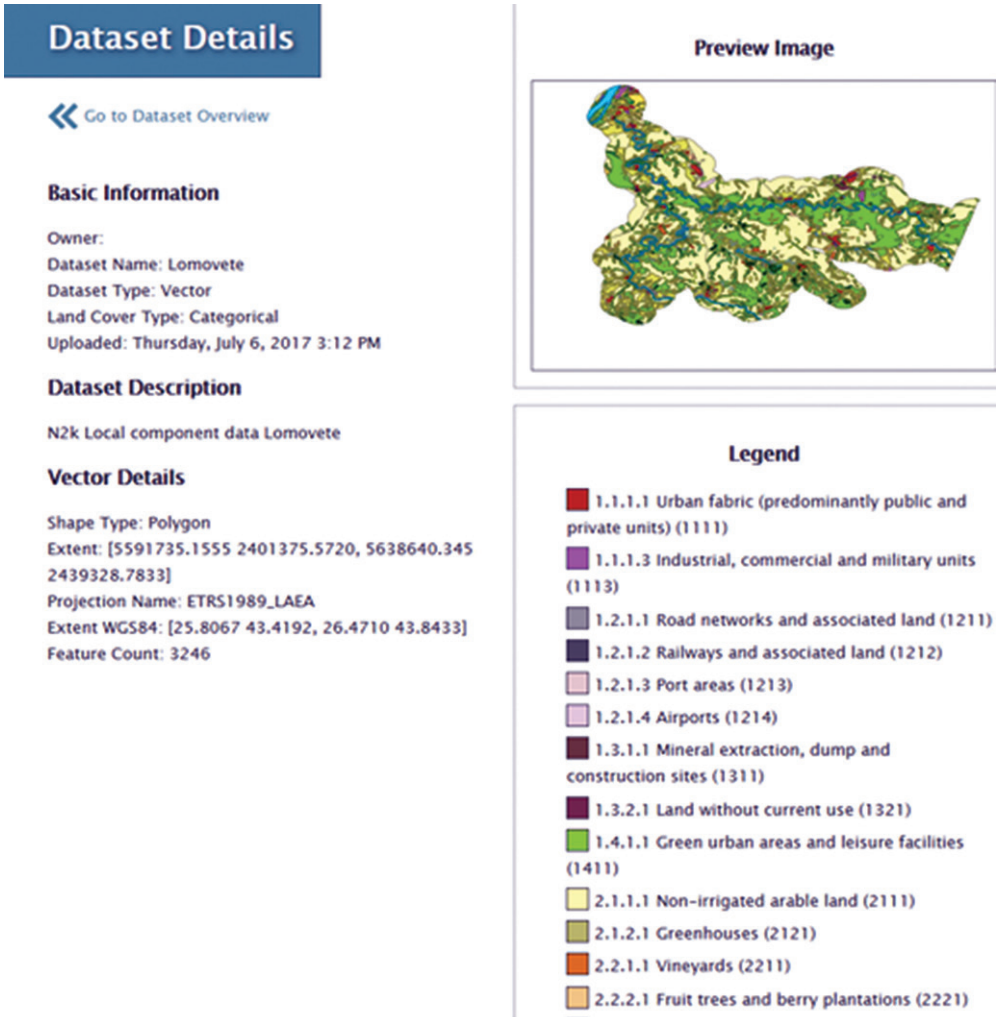


Fig. 2. Dataset Lomovete.

set with a definable number of points per class (e.g. land cover), which will be randomly distributed over the specified classes of the reference dataset.

### Stratified random pixel

This approach creates a sample dataset with a definable number of pixels per class (e.g. land cover), which will be ran-

domly selected from the specified classes of the reference dataset.

### Stratified random polygon

This approach creates a sample dataset with a definable number of polygons per class (e.g. land cover), which will be randomly selected from the specified classes of the reference dataset.

## Validation

The Validation exercise for Dataset Lomovete is created. As a validation Method from 3 possible (Fig. 3) is selected Enhanced Plausibility. The validation exercise makes the use of ESRI World imagery and national orthophoto as reference.

The process of validating can be paused and continued at any time. LA-CO-Wiki also allows you to split the workload by sharing the current validation session with other users and let them continue validating the same dataset.

## Visual inspection of sample polygons

Selected sample polygons are displayed on the top of reference imagery one by one. Interpreters are asked to provide information about following characteristics for each sample:

- Correctness of LC/LU code around the sample point within the sample polygon, considering actual MMU value:
  - ✓ Correct (Fig. 4) / Non correct;
  - ✓ If the LC/LU code is found as non-correct, the interpreter is asked to suggest correct code (Fig. 5).

## Create your Validation exercise

Here you can define a validation exercise for your previously created samples.

**Basic Settings**

Name:  ✓

Description:  ✓

Validation Method:  ✓

**Blind:**  
*The user has no information about the classification of the sample and therefore needs to provide a new interpretation based on a pre-defined list of classes.*

**Plausibility:**  
*The user has information about the classification of the sample and evaluates the plausibility of the thematic classification with yes or no.*

**Enhanced Plausibility:**  
*The user has information about the classification of the sample and evaluates the plausibility of the thematic classification with yes or no. In case the classification is incorrect, the user provides a new interpretation based on a pre-defined list of classes.*

Fig. 3. Creating a Validation exercise for Dataset Lomovete.

- Correctness of delineation of the sample polygon:
  - ✓ Delineated area: Correct / Unnecessary parts included (Fig. 6) / Missing parts / Missing and Unnecessary parts included;
  - ✓ Detail of delineation: Correct /

- Too coarse / Too detailed;
  - ✓ Positional accuracy: Correct / Shifted.
- Characterizing the sample polygon through free text comment.
  - The correctness of LC/LU class should be checked around a random sample

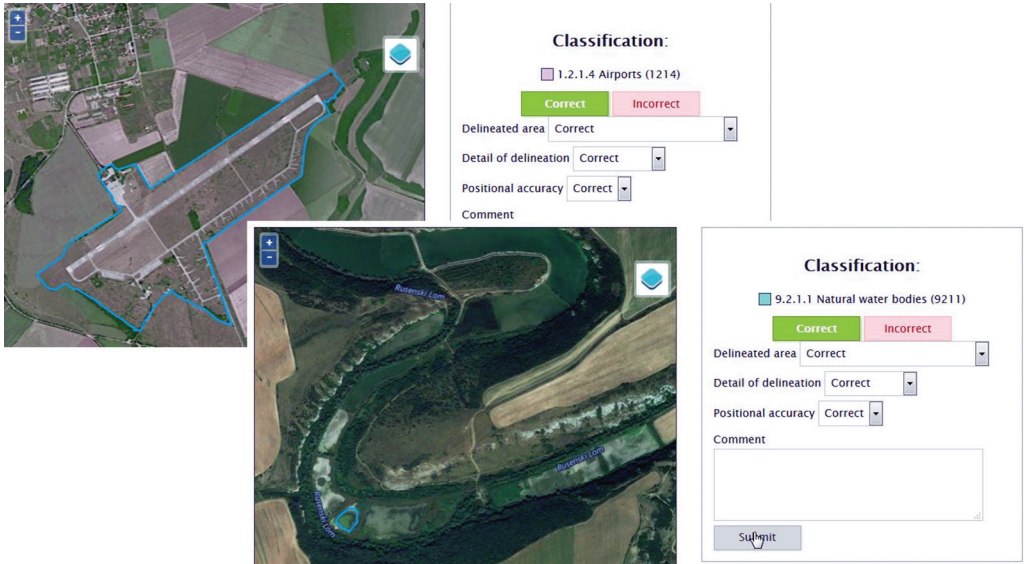


Fig. 4. Correct codes about Airport Straklevo – Ruse and natural water body near Rusenski Lom River.

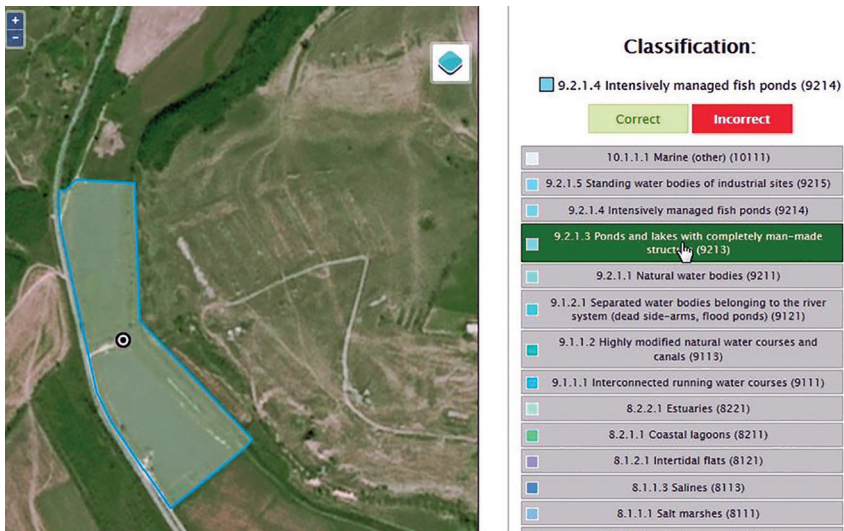
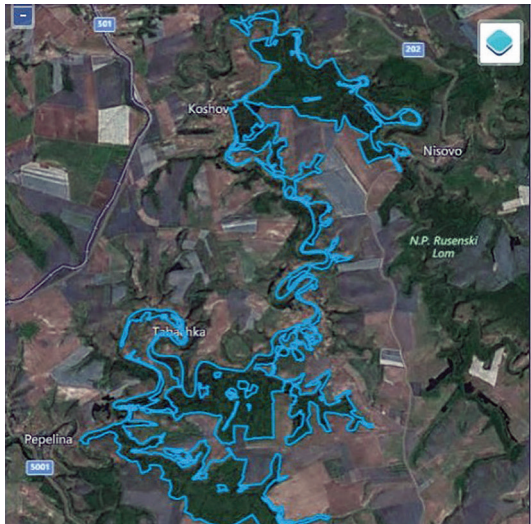


Fig. 5. An incorrect code and interpreter’s suggestion for the correct code.



**Classification:**

3.1.3.1 Other natural & semi natural broadleaved forest (3131)

Correct  Incorrect

Delineated area  Unnecessary parts included

Detail of delineation

Positional accuracy

Comment

**Sample Information**

Sample Item ID 177068

Fig. 6. A correct code with a note about unnecessary parts included in broadleaved forests on the territory of the Natural Park Rusenski Lom.

Classification Error	Classification Error															
	1.1.1.1 Urban fabric (predominantly public and private units) (1111)	1.1.1.3 Industrial, commercial and military units (1113)	1.2.1.1 Road networks and associated land (1211)	1.2.1.2 Railways and associated land (1212)	1.2.1.3 Port areas (1213)	1.2.1.4 Airports (1214)	1.3.1.1 Mineral extraction, dump and construction sites (1311)	1.3.2.1 Land without current use (1321)	1.4.1.1 Green urban areas and leisure facilities (1411)	2.1.1.1 Non-irrigated arable land (2111)	2.1.2.1 Greenhouses (2121)	2.2.1.1 Vineyards (2211)	2.2.2.1 Fruit trees and berry plantations (2221)	2.3.1.1 Olive groves (2311)	2.3.2.1 Annual crops associated with permanent crops (2311)	2.3.2.1 Complex cultivation patterns (2321)
True	3	3	3	3	2	2	3	2	2	3	0	1	1	0	0	2
False	0	0	0	0	0	0	0	0	1	0	1	2	2	0	0	1
Column Total	3	3	3	3	2	2	3	2	3	3	1	3	3	0	0	3
Producer Accuracy	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	66.67%	100.00%	0.00%	33.33%	33.33%	0.00%	0.00%	66.67%
Overall Accuracy	0,780172															
Geometric Agreement																
Delineated area	0,988636															
Detail of delineation	1															
Positional accuracy	1															
	25	9.2.1.3 Ponds and lakes with completely man-made structure	TRUE	Correct	Correct	Correct										
	26	4.1.1.3 Managed grassland	FALSE	Correct	Correct	Correct	2.1.1.1 Arable irrigated and non-irrigated land									
	27	1.2.1.1 Road networks and associated land	TRUE	Correct	Correct	Correct										
	28	2.1.1.1 Non-irrigated arable land	TRUE	Correct	Correct	Correct										
	29	2.3.2.1 Complex cultivation patterns	FALSE	Correct	Correct	Correct	The larger part of this area is 2.1.1.1 Arable irrigated									
	30	9.1.1.2 Highly modified natural water courses and canals	TRUE	Correct	Correct	Correct										
	31	6.2.1.3 River banks	TRUE	Correct	Correct	Correct										
	32	3.4.1.2 Lines of trees and scrub	TRUE	Correct	Correct	Correct										
	33	1.1.1.1 Urban fabric (predominantly public and private units)	TRUE	Correct	Correct	Correct										
	34	2.1.1.1 Non-irrigated arable land	TRUE	Correct	Correct	Correct										
	35	1.3.2.1 Land without current use	TRUE	Correct	Correct	Correct										
	36	9.2.1.4 Intensively managed fish ponds	TRUE	Correct	Correct	Correct										
	37	3.3.3.1 Other natural & semi natural mixed forest	TRUE	Correct	Correct	Correct										
	38	3.3.3.1 Other natural & semi natural mixed forest	FALSE	Correct	Correct	Correct	3.1.3.1 Other natural & semi-natural broadleaved for									
	39	6.1.1.1 Sparsely vegetated areas	TRUE	Correct	Correct	Correct										
	40	2.3.3.1 Land principally occupied by agriculture with significant areas of natural vegetation	TRUE	Correct	Correct	Correct										
	41	1.2.1.3 Port areas	TRUE	Correct	Correct	Correct										
	42	9.1.1.2 Highly modified natural water courses and canals	TRUE	Correct	Correct	Correct										
	43	6.2.2.1 Bare rocks and rock debris	TRUE	Correct	Correct	Correct										

Fig. 7. Parts of Local component verification report.

point within the sample polygon (Fig. 5), taking into account the MMU defined for the dataset – in this case 0.5 ha.

### Local Component Verification Report

The harmonized evaluation of the results is created automatically and provided as an Excel file to download (Fig. 7). The report includes:

- Class specific accuracy parameters calculated automatically by LACO-Wiki tool:
  - ✓ User's accuracy by LC/LU class;
  - ✓ Producer's accuracy by LC/LU class;
  - ✓ Overall user's accuracy;
  - ✓ Uncertainty values will be provided for each accuracy value.
- Summary of the correctness of delineation by LC/LU class based on pre-defined attributes.
- All sample based comments listed by LC/LU class.

### Conclusions

The Very High Resolution local component products are a part of the Pan-European component of the Copernicus Land Monitoring Services, managed by the European Environment Agency. The creation of many of the Copernicus information products and services provide an assessment of the thematic and positional accuracies. Extracted from VHR satellite data LC/LU information in a buffer zone of selected N2K sites provides supporting of the biodiversity monitoring, the mapping and assessment of ecosystems and their

services. Based on the MAES nomenclature the validation allows implementation of these activities on the level of land cover/land use.

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