Developing support for monitoring and reporting of GHG emissions and removals from land use change and forestry

LULUCF

Copernicus for agri-environmental applications
Session 3: Copernicus for Climate Change: monitoring land use and land changes
Thursday, 17th October 2019
Human activities impact terrestrial sinks through land use, land-use change and forestry (LULUCF) activities, therefore the exchange of CO₂ (carbon cycle) between terrestrial biosphere system and the atmosphere is altered. To monitor and report GHG emissions and removals from LULUCF, relevant Commission Regulations are EU 2018/841, EU 2018/1999 and the current one EU 525/2013. They include mechanism for monitoring and reporting GHG emm.

However, the reporting is inconsistent across EU MS with different methods and data sources being employed.
There is an absence of a single/complete dataset providing all the information needed to accurately report on LUCC as required by LULUCF. Therefore, MS combine a variety of data sources including remote sensing (RS), ground-based methods, and statistics, achieving specific results that cannot be compared among MS and through time.

Towards CLC+
Conceptual design and product outlines

Geoff Smith
EAGLE
Land Monitoring in Europe

ENHANCING MONITORING

- Climate Change
- Marine Monitoring
- Atmosphere Monitoring
- Land Monitoring
- Security
- Emergency Management
The BIGGEST Earth Observation System

COPERNICUS USER UPTAKE
Engaging with public authorities, the private sector and civil society

Research → Operational Data
Operational Data → End Users

EUR 8.2 BILLION

Copernicus Market report – Feb 2019
In its 2016 Communication on a European Space Strategy (COM 2016 705 final) the "Commission’s aim is to optimise the benefits that space brings to society and the wider EU economy. Achieving this means boosting demand among public and private users, facilitating access to and use of space data, and stimulating the development and use of innovative downstream applications. It also means ensuring the continuity and user-driven development of EU space programmes“

A principal element of achieving this aim is to enhance user uptake of Copernicus data and services. The Commission has defined a User Uptake Strategy, identifying objectives, key principles and 16 specific actions to implement user uptake measures in the framework of Copernicus and CUP Network.

The FPCUP (Framework Partnership Agreement "Copernicus User Uptake“) consortium has scoped the actions to be implemented in an Action Plan, which is an Annex to the FPA between Commission and the Consortium.

Framework Partnership Agreement on Copernicus User Uptake (FPCUP)
Supplementary Work Programme 2019
COPERNICUS USER UPTAKE NETWORK

Engaging with public authorities, the private sector and civil society

2017 MARKS THE BIRTH OF THREE NEW USER COPERNICUS UPTAKE TOOLS

Copernicus User Uptake Network: traditional partners such as existing thematic or geographic networks and industry, and new entities such as the Copernicus Contact Points and the Copernicus Academy.
Desde 2017 somos Copernicus Academy!


Desde 2017 formamos parte de la FPA!

- 1M€ / año
- 4 años (2018-2021)
- Cofinanciado 85%
- Coordinador DLR

Acciones IHCantabria:

- 2018:
  - Tier 1: Copernicus Academy Training courses in the fields of coastal and catchment zone management (EcoFlu, IT)
  - Tier:
  - Tier 3: Downstream applications for Economic Growth

- 2019:
  - DG_Clima - Developing regional or Member State-specific support for monitoring and reporting of GHG emissions and removals from land use land use change and forestry (Clima, EcoFlu, EcoLit, Oceano)

- 2020: Propuestas para el 24/09/2019!!
  - Tier 1: National User uptake
  - Tier 2: Global actions
  - Tier 3: Business solutions and innovative products
This Action Plan describes **five types of activities** to be implemented:

1. National and multi-national information and **training events**, including workshops conducted by national institutions;
2. Building an **active dialogue** with actors in these measures regarding their needs;
3. Developing **downstream applications and services**, both for public institutions or companies with a need for EO-services;
4. **Piloting** downstream applications and services for public institutions in different Member States or Copernicus Participating States;
5. **Promoting** national and multi-national **innovative actions**.

Actions in FPCUP Work Programmes are generally named according to YEAR-TIER-NUMBER, e.g. 2019-3-03.

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Global actions, including European cross-border user uptake and international user uptake (Tier 2)

The action of this Supplementary WP is under Tier 2 including European cross-borders user uptake and international user uptake activities.

<table>
<thead>
<tr>
<th>Action Title</th>
<th>Partner</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tier 2: Global actions (1 additional Action)</strong></td>
<td></td>
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<tr>
<td>2019-2-49 Developing support for monitoring and reporting of GHG emissions and removals from land use, land use change and forestry</td>
<td>FMI, IGiK, SYKE, SRTI-BAS, CUNI, CBK PAN, Castra, IH Cantabria, NUIM</td>
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</tbody>
</table>
Developing support for monitoring and reporting of GHG emissions and removals from land use, land use change and forestry (LULUCF). The objectives of the current Action are:

1. to examine existing reporting systems in the Member States (MS) while developing supports for monitoring and reporting of GHG emissions and removals from land use, land use change and forestry (LULUCF);

2. to propose developing a pan-European system for collectively estimating the change in carbon stocks and resulting GHG emissions and removals from land use, land use change and forestry;

3. to carry out a pilot study on the emerging methods for developing these estimates, building largely on Copernicus data and services such as CLC+ components and Sentinel imagery, with the aim of capitalizing LULUCF Monitoring on existing pan-EU data sets;

4. to evaluate these integrated national estimates at selected test regions using long-term time series of maps derived from satellite data.
Spatial Datasets + Methodology for unifying LULUCF spatial data

MITECO meetings - real needs - Copernicus solutions - Advisory group:
Success case studies
Three main axes:

1. **validation** of the National Emissions Inventory, i.e. time series of changes validated through RS data;

2. more **specificity** in the LULC types of interest (forests, grasslands, croplands, wetlands) by using Spatial Datasets available at the regional, national and EU levels (e.g. CLC+, IFN4 and MFE25 or specific analyses derived from projects or monitoring programs);

3. **Monitoring** and update of the LULC database since 2016 using S2 and auxiliary data.

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1. **LULUCF technicians** from the Ministry

2. **Advisory Research Group** (Research centres and private companies)

**Success case studies**
Mapping broad-scale vegetation patterns in complex mountainous territories

Habitat maps using modelling techniques in SCI→SAC of Natura 2000 Network in Cantabria (NW Spain) 26% of Cantabria. 25 hábitats...

Álvarez-Martínez et al, 2017
## LC TYPOLOGIES (habitats)

### EUNIS typologies in Cantabria

<table>
<thead>
<tr>
<th>ID</th>
<th>EUNIS</th>
<th>N</th>
<th>Descripción</th>
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<tbody>
<tr>
<td>1</td>
<td>A2</td>
<td>103</td>
<td>Littoral sediment</td>
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<tr>
<td>2</td>
<td>A2.61</td>
<td>37</td>
<td>Seagrass beds on littoral sediments</td>
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<tr>
<td>3</td>
<td>C1</td>
<td>271</td>
<td>Surface standing waters</td>
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<tr>
<td>4</td>
<td>C2.2</td>
<td>169</td>
<td>Permanent non-tidal, fast, turbulent watercourses</td>
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<tr>
<td>5</td>
<td>D1.21</td>
<td>385</td>
<td>Hyperoceanic low-altitude blanket bogs, typically with dominant [Trichophorum]</td>
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<tr>
<td>6</td>
<td>E1.2</td>
<td>62</td>
<td>Perennial calcareous grassland and basic steppes</td>
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<td>7</td>
<td>E1.263</td>
<td>227</td>
<td>Middle European [Brachypodium] semidry grasslands</td>
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<td>8</td>
<td>E1.7</td>
<td>41</td>
<td>Closed non-Mediterranean dry acid and neutral grassland</td>
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<tr>
<td>9</td>
<td>E1.712</td>
<td>95</td>
<td>Sub-Atlantic [Nardus]-[Galium] grasslands</td>
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<tr>
<td>10</td>
<td>E1.721</td>
<td>131</td>
<td>Nemoral [Agrostis]-[Festuca] grasslands</td>
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<tr>
<td>11</td>
<td>E2.1</td>
<td>243</td>
<td>Permanent mesotrophic pastures and aftermath-grazed meadows</td>
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<tr>
<td>12</td>
<td>E2.11</td>
<td>436</td>
<td>Unbroken pastures</td>
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<tr>
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<td>E2.111</td>
<td>612</td>
<td>Ryegrass pastures</td>
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<td>14</td>
<td>E2.112</td>
<td>171</td>
<td>Atlantic [Cynosurus]-[Centaurea] pastures</td>
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<td>15</td>
<td>E2.2</td>
<td>328</td>
<td>Low and medium altitude hay meadows</td>
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<td>E2.21</td>
<td>125</td>
<td>Atlantic hay meadows</td>
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<td>Sub-Atlantic lowland hay meadows</td>
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<td>18</td>
<td>E5.31</td>
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<td>Sub-Atlantic [Pteridium aquilinum] fields</td>
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<td>19</td>
<td>F2.2</td>
<td>52</td>
<td>Evergreen alpine and subalpine heath and scrub</td>
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<td>20</td>
<td>F2.231</td>
<td>73</td>
<td>Mountain [Juniperus nana] scrub</td>
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<td>F3.13</td>
<td>31</td>
<td>Atlantic poor soil thickets</td>
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<tr>
<td>22</td>
<td>F3.17</td>
<td>125</td>
<td>[Corylus] thickets</td>
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<td>23</td>
<td>F3.171</td>
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<td>Atlantic and sub-Atlantic hazel thickets</td>
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<td>24</td>
<td>F3.25</td>
<td>37</td>
<td>Piornales</td>
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<td>26</td>
<td>F4.2</td>
<td>978</td>
<td>Dry heaths</td>
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<td>27</td>
<td>F4.23</td>
<td>120</td>
<td>Atlantic [Erica]-[Ulex] heaths</td>
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<tr>
<td>28</td>
<td>F4.237</td>
<td>190</td>
<td>Cantabro-Pyrenean [Erica vagans]-[E. cinerea] heaths</td>
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<tr>
<td>29</td>
<td>F7.4</td>
<td>138</td>
<td>Hedgehog-heaths</td>
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<td>834</td>
<td>Pyreneo-Cantabrian cushion-heaths</td>
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<tr>
<td>31</td>
<td>FA</td>
<td>46</td>
<td>Hedgerows</td>
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<tr>
<td>32</td>
<td>G1</td>
<td>40</td>
<td>Broadleaved deciduous Woodland</td>
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<tr>
<td>33</td>
<td>G1.21</td>
<td>252</td>
<td>Riverine [Fraxinus] - [Alnus] woodland, wet at high but not at low water</td>
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<tr>
<td>34</td>
<td>G1.214</td>
<td>130</td>
<td>Pyreneo-Cantabrian alder galleries</td>
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<tr>
<td>35</td>
<td>G1.6</td>
<td>134</td>
<td>[Fagus] woodland</td>
</tr>
<tr>
<td>36</td>
<td>G1.62</td>
<td>353</td>
<td>Atlantic acidophilous [Fagus] forests</td>
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<tr>
<td>37</td>
<td>G1.624</td>
<td>65</td>
<td>Pyreneo-Cantabrian acidophilous beech forests</td>
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<tr>
<td>38</td>
<td>G1.625</td>
<td>179</td>
<td>Western Cantabrian acidophilous beech forests</td>
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<tr>
<td>39</td>
<td>G1.64</td>
<td>247</td>
<td>Pyreneo-Cantabrian neutrophile [Fagus] forests</td>
</tr>
</tbody>
</table>
2016-2018
25000 puntos

MAR CANTÁBRICO

Jose A. Prieto
Borja Jiménez-Alfaro
(U. de Oviedo)
Fermin del Ejido
(U. de León)

Puntos de entrenamiento:
- Calidad media y baja
- Calidad media
- Calidad alta

Altitud (m)

N

0 10 20 km
Remote Sensing (RS)

Satellite imagery:
Landsat 5TM and 8OLI 30m
Sentinel 2 A and B, 10-20m
DEIMOS-2, 4m
LiDAR derived data, 5-30m

ENV. LIMITING FACTORS

topography, climate, soil
SPECTRAL SIGNATURES

Habitat 4020

Verano

A

Habitat 4030 (b)

C

Habitat 6510 (a)

E

B

D

F

Soectral library: HABITAT TYPES
Pasture campaign
Year 2020 (N2000)
Processing in real time of data series of imagery

Landsat, MODIS and Sentinel 2

Daily data for the 2000-present period.
MONITORING LULC

N2K PROTECTED AREA DOÑANA NATIONAL PARK (ANDALUSIA-SOUTHERN SPAIN)

TEMPORAL PROFILE

36 DAYS COMPOSITE

NDVI MOD13
NDVI MOD13 Filter
Beech forest, Stable, Climatic variation

Secondary succession
Grassland decrease
Higher minimums

Vetetation recovery after fire
Deep learning is a class of machine learning algorithms that use a cascade of multiple layers of nonlinear processing units for feature extraction and transformation to learn about the feature to represent by using supervised or unsupervised approaches.
AREA OF OCCUPANCY

4030 - European dry heathlands
Higher sun elevation and minimum cloud cover from USGS and ESA

Zoom
175_033
false_color_752
Reflect BOA
Roads detail
Higher sun elevation and minimum cloud cover from ESA

Zoom
Sentinel_2A_1282
ReflecBOA_topo
Roads detail
Landsat 8 MVC
Landsat8 x2
Sentinel2 x2
Deimos2 x2
+LiDAR +MDT

MODELLING RESULTS

High suitability

Low suitability
Landsat 8 MVC
Landsat 8 x2
Sentinel2 x2
Deimos2 x2
+LiDAR +MDT

MODELLING RESULTS

High suitability

Low suitability
¡Gracias!