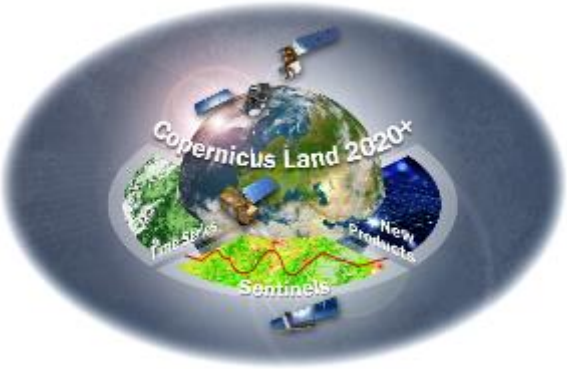
Horizon 2020

Space Call - Earth Observation: EO-3-2016: Evolution of Copernicus services

Grant Agreement No. 730008

ECoLaSS

Evolution of Copernicus Land Services based on Sentinel data



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"D53.2a – White Paper on Copernicus Land Evolution (Issue 1)"

Issue/Rev.: 1.0

Date Issued: 23.12.2018

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in collaboration with the consortium partners:

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submitted to:

European Commission – Research Executive Agency

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme, under Grant Agreement No. 730008.

DOCUMENT RELEASE SHEET

	NAME, FUNCTION	DATE	SIGNATURE
Author(s):	Christophe Sannier (SIRS), Sophie Villerot (SIRS), Markus Probeck (GAF)	21.12.2018	
Review:	Sophie Villerot (SIRS)	22.12.2018	
Approval:	Markus Probeck (GAF)	23.12.2018	
Acceptance:	Massimo Ciscato (REA)		
Distribution:	Public		

DISSEMINATION LEVEL

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PU	Public	**X**
CO	Confidential: only for members of the consortium (including the Commission Services)	

DOCUMENT STATUS SHEET

ISSUE/REV	DATE	PAGE(S)	DESCRIPTION / CHANGES
1.0	23.12.2018	5	First draft Issue with outline of final White Paper on Copernicus Land Evolution.

The Horizon 2020 (H2020) project "Evolution of Copernicus Land Services based on Sentinel data" (ECoLaSS) addresses the H2020 Work Programme 5 iii. Leadership in Enabling and Industrial technologies - Space, specifically the Topic EO-3-2016: Evolution of Copernicus services. ECoLaSS is being conducted from 2017–2019 and aims at developing and prototypically demonstrating selected innovative products and methods as candidates for future next-generation operational Copernicus Land Monitoring Service (CLMS) products of the pan-European and Global Components. ECoLaSS assesses the operational readiness of such candidate products and eventually suggests some of these for implementation. This shall enable the key CLMS stakeholders (i.e. mainly the Entrusted European Entities (EEE) EEA and JRC) to take informed decisions on potential procurement as (part of) the next generation of Copernicus Land services from 2020 onwards.

To achieve this goal, ECoLaSS makes full use of dense time series of High-Resolution (HR) Sentinel-2 optical and Sentinel-1 Synthetic Aperture Radar (SAR) data, complemented by Medium-Resolution (MR) Sentinel-3 optical data if needed. Rapidly evolving scientific developments as well as user requirements are continuously analysed in a close stakeholder interaction process, targeting a future pan-European roll-out of new/improved CLMS products, and the potential transferability to global applications.

The present White Paper is intended to summarise the status of the project's developments and operationality assessments, and present the project's suggestions for new/improved Copernicus Land Monitoring Service (CLMS) candidate products for operational implementation. Together with the more detailed documentary evidence (in various public project reports), it is directed mainly towards the Copernicus decision makers in the EC, the EEEs and the Copernicus User Forum and Copernicus Committee, to allow taking informed decisions. However, since the project has only passed the mid-term development milestone, the results are still in a very preliminary stage and actually, it is still too early to present a fully-fledged White Paper. Nevertheless, this early draft version gives a preview on the outline of the White Paper, which will be published towards the end of the ECoLaSS project in late-2019.

As part of its operationalization framework task, ECoLaSS is currently assessing several new/improved Copernicus Land Monitoring Service (CLMS) candidate products based on a range of collected user requirements, in terms of dedicated technical, operational and political framework criteria which will need to be fulfilled before a formal process of integration into the CLMS portfolio can be considered. This assessment is done through a dedicated benchmarking process, at the end of which the most "operationally promising" product candidates are identified.

An integration into the CLMS operational environment is envisaged to be facilitated by a dedicated Integration Plan, suggesting a roadmap towards the integration of improved and new products into the Copernicus service architecture, with a clear description of the requirements and practical modalities for implementing these products. Furthermore, it proves the rationale behind each suggested operational candidate product, together with a related clear justification as to why it should become part of the Copernicus service evolution, specifically in view of policy requirements and stakeholder needs. A final version of this is expected once substantial results are available from the project's product testing and demonstration efforts in mid-2019. It is expected to distinguish two main mechanisms for integrating operational candidate products:

- Products which constitute improvements of existing CLMS products will be easier to integrate, and the related integration plan will be a matter of assessing mainly whether and how the related improvements can be implemented for the next planned regular update cycle of the products.
- For newly developed products, a careful assessment will be undertaken to examine how and when they could be integrated into the then existing Copernicus Land service architecture in terms of availability of respective funds/budget lines, policy relevance and complementarity with other products.

In the following, a short preview of the final White Paper's outline is presented:

General Findings/Issues:

- Increased spatial resolution to 10 m for the High Resolution Layer (HRL) status layers
- Change layers with a stable spatial resolution of 20 m
- Production could be envisioned on DIAS
- Current requirements of 85/90% thematic accuracy are still challenging for change layers/update products, but presumably reachable with light manual enhancement of status layers
- Backward compatibility when possible, through the flagging of technical errors in the previous layers
- Minimisation of overlap between HRLs
- To be assessed in 2019: Feasibility of a yearly update that would propel the services into a continuous production mechanism, implying the shortening of the production to 12 months
- If possible, yearly update will be dimensioned: the automated approach, supported by the use of time series, should already shorten the production times
- In addition, it should be noticed that there is a trade-off between the magnitude of change and the resulting accuracy of the change detection. In other words, the smaller the time interval between updates, the less changes will have occurred and the less accurate the resulting change map will be.
- It is suggested that the current 3-year CLMS product update cycle is kept until 2021, with yearly incremental updates implemented gradually with a 2023 update followed by a 2024 and then an onward yearly cycle.

Improved HR Imperviousness layers:

- The prototyping and assessment of operationality of a built-up mask at 10 m to be tested in 2019
- Continuous scale: the feasibility of an improved imperviousness density layer and a new imperviousness density change layer will also be assessed in 2019
- Exclusive use of S-2, integration of S-1 data degraded the results of the optical classification: to be further investigated in 2019

Improved HR Forest layers:

- Continuous scale: the feasibility of an improved continuous tree cover density layer and a new tree cover density change layer will be assessed in 2019
- Exclusive use of S-2, integration of S-1 to be explored in 2019
- No tree species layer envisioned and no discrimination between plantation and other types of forest: lack of extensive in-situ data

Improved HR Grassland layers:

- Products with significant modifications and new baselines
- Short-term changes such as regional losses or changes are taken into account
- Phenological and statistical parameters are incorporated into the computation of the status layer
- Differentiation between grasslands and croplands
- Change detections will be addressed in 2019
- Distinction between intensively and extensively used grasslands

New Agricultural products:

- Spatial resolution at 10 m
- Feasibility of a dynamic product to be tested to capture intra-annual variations such as crop rotations
- Pan-European Crop Mask Layer to be produced independently from LPIS, whose access is restricted. Operational implementation seems possible. Investigation how LUCAS database could be included.
- Crop Types Layer with a unified European nomenclature of about 10-15 classes to be prototyped in 2019
- Crop status/monitoring Layers: More experimental prototypes on Crop growth conditions / Crop emergence date are being investigated at European and global scales.

New Phenology products:

- Optical data from Sentinel-2 deliver images over the same areas at least every 5 days, subject to cloud-freeness
- First tests on timings of start, end and length of seasons look promising but not at an operational stage
- To monitor vegetation anomalies
- Assessment of feasibility with Sentinel-1 and Sentinel-2 data in synergy

New generation of land cover / land use products (CLC+):

- Link with Agricultural products: assembling common European nomenclature regarding the crop types
- Spatial resolution at 10 m, need to fix the MMU
- Incorporation of HRLs into the workflow to obtain complementary datasets
- Currently moving specifications are expected to be settled in early 2019
- Accent on the EAGLE matrix compliance to be incorporated in 2019
- Harmonisation with local components to be assessed