



LandSense

A Citizen Observatory and Innovation Marketplace
for Land Use and Land Cover Monitoring

Deliverable 2.4

D2.4: Impact and sustainability assessment of the LandSense Citizen Observatory



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This deliverable reports on multi-stakeholder workshops held at the European week or Regions and Cities and the EuroSDR event in online formats enhancing the sustainability of the LandSense outputs and associated applications.
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ACRONYMS

ECSA	European Citizen Science Association
EODC	Earth Observation Data Centre
EOSC	European Open Science Cloud
LEP	LandSense Engagement Platform
LULC	Land Use and Land Cover
OSM	OpenStreetMap
SDG	Sustainable Development Goals
VGI	Volunteered Geographic Information

Executive Summary

The deliverable summarizes new events that have been organized in 2020 and that have, and continue, to contribute to the impact of the LandSense Citizen Observatory. Originally D2.4 was meant to report on outcomes of the multi-stakeholder workshop and evidence gathered there on the impact and sustainability of the LandSense Citizen Observatory. Unfortunately, the COVID-19 situation did not allow for such a 'live' workshop to occur in which the LandSense community could meet. Nevertheless, multi-stakeholder online workshops, which were focussed on enhancing the sustainability of LandSense outputs and associated applications, were held at the European week or Regions and Cities and the EuroSDR event, which are described in more detail in the deliverable. The LandSense outputs are then presented along with their sustainability plans including more detailed descriptions of those outputs that have strong sustainability. The assessment of outputs shows that continuity of LandSense initiatives is guaranteed through the uptake of several LandSense applications such as the Natura Alert app, OSMLandUse, Picture Pile, and the LandSense Authentication Service which will be continued as an EOSC (European Open Science Cloud) community plugin.

1 Introduction

Exposing the functionality of the LandSense Engagement Platform (LEP) to various stakeholders and providing training is essential to foster uptake and continuity in using the suite of tools available in the LEP. To this end, several events were organized in 2020. Unfortunately, the COVID-19 situation did not allow for such multi-stakeholder workshops to occur ‘off-line’. Instead the LandSense community met ‘online’. Two multi-stakeholder workshops were organized in an online format. This included the ‘virtual stand’ that was organized at the European week of Regions and Cities as well as activities around the LandSense Mapathon. These events as well as other dedicated activities have led to the participation of large groups of citizens, scientists, and policymakers in the online training and application of LandSense tools. This deliverable describes these events and then summarizes the sustainability of outputs from the LandSense Citizen Observatory.

2 Events

The events organized include those dedicated to presentations as part of larger conferences, specific training events where the applications that have been developed in LandSense have been demonstrated, and events where implemented applications have been used through online meetings on dedicated topics. The following events have been organized in the last period of the LandSense project.

2.1 European Week of Regions and Cities

A description of the [European Week of Regions and Cities](#) (#EURegionsWeek) can be found on the dedicated website. It is:” the biggest annual Brussels-based event dedicated to cohesion policy. The event has grown to become a unique communication and networking platform, bringing together regions and cities from all over Europe, including their political representatives, officials as well as experts and academics”.

The #EURegionsWeek was a perfect event to showcase the LandSense experience to a wide, yet relevant and European audience. The themes for 2020 were:

- Green Europe
- Cohesion and Cooperation
- Empowering Citizens

where the last theme on empowering citizens was particularly relevant to LandSense.

One of the overarching goals of the #EURegionsWeeks is to discuss common challenges, the sharing of good practices, and to promote learning about policy relevant solutions by bringing together political representatives, decision-makers, experts and practitioners of regional policy, as well as stakeholders from business, banking, civil society organisations, academia, the EU institutions and the media. During the #EURegions week, citizens can also contribute to the debate on the future of European regions and cities. An interesting aspect here is that it specifically provides a platform to exchange experiences in using new approaches and tools to develop regional land cover and land use policies. The LandSense project - A Citizen Observatory and Innovation Marketplace for Land Use and Land Cover Monitoring - brings in experience in how citizens can be engaged in this process by developing appealing applications where anyone can contribute to create and curate data, and where anyone can learn how detailed and accurate geospatial data are needed to make informed decisions.

The LandSense project had a [virtual stand](#) at the #territorialdata initiative in the session on thematic and territorial analysis. More than 50 participants attended the introductory presentation (see [here](#)), and many more visitors came by the virtual stand. These participants and visitors learned all about the project as well as the LandSense Engagement Platform, which brings together various key pieces of technology including: [Geo-Wiki](#), [LACO-Wiki](#), [Geopedia](#), [Sentinel Hub](#) and the [EODC](#). The platform offers collaborative mapping functionalities to allow citizens to view, analyze and share data collected from different campaigns and create their own maps, individually and collaboratively. Everyone was invited to actively test these technologies and use the various LandSense apps.

Even though everything was online, it is clear that detailed and frequent geospatial data are increasingly transforming our societies across many domains. For example, one of the more rewarding aspects of the #territorial data initiative was seeing the activities at the other #virtual stands, which demonstrated this reality and to which LandSense contributes. In the LandSense virtual stand, participants could uncover the potential of citizen science and Earth Observation to improve the way in which they see, map, and understand the world. In this sense, such events showcasing LandSense to a wide, yet relevant, and European audience, can help to kickstart an Earth Observation-enabled crowdsourcing economy.

2.2 Mapathon – participatory lab at European week of Regions and Cities

During the #EURegionsWeek, a participatory lab was organized on improving maps with the crowd and satellites. The participatory lab was an interactive 1.5-hour session with 40 participants from various regional governments and companies. The participatory lab kicked off a Mapathon (<https://landsense.eu/Mapathon>) on the 14th of October. In a brief presentation, the participants learned about the crowdsourcing approach and the tool used in the Mapathon. Through subsequent

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participation, they contributed to validating a citizen-powered land use map of the European Union based on OpenStreetMap and Sentinel 2 satellite imagery. The land use map validated in the Mapathon is the OSMLandUse product (<https://osmlanduse.org/#12/8.7/49.4/0/>) created by the GIScience Research Group at the University of Heidelberg.

Several participants were inspired by the Mapathon approach, and they expressed their appreciation in the user-friendly way in which participation was facilitated through the Mapathon website, which was a joint effort between four Landsense partners. Over 3000 contributions were made during the 1.5 hr participatory lab, and the Mapathon is still continuing, having been further promoted at other events (see section 2.3 below) and will continue to do so at least until the end of 2020. A wide range of institutions and their representatives across the EU (and internationally) participated in the Mapathon as shown in Table 1.

Table 1: Representatives of the following organization attended the Mapathon kick-off during #EURegionsWeek.

Country	Organization	Country	Organization
Austria	Environment Agency Austria	Italy	City of Torino
Austria	International Institute for Applied Systems Analysis	Italy	European Commission - JRC
Belgium	EARSC	Italy	Regione del Veneto
Belgium	Urban.brussels	Italy	European Commission - JRC
Belgium	Representative of regione Veneto	Italy	ISIG
Belgium	Ghent University	Italy	Politecnico di Milano
Belgium	European Commission	Italy	Politecnico di Milano
Costa Rica	Urbanalytica	Luxembourg	Spatial Foresight
Croatia	Consultancy	Luxembourg	Luxembourg Institute of Science and Technology (LIST)
Denmark	European Environment Agency	Luxembourg	Luxembourg Institute of Socio-Economic Research
France	Association RACINE à Louveciennes	Netherlands	European Commission
France	IGN	Poland	Statistics Poland
Germany	Consultancy	Regione Veneto	Regione Veneto
Germany	IBA	Romania	National Scientific Research Institute for Labor and Social Protection

Germany	European Office of the Metropolitan Region FrankfurtRheinMain	Spain	Xunta de Galicia
Germany	MitOst	Spain	Instituto de estudios do territorio
Germany	Heidelberg University	Spain	European Forest Institute
Greece	UIA	Spain	COCEDER
Italy	Politecnico di Milano	Sweden	Varbergs kommun
Italy	European Commission - JRC	Turkey	Istanbul Technical University
Italy	European Commission - JRC	UK	NIEA

The Mapathon illustrated and highlighted how anyone can contribute to creating better land use maps. Improving the gamification aspects will help to ensure the continued engagement of citizens - which remains a bottleneck - for such Mapathons and comparable citizen science initiatives.

2.3 VGI for LULC Workshop

During two half days on 24 and 25 November 2020, the LandSense team, together with EuroSDR and IGN France, organised an online workshop titled: [The Use of Volunteer Geographic Information for Producing and Maintaining Authoritative Land Use and Land Cover Data](#). The goal of the workshop was to bring together different actors (e.g., national mapping agencies, academic communities, private companies) with experience in LULC data production or change detection. This gave the opportunity to address an exhaustive list of the current practices and issues in mapping feature-based LULC data and to share new approaches in the production, monitoring, and updating of LULC data. The workshop was successful, with 137 registrations from different public and private mapping communities, universities from Europe and outside Europe, and members of the LandSense User Advisory Board. The workshop reached a global audience with participants from numerous countries including Nigeria, Brazil, Argentina, Iran, Canada, and the United States of America. During each half day, between 48 to 60 participants were engaged in the workshop.

The program of the workshop was very rich, proposing 13 presentations addressing an overview of current challenges in producing and maintaining LULC data, the use of VGI for LULC data production, data collection and validation, as well as sustainability. The LandSense project was successfully represented by different partners who disseminated various LandSense results including Sinergise, University of Heidelberg, IIASA, IGN-France, Wageningen University, and Secure Dimensions.

The following key conclusions can be summarized from the large list of topics that were addressed during the event:

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- Deep learning approaches should be used to classify time series of high-resolution images in order to produce LC data. Promising results were presented but progress still needs to be made in improving the classification of difficult classes and in validating the results.
- The use of VGI to produce LULC data or to complement LULC authoritative data is becoming a more common practice. However, issues regarding data quality, multi-source data integration and license consistencies need more research.
- In term of VGI data collection, it was evident that the main issue facing different VGI initiatives was the motivation and participation of the contributors. Different strategies were noted, such as organising thematic challenges such as Mapathons, giving prizes to the “best contributors”, or proposing gamification tools. How to build a sustainable VGI initiative beyond OpenStreetMap is still a major unresolved question. Giving a more prominent place to the local and regional public authorities in VGI data collection initiatives seems to be a way forward.
- A topic that was only marginally addressed but is important concerned ‘updating’. There are many LULC and validation data produced by innovative methods, but this raises important questions such as: How will these data be updated? How can we take best advantage of time series from different remote sensing products to facilitate LULC monitoring over time?
- Finally, this workshop highlighted the very large panel of available LULC data at different spatial (e.g., from global to very local) and temporal resolutions. One issue that should be addressed is usability: How can we help users to choose the right LULC product for their needs? How can we help users to measure the uncertainty that is specific to each LULC product depending on the methods used in the production and validation?

The presentations from the workshop are being made available. and a EuroSDR report is currently being written to summarize the workshop and to share the findings with the wider community.

As a side event of the workshop, the LandSense team organized an additional Mapathon for workshop participants, using the application developed for the #EURegionsWeek event. During the Mapathon, we collected 829 reference points, in particular the Expert campaign reference points, which is one of four categories in the data collection options of the Mapathon interface (<https://landsense.eu/Mapathon>). Given the expert audience at this workshop, we were able to tap into their expert knowledge for this image classification exercise. Accounting for all suitable reference points, the class user accuracy for urban land use was 59%, for mining areas and construction sites it was 61%, for agricultural areas 97%, and for forested areas 95%. Hence, this allowed us to identify a flaw in OSMLanduse.org, which is the confusion between industrial and urban land use. This confusion is rooted in the diverse thematic description and definition of OSM representations of related objects throughout EU countries. Country wise benchmark activities suggest that when using country specific targeted legends, the OSMLanduse urban and industrial land use classes perform well, i.e., at above 80%, and there is less confusion. However, classes less affected by such heterogeneity have much higher agreement.

Figure 1 shows the statistics from the Mapathon before 24 November 2020 (based on contributions from the #EURegionsWeek and afterwards, and those after the Mapathon at the VGI LULC workshop. We will continue to collect data via the Mapathon and use the data to improve the OSMLanduse map.

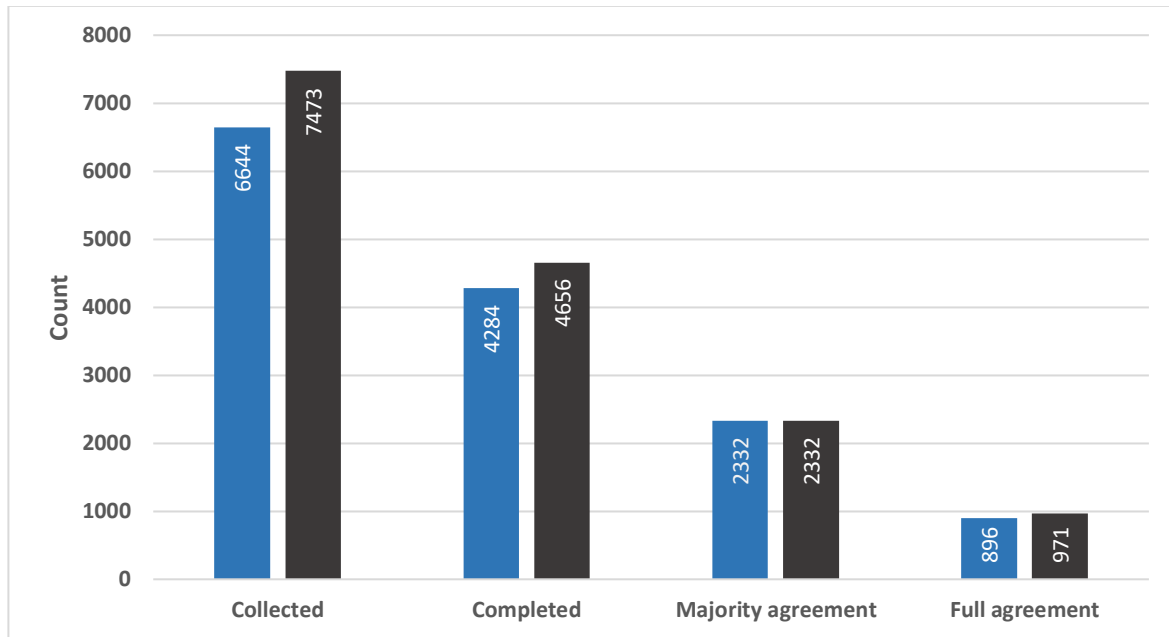


Figure 1: Campaign collection statistics before (blue) and after (grey) Euro SDR campaign. The total is shown as collected while completed means that at least three contributions were captured. Full agreement means that all contributors agreed on the same class while majority agreement means that the majority of contributors agreed on one class.

3 Sustaining LandSense outputs

Various actions have been taken to guarantee the continuity of the LandSense Engagement Platform and associated apps. Follow up has included the streamlining of the LandSense apps in the wider citizen science community through the WeObserve project, e.g., through promotion via the WeObserve Toolkit (<https://www.weobserve.eu/knowledge-base/toolkit/>). Continuity of food and agriculture related citizen science activities is also being explored via the creation of an agri-food ECSA working group, first presented at the online ECSA Conference 2020 in September 2020. Other examples are the ongoing use of the Natura Alert app and the continuation of the LandSense Authentication Service as an EOSC (European Open Science Cloud) community plugin. Table 2 summarizes the main LandSense outputs, categorizes the type and indicates their sustainability. In the sections that follow, we describe some of the outputs that will be sustained in the future.

Table 2: A summary of the LandSense outputs and their anticipated sustainability into 2021

Output	Type	Description	Owner	Contributors	Sustainability
ECSA Working Group on Citizen Science, Agriculture and Food	Community of Practice	Working group to investigate the promises of citizen science for sustainable food security and sustainable agriculture as key objectives of the sustainable development goals	/	JRC, IIASA	Via ECSA
City Oases	Mobile application	CityOases empowers people to report on their subjective perceptions of parks and open spaces in their urban environments. https://landsense.eu/Explore/5	IIASA	UBA, G2K	Seeking collaboration & funding
MijnPark	Mobile application	MijnPark promotes sustainable urban development based on citizen insights on the perceptions of green and open spaces https://landsense.eu/Explore/4	IIASA	VUA	Seeking collaboration & funding
Paysages	Mobile/Web application	Integrating expert contributions using crowdsourcing approaches into LULC authoritative databases https://paysages.ign.fr/	IGN-FRANCE	IIASA	No – Functions from application are being added to IGN operational platform
Natura Alert	Mobile/Web application	A digital workflow for volunteer reporting, validation and subsequent national level assessments of threats to biodiversity https://natura-alert.net/	IIASA/BLI	SEO, BURUNG, SINERGISE	Yes – continued via EuropaBON project and scaling up to BLI partner countries in 2021
OSMLandUse	Web application	A WebGIS application to explore the OpenStreetMap database specifically in terms of landuse and landcover information https://osmlanduse.org	UHEI	SINERGISE, IIASA	Yes – continued investment from UHEI
Picture Pile	Mobile application	Rapid classification of satellite imagery and photographs to support EO monitoring mechanisms https://geo-wiki.org/games/picturepile/	IIASA	/	Yes – continued via new ERC proof of concept project
CropSupport	Mobile/Web application	Leveraging the power of EO systems and crowdsourcing to deliver value added service to farmers https://landsense.inosens.rs	INOSSENS	/	Seeking collaboration & funding

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LandSense Authorization Server	Service	Authentication as a Service improves FAIR re-use of Citizen Science data with GDPR compliant personal information brokering and non-trackable unique user identifiers. https://www.authenix.eu	SECD	/	Yes – Continued via Cos4Cloud project for implementation in the EOSC infrastructure
QA – Face Detection & Blurring	ICT software – Open GitHub Repository	The QA Platform Server contains procedures directly implemented in Java and R, as well as a Docker3 image that includes software for facial recognition and licence plate blurring. https://github.com/LandSense/QA-Platform	UNOTT	HELYX, UNOTT	No – Openly available in GitHub with CC BY 4.0 License
Urban Change Detection Service	Service	Providing areas of change within urban environments for monitoring and validation	GEOVILLE	IGN-FRANCE	Seeking collaborating & funding
Agricultural Change Detection Service	Service	Providing information on intra-field variability to identify crop quality and condition of agricultural fields	GEOVILLE	INOSENS	Seeking collaborating& funding
BFast Forest Change Detection Service	ICT software – Open GitHub Repository	This repository has a minimal working example of using Sentinel-Hub services together with BFast monitor to detect forest change. https://github.com/LandSense/SH-bfast	SINERGISE	UHEI	No – Openly available in GitHub with CC BY 4.0 License

3.1 ECSA Working Group

At the September 2020 ECSA (European Citizen Science Association) conference the idea for an ECSA working group on Citizen Science and Agriculture and Food was launched by Anett Richter, Jacob van Etten, and Marijn van der Velde. This initiative is ongoing and was fully supported by the LandSense project as it could help to facilitate the creation of a community that will continue to work on this topic beyond LandSense. The ideas were first exposed through an interactive session to scope and start to co-develop an ECSA working group on this subject in light of the implementation of the Sustainable Development Goals.

Session aims were to:

- 1) Investigate the promises of citizen science for sustainable food security and sustainable agriculture as key objectives of the sustainable development goals (SDG),
- 2) Assess potential needs for the establishment of an ECSA working group on Citizen Science on Food and Agriculture,

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- 3) Co-develop with the participants a first set of aims and objectives for the prospective ECSA WG on Citizen Science on Food and Agriculture; and,
- 4) Develop an activity plan and first ideas on how to get people involved in the ECSA working group.

The idea of the establishment of an ECSA working group on Agri-food systems was presented and potential benefits of such a group briefly introduced. A polling session was designed to elicit feedback from the audiences about this idea, followed with a brief wrap-up to close the session.

The following questions were asked in the polling session:

- What is your involvement in citizen science research for agri-food systems?
- Please tell us how an ECSA Working Group on agri-food systems could help you in your work? Finish this sentence: An ECSA Working Group can support me in: ...
- Please rank your interest to contribute to a scientific paper that is mapping the research landscape of citizen science for agri-food systems within the next 6 months?

A total of 46 people participated in the poll. Participants had contributed to citizen science activities in agri-food systems (22%) or had run a citizen science project in this field (24%). The majority of the participants considered future involvement in citizen science as stakeholders (43%) and one third of the participants wished to integrate citizen science in the future (30%). Very few participants indicated their participation in citizen science as stakeholders (6%). This is a crucial point for future attention. “Sharing best practice”, “collaborations”, “community building” and “sharing data and experiences” were named as goals of such a working group. An example of the feedback is shown in Figure 2.

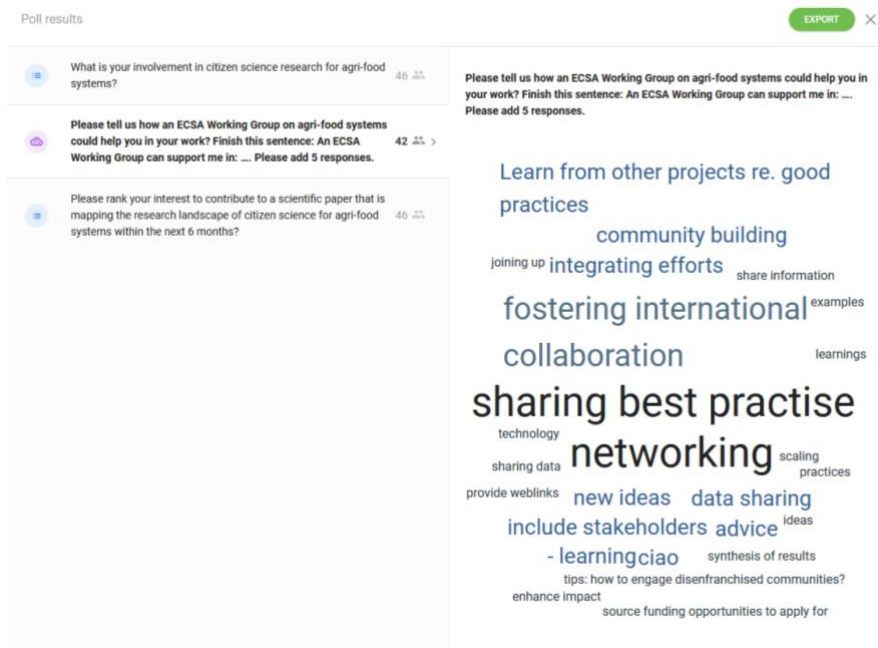


Figure 2: Feedback from workshop participants answering ‘Please tell us how an ECSA Working Group on agri-food systems could help you in your work? Finish this sentence: An ECSA Working Group can support me in: ...’.

Since then, a summary of the session has been prepared, and ECSA has been informed about the outcomes of the session. We will now organize a first meeting with those participants who expressed an interest in co-creating such a working group, so that we can learn from other projects and discuss next steps. The idea is that with this group of interested people, we will also pursue and rally around a scientific paper reviewing citizen science in agri-food systems.

3.2 Natura Alert

[Natura Alert](#) is a mobile app and web portal that allows users to pinpoint the location of threats to biodiversity and habitat changes, to prevent the further damage or loss to our biodiversity. We are particularly interested in threats that are occurring inside Important Bird and Biodiversity Areas, Key Biodiversity Areas and Natura 2000 sites in the European Union, although submitting records in other areas is also possible. Information on the condition of these sites, the threats to them, the conservation measures in place and the changes in these aspects over time are essential to set priorities, hold governments to account and inform policies and decision-makers. Volunteers can share their observations with the wider community and help to map the state of our most valuable sites around the world. They can download our mobile app to quickly record their observations in the field or use the web app to discover more functionalities, such as visualizing reports from other users, creating dashboards per country and downloading their own reports.

Continuity and sustainability of this app – which is unique in its threat reporting, is guaranteed through funding via the H2020 [EuropaBON project](#). Currently, we are developing plans for scaling the app to the Netherlands and Greece.

3.3 Picture Pile

[Picture Pile](#) is a successful example of a tool developed as part of LandSense that has a wide and generic applicability beyond the project. The concept behind Picture Pile is simple and appealing. Players can help solve global problems by sorting through piles of pictures and satellite imagery to map for example forest degradation or urban expansion. Picture Pile has quickly grown as one of the standard apps in the wider citizen science toolkit available at IIASA and was part of the [Earth Challenge 2020](#) initiative.

3.4 OSMLandUse

[OSMLandUse](#) is a WebGIS application developed during LandSense by the University of Heidelberg (UHEI). OSMLandUse allows exploring the OpenStreetMap database specifically in terms of land use and land cover information. Importantly it also hosts the new 10 m Sentinel-2-based land use map

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product OSMLandUse validated through the mapathon. Continued investment from UHEI will guarantee continuity of this new platform beyond LandSense.

3.5 Authentication Server

The work developed on the LandSense Authentication Server is reported in Deliverable 3.9. The LandSense Authentication Server will continue beyond LandSense as a service in the European Open Science Cloud (EOSC). Through the H2020 [Cos4Cloud](#) project, the LandSense Authentication Server will become a European Open Science Cloud (EOSC) Community plugin. This will allow Authentication as a Service and will improve FAIR re-use of Citizen Science data with GDPR compliant personal information brokering and non-trackable unique user identifiers (<https://www.authenix.eu>).