LandSense

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

Deliverable 2.3

Engagement action plans and campaign strategies for LandSense demonstration cases - II

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Short Description:
This deliverable describes the follow up of the initial action plans and engagement strategies for the LandSense demonstration pilots defined in 2017, including the improvements and modifications needed to ensure the successful implementation of the pilots during the second iteration (February 2019 – December 2019).
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1.0	Linda	Final version	Finalized the deliverable	March 29th 2019

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List of Acronyms

CDS	Change Detection Service
EEA/UBA	Environment Agency Austria/Umweltbundesamt
EO	Earth Observation
FGD	Focus Group Discussions
FMU	Forest Monitoring Unit
KPI	Key Performance Indicator
LEP	LandSense Engagement Platform
LCGs	Local Conservation Groups
LULC	Land Use and Land Cover
NDVI	Normalized Difference Vegetation Index
OSM	OpenStreetMap
QA	Quality Assurance

Executive Summary

The LandSense Citizen Observatory (https://landsense.eu/) connects the domains of citizen science and Earth Observation to address critical issues in the field of Land Use and Land Cover (LULC). As part of the observatory, several technologies are being developed and deployed across various themes and communities to illustrate the potential of citizen observatories to tackle environmental monitoring issues. A key success factor to the LandSense Citizen Observatory is to aggregate key end-users including research organizations, NGOs, SMEs, data providers, public bodies, and citizens to directly address local and regional LULC topics. The direct involvement of user communities in the LULC data collection process will generate relevant information and promote demand-driven policy responses that will hopefully lead to the emergence of horizontal 'modes of governance' (Wehn et al. 2015). As such, LandSense conducted an assessment of user requirements and barriers (D2.1) and the elaboration of action plans, strategies and campaigns for citizen engagement across the demonstration pilots (D2.2). D2.2, prepared at the end of 2017, summarized activities undertaken within Task 2.2, and it was organized based on each pilot. Since then, the concepts and tools proposed under LandSense have significantly evolved and improved thanks to the hard work of multidisciplinary teams. Multiple consultations and workshops were held across Europe and internationally in order to boost citizen engagement and to test our mobile apps and web platforms (see https://landsense.eu/News). Although some of the data collection campaigns have suffered delays because of the ongoing efforts to improve the LandSense technology and tools, the citizen experience will now be greatly enriched.

The following table provides a summary of the themes, pilot locations and technologies employed as part of the LandSense Citizen Observatory. Each pilot is described in detail, providing updates to the material found in D2.2.

Theme	Pilot	Technology
Urban Landscape Dynamics	• City of Vienna • City of Amsterdam • City of Toulouse and surrounding areas • City of Heidelberg	• Frei.Raum.Netz app • CityOases app • Mijn Park app • CityOases app • PAYSAGES France mobile app
Agricultural Land Use	• Serbia	• CropSupport app
Forest and Habitat Monitoring	• Spain • Indonesia	• Natura Alert mobile app • Natura Alert web app

1 Methodology

The LandSense Year 2 Workshop, held in November 2018, provided the opportunity to discuss the progress of the project as well as to exchange experiences over the past year (Figure 1).

The contents of the present deliverable are based on the results from the testing of the different apps and the engagement of citizens that were presented and discussed during the year 2 workshop.

Within the Urban Landscape Dynamics theme, a total of four pilot cases were conducted targeting: (i) green space monitoring in Vienna using the Frei.Raum.Netz app, which has now evolved into the CItyOases app; (ii) citizen perception of the participatory Rembrandt Park in Amsterdam via the Mijn Park app (VUA); (iii) LULC monitoring in the Occitanie region of France using the PAYSAGES France app (IGN France); and (iv) land use mapping and validation in Heidelberg University using OpenStreetMap. The Agricultural Land Use theme featured the CropSupport app for farm management, and InoSens shared their outcomes from their collaboration with more than 50 young citizen scientists. Furthermore, BirdLife International presented their improvements in the Natura Alert app and the 2019 plans for the biodiversity threat monitoring campaign in Spain and Indonesia as part of the Forest and Habitat monitoring theme.

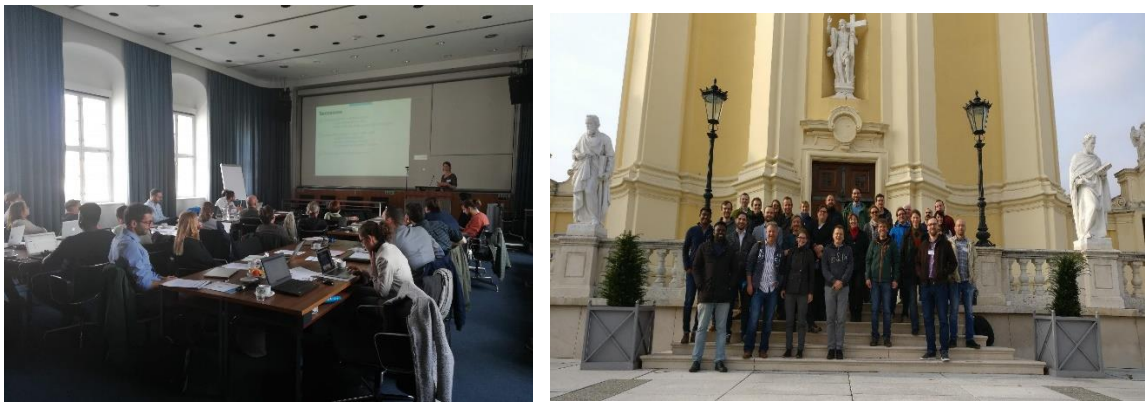

Figure 1: LandSense meeting year 2, Laxenburg, Austria

In this report, and following the methodology agreed at the LandSense Year 1 workshop and presented in D2.2, the different pilot cases are presented based on a structure outlined in Table 1, which includes some improvements and additional pieces of information compared to that presented in D2.2. Note that it is important to take into consideration the different levels of maturity of the pilots and therefore the level of implementation of each of the elements detailed in Table 1 below.

Table 1: List of elements to describe the progress of each pilot

Element	Task/Objectives
Storyline	Word cloud summarizes the storyline provided in D.2.2.
Target Groups	Word cloud summarizes the target groups detailed in D.2.2.
Engagement Strategies	Create an engagement strategy for your 2019 campaign that addresses each of the questions below: • How do you plan to create awareness of the campaign? • How do you plan to get volunteers/users on-board? • How do you plan to sustain engagement of the users? • How do you plan to give feedback to the users? • Which partner will lead the engagement for the campaign?
Timeline & KPIs **(New table)**	Think about the timeline for your first campaign in 2019. Answer the following questions: • What is the launch date of the campaign in 2019? • Can the launch be linked to an ongoing event/community? • How long do you plan to run the campaign for in 2019? • Define 5 quantifiable Key Performance Indicators (KPIs) and your targets for these KPIs, e.g. number of expected participants, and then think about ways to help you reach these targets.
User Profiles **(New table)**	Have the user profiles you defined in 2017/2018 evolved?
Current technology (mobile apps, webapps, other platforms)	• Has your mobile app been tested? • Document any modifications that happened to improve the app • Is your technology missing any further development? • Identify the essential features that are needed
Data control and Privacy **(New table)**	• What data did you collect during the 2018 campaign? • Where are the data stored? Who gets access to the data? • Do you have Terms and Conditions associated with joining the campaign? • Did you collect personal data? Are there any significant changes for the 2019 data collection campaign?
Quality Assurance **(New table)**	• Identify the types of quality assurance (QA) processes that you would like to see implemented as part of your campaign • Determine when the QA should be implemented (i.e. real-time/near-real time/post-campaign)
Business opportunities	• What are the potential business opportunities that could result from your pilot? • For whom do you plan to create value and who are the most important customers? • Which one of your customer's problems are you helping to solve? • How can the LandSense Engagement Platform serve as a channel to reach your customer segments? • For what value are your customers really willing to pay? For what do they currently pay?

2 Theme “Urban LandScape Dynamics”

2.1.1 City of Vienna

→ Storyline

Figure 2 captures the storyline of the city of Vienna pilot as a word cloud.

Figure 2: Vienna storyline captured in a word cloud

→ Target groups

Figure 3 captures the target groups for the city of Vienna pilot as a word cloud.

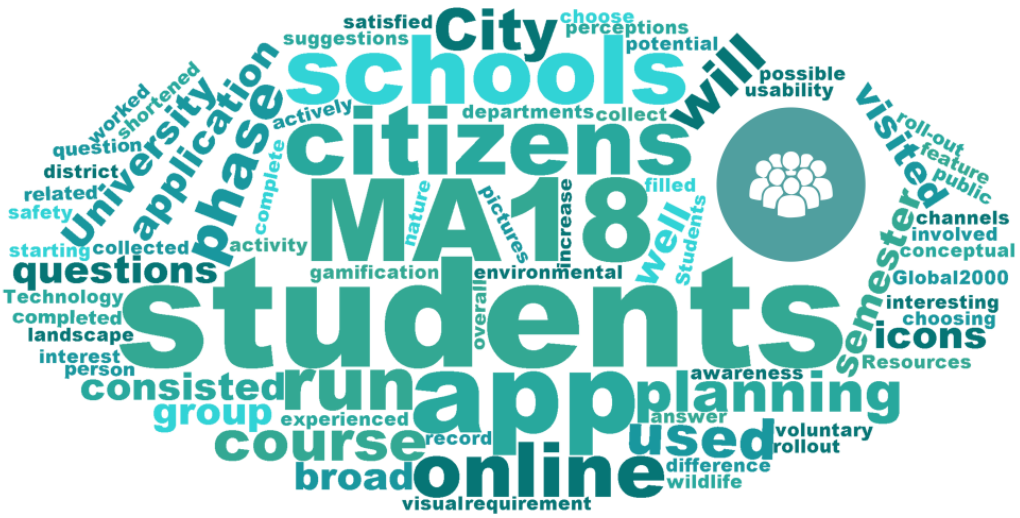

Figure 3: Vienna target groups captured in a word cloud

→ Engagement strategies?

How do you plan to create awareness of the campaign?

The engagement strategy consists currently of three steps:

Step 1: Launch of beta version (early access phase) of the CityOases app (evolved from the Frei.Raum.Netz app), tested with volunteers from the public, the City of Vienna administration and UBA colleagues in April 2019.

Step 2: Engagement with the general public - citizens of Vienna

The public app will be launched on 2nd May 2019. Via MA 18 (City Development and City Planning in Vienna), the districts will also be informed about the app. MA 18 will also contact the organizers of the Local Agenda 21 activities of the City of Vienna, the local coordinators of the "Gebietsbetreuung", and the mobility agency. Global 2000 will activate their members and other NGOs; UBA will distribute information about the campaign and app via its network.

Step 3: Engagement with the general public – schools, pupils, young adults

CityOases was invited to participate in the Citizen Science Award 2019. From 1st April to 5nd July 2019, school classes and individuals are invited to participate in one of seven Citizen Science Award research projects. The various activities range from working with historical materials and discussing an open concept of a home to bird watching and waste in nature. CityOases is one of these seven projects (see Figures 4 and 5).

How do you plan to get volunteers/users on board?

Step 1: The users of the beta version will be encouraged to actively spread the app within their networks.

Step 2: Users of the public version will potentially be engaged through:

- a competition/gamified mode (i.e., who can collect the most points)
- possible cooperation with local businesses (e.g., city bike) to provide further incentives to participants
- raising interest about sharing nice and interesting places in Vienna with others
- raising interest in using CityOases as a tool for finding nice and interesting places in Vienna
- raising interest in contributing to improvements in the city, city green spaces and neighborhoods.

Step 3: CityOases is one of seven projects of the Austrian Citizen Science Award 2019 (see Figures 4 and 5). The winners consist of persons or school classes that support these projects most enthusiastically. Individual persons can win non-monetary prizes, and school classes can receive an award of cash prizes up to 1.000€ and 2.000€ (the latter for creative contributions to the projects). Additionally, the winners will be recognized at the award ceremony on 19th November 2019, at the University of Vienna.

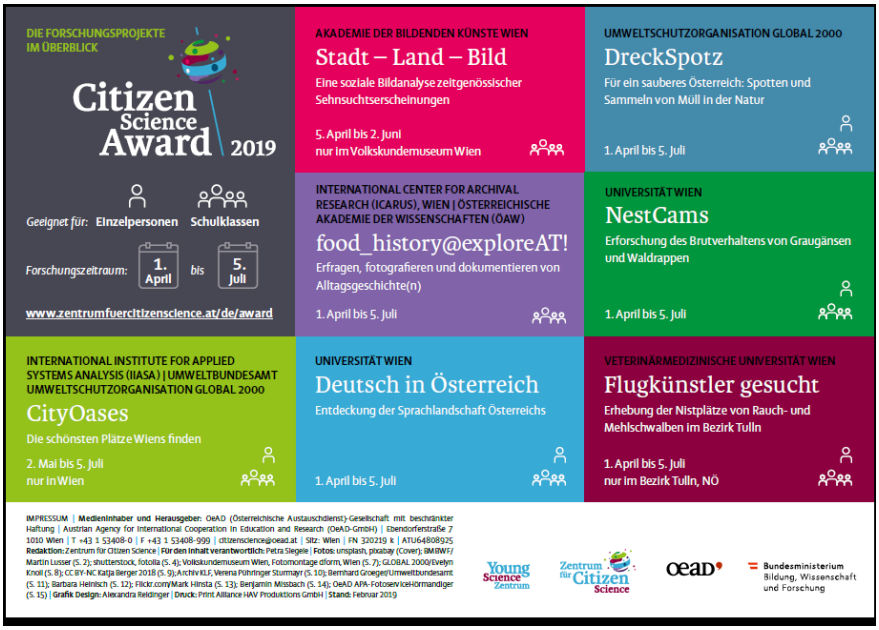

Figure 4: Screenshot providing an overview of the seven projects of the Citizen Science Award 2019

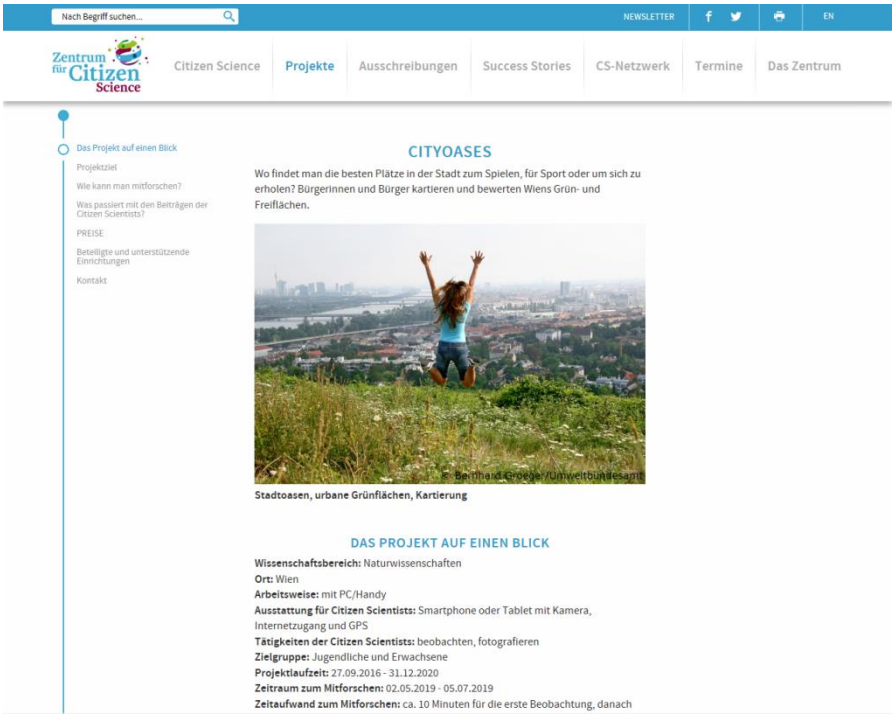

Figure 5: Description of CityOases on the Citizen Science Award 2019 web page

How do you plan to sustain engagement of the users?

There will be different communication channels used, and multiple waves will be initiated to broadcast information about the app. Additionally, different competition modes (e.g., who can collect the most points) and various incentives will be implemented. This activity will be linked to a strategic campaign of the city government, which is a chance to leverage MA 18 PR campaigns. Additionally, if user uptake is high, some money could be generated via advertisement. Additionally,

the CityOases app is part of the Citizen Science Award 2019, which was initiated by the Austrian Ministry of Education, Science and Research. There will be a massive media campaign for participation by the organizers of the award in the spring of 2019 and also for the award ceremony in November 2019. Additionally, all seven citizen science projects will stay on the website of the Austrian Center for Citizen Science https://www.zentrumfuercitizenscience.at even after this campaign is completed.

In 2018, students of the Vienna University of Technology and the University of Natural Resources and Life Sciences (BOKU), Vienna, were required to use the Frei.Raum.Netz app as part of a course within the university curriculum. This cooperation will be restarted during the next winter semester in 2019, where they will use the CityOases app.

How do you plan to give feedback to the users?

Users can express their perception on and highlight their activities in the green space network and search for activities to which other users have contributed. The app is centred on finding and evaluating 'City Oases' – the ideal places to hang out in an urban environment. Further to this, one can rate the site according to a pre-defined set of activity icons. These are based on research on how to make cities more user friendly (Gehl and Svarre 2013). These ratings are available to all users.

Which partner will lead the engagement for the campaign?

UBA will lead all engagement activities and will cooperate closely with the following partners:

- Partners for public roll out: City of Vienna / MA 18 (City Development and City Planning) and GLOBAL2000 (general public) - coordinated with the PR offices of the city of Vienna/MA 18
- Partner for cooperation with Citizen Science Award: Austrian Center for Citizen Science.

Due to the fact that communication with the broad public concerns the interests of all partners, the City of Vienna and GLOBAL2000 will collaborate and agree on media and public relation activities. All information activities will be carried out in German.

What kind of outcomes do you expect if the engagement strategies are successful? Can you forecast any societal changes?

The topics of land use change and reduction of green spaces, especially in urban areas, are increasingly discussed in the (Austrian) media and have a potential for future conflicts. Achieving societal change through individual or dissemination activities within a research project is difficult. However, if the CityOases app is used by a significant number of people, then we may be able to demonstrate that the topic of land use is being discussed by the broader public. Moreover, the outcomes can be used for better planning processes by the City of Vienna administration and the district administrations, which are, in most cases, responsible for urban open space, e.g., by proactively intervening and preventing conflicts in areas that are seen as negative in the broadest sense.

→ Timeline & KPIs

What is the launch date of the campaign in 2019?

- Launch of beta version: April 2019
- Launch of public version: 2 May 2019

- Launch of Citizen Science Award: 2 May 2019
- Second roll out of public version in connection with heat: summer 2019.

Can the launch be linked to an ongoing event/community?

CityOases is one of the seven projects selected for the Citizen Science Award 2019, and will be presented within the frame of these activities.

Additionally a cooperation with the Forum Public Space (Forum öffentlicher Raum) is planned from 16-18 May, 2019 in Vienna. This event is organized by MA 18 and MA 19 in cooperation with other departments of the administration of the City of Vienna. Within the events, different kinds of activities, e.g., landscape strolls, picnics, theaters, and urban interventions or excursions, will be offered to the public.

How long do you plan to run the campaign in 2019?

- Beta version: April 2019 (1 month)
- Public version first campaign: 2 May 2019 – End of June/July (2 - 3 months)
- Citizen Science Award: 2 May to 5 July 2019 (2 months)
- Public version second roll out in connection with heat: July/August 2019 – September 2019

Define 5 quantifiable Key Performance Indicators (KPIs) and your targets for these KPIs, e.g. number of expected participants, and then think about ways to help you reach these targets

These KPIs for the Vienna pilot are listed in Table 2.

Table 2: Key Performance Indicators for the Vienna pilot

KPI	Target for the 2017 and 2018 campaign	Was the target achieved? Provide an explanation	Target for the 2019 campaign
KP1 Number of installs	500+	(463) Nearly, due to required participation by students	650+
KP2 Number of testers/users	500+	(196) Satisfying for test runs, broad public roll out will start spring 2019	650+
KP3 Number of observations	Enough to create a map of attractiveness/Emotion map	(626) Enough for the test run	1000+ (to gain enough information for all activities so that newcomers can receive information concerning suitable places for activities they are interested in)
KP4 Media mentions	15	Broad public roll out will start spring 2019	30
KP5 Social media numbers		Broad public roll out will start spring 2019	30

→ User Profiles

The user profiles for the Vienna pilot are listed in Table 3.

Table 3: User profiles in the Vienna pilot

User Profile 2017 and 2018 (see D.2.2)	User Profile 2019
User 1: University student (obligatory and voluntary participation)	Interested in land use (changes), and/ or citizen science, likes the principle of sharing, likes to meet in public green spaces with friends, likes sports, is a romantic (but would deny it if asked).
User 2: Student (10-18 years old)	Heard about CityOases due to Citizen Science Award from the teacher in a school project. Thinks it is cool to have a good reason to use their smartphone as often as possible (parents cannot complain if it is for a good cause, i.e., school project). Seeks spaces were peers meet.
User 3: Member of an environmental organization	Loves nature and is concerned about it, likes also to meet with friends where it is green and quiet. Sees the app as an appropriate tool to fight urbanization and to voice the request for more green space – maybe even a little bit of urban wilderness?
User 4: Sport enthusiasts	Interested in tennis, football, biking, swimming, and all other ways to stay healthy and improve oneself. Green spaces are important, but more important are convenient places to exhaust oneself and relax after a hard day in the office.
User 5: Parents	Looking for new, good ideas to entertain the kids. Kids need space where they can run around and play with others. But they grow up fast and a nice place in one year can be outdated by the next year.
User 6: Employee of UBA or Vienna's districts or member of the city administration	They are interested in the app and the results are a useful tool to refine and complement planning instruments by gaining more relevant data and georeferenced photos. They are willing to participate, also in their spare time, to contribute their own perceptions.
User 7: Citizens of Vienna (and tourists)	It is nice to find places for activities in the city and to share emotions and opinions about green and open spaces and see how others perceive the city.

→ Current technology (mobile apps, web apps, other platforms)

Has your mobile app been tested?

The Frei.Raum.Netz mobile app has been tested in two trial runs with students from two Viennese Universities, which has evolved into the CityOases app. The beta version will be tested in April 2019.

Document any modifications that have happened to improve the app

Modifications of the content: due to feedback from the two trial runs with students and discussions with the City of Vienna, the main focus of the app has shifted from creating an emotion map to an app

that will: a) guide a user to places where activities can be undertaken and b) to comment on existing locations or enter new locations.

Users are now given a suggestion of the shortest route to a selected point. Moreover, the information they receive on a selected point has been extended and graphically reworked to give them an overview of the suitability of the place for certain activities.

The option to share their observations via social media (e.g., Twitter) has also been included.

The application is multi-language ready and has so far been translated into German, Croatian, Czech, Polish and Dutch.

Additionally, Terms and Conditions for CityOases have been drafted and are accessible from the app. Users must agree to these Terms and Conditions the first time they use the app.

For the green space monitoring, we derived Normalized Difference Vegetation Index (NDVI) values from Sentinel-2 time series to monitor vegetation dynamics in Vienna. Special emphasis was placed on the open space network of the city (FREI.RAUM.NETZ), which promotes green space equity for citizens as well as the preservation of ecological, social and economic functions. Using the temporal dimension in the analysis of remotely sensed imagery can enable the characterization of green spaces with respect to their phenology. Phenology – the study of cyclic and seasonal phenomena in plant and animal life, such as bud burst or leaf senescence – provides important information on the response of vegetation to external influences, e.g., temperature changes. Communicating such information to citizens can promote a richer discussion on changes within their living environment.

Is your technology missing any further development?

The CityOases app is nearly finished, but there are already ideas for improvement that include a module for special campaigns geared towards important environmental topics such as climate change.

Overview of app/prototype

From the user's perspective, this is an app where they can find and share their favorite spots to hang out or for recreational activities.

Possible activities include:

1. Searching for a suitable spot (as shown in Figure 6)

Users can search for activities by pressing the button "What do you want to do?" and selecting the desired activity. The map will then show all points where other users have suggested that this activity is possible to do. By selecting a point, the app will suggest the shortest route to the point from the current location and also show a preview of ratings, which can be expanded to show ratings, comments and pictures.

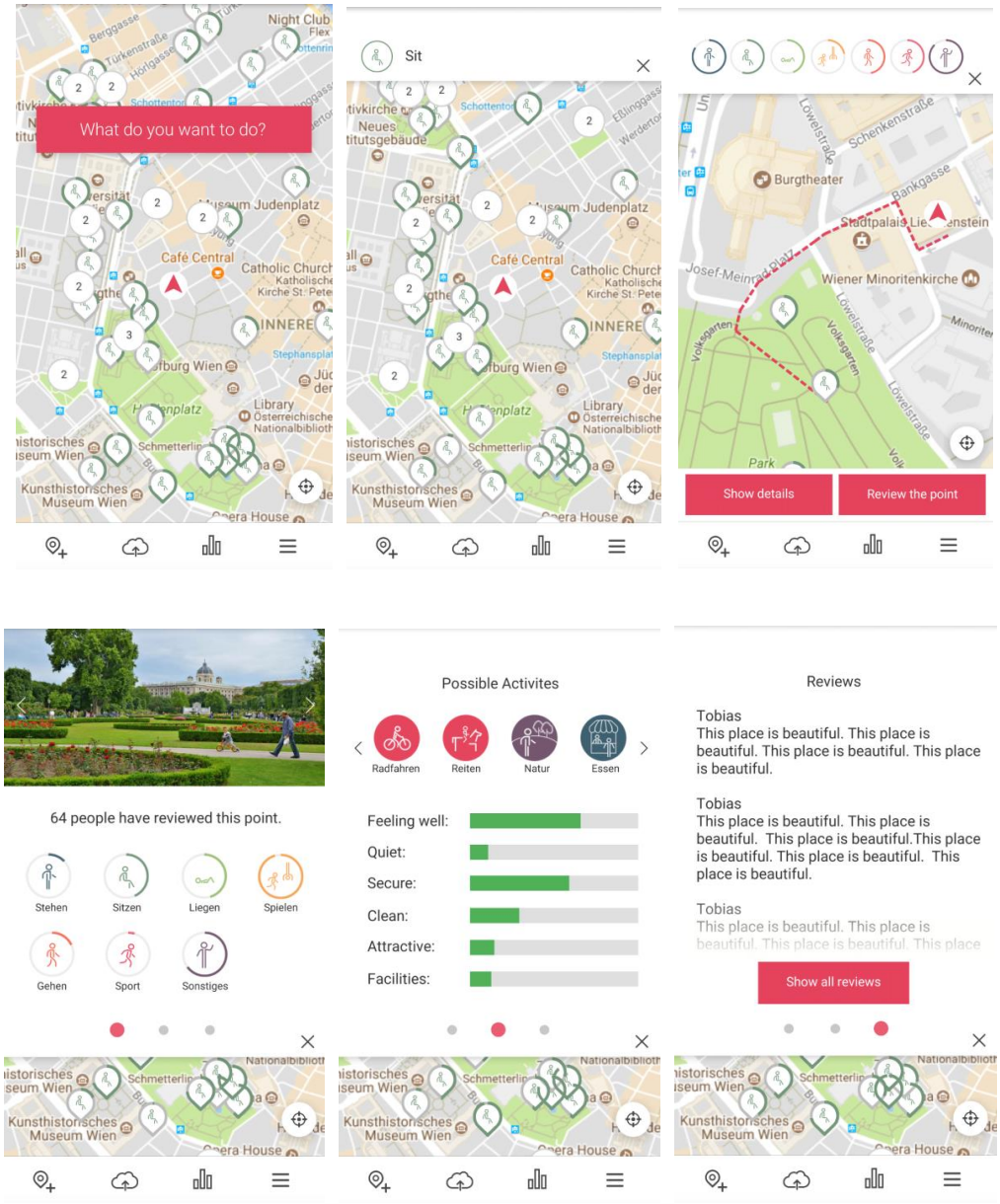

Figure 6: Screen dumps from the CityOases app including searching for activities, the quickest way to reach a point and the preview feature, which gives an overview of other people's ratings of the spot.

2. Adding and evaluating spots in the city

Users can either add a new spot or evaluate an existing point (Figure 7). They must indicate whether the point is publicly accessible (inaccessible points will not be shown on the map) and then answer a short questionnaire about the subjective perception and the activities that are possible. The users will then be asked to provide pictures in four cardinal directions away from the spot (Figure 8), but they have the option to skip a direction if there are too many people in the shot or if they are facing a wall. Before the point is uploaded, they have the option to blur out any faces or number plates from the pictures.

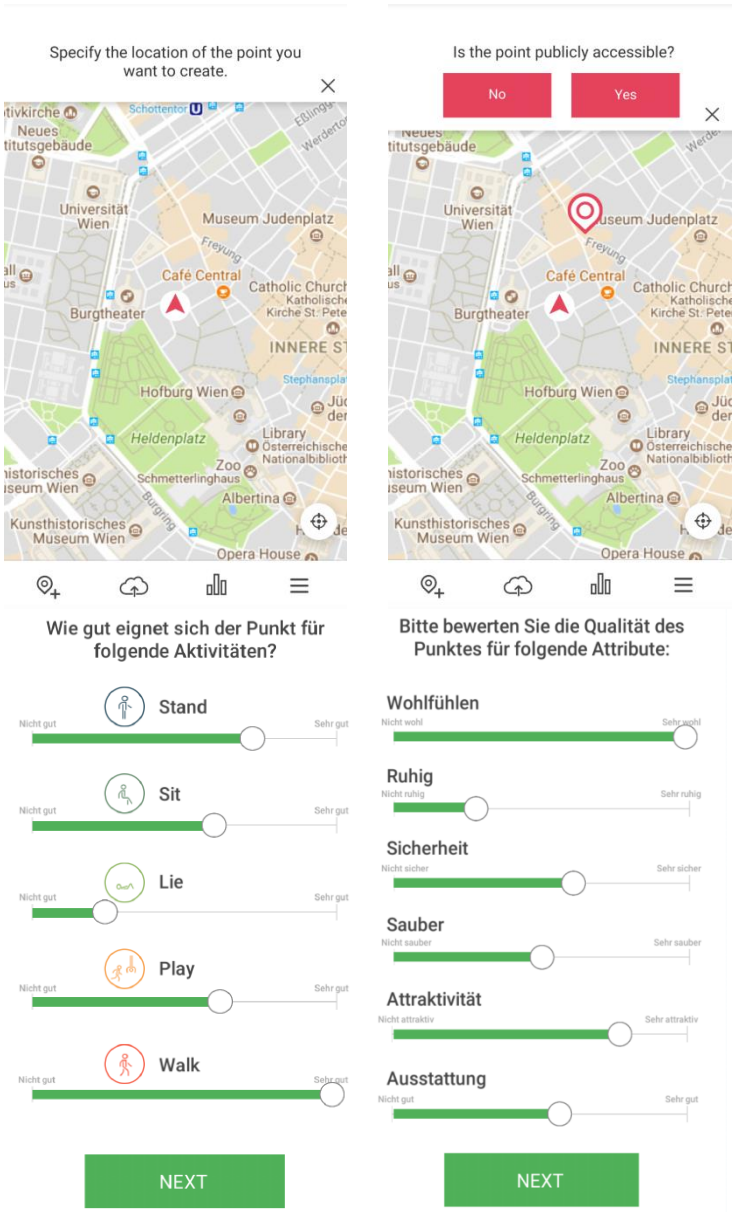

Figure 7: Screen dumps from the CityOases app: adding and reviewing a point

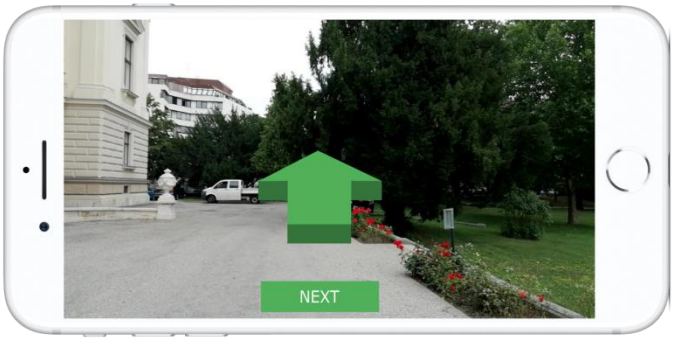

Figure 8: An example of a feature in the app for taking pictures in different cardinal directions

The questionnaire finishes with an open comment box and the option to share the location via social

media.

Before the rollout, a focus group will test this version and give feedback on the functionality and usability of the app from the public's point of view. This focus group will consist of staff members of the City of Vienna and the Environment Agency Austria plus a group of GLOBAL2000 activists.

→ Data control and privacy

Table 4 lists the issues related to data control and privacy and how these are handled in the Vienna pilot.

Table 4: Data control and privacy in the Vienna pilot

Data control and privacy issues	How these are handled
What data did you collect during the 2018 campaign?	Test data were collected based on the requirements of the university modules in which the app was used (i.e., an extended questionnaire).
Where are the data stored?	IIASA stores the data associated with the Vienna pilot study.
Who gets access to the data?	The data will be anonymized and made available as open data.
Do you have Terms and Conditions associated with joining the campaign?	Yes, IIASA has drafted a set of Terms and Conditions, which were then modified by the EAA lawyer.
Did you collect personal data?	Yes, names of the users who took part in the test run. The app collects usernames, email addresses and passwords only. The usernames are not identifiable names in some cases, e.g., first and last name of a person.
Are there any significant changes for the 2019 data collection campaign?	The data collection is now more focused on the specific use of the app with a short questionnaire and pictures to be submitted.

→ Quality Assurance

The quality assurance process for the Vienna pilot is outlined in Table 5.

Table 5: The quality assurance process for the Vienna pilot

Quality assurance process	When will the process be implemented	Any lessons learnt during the testing in 2018?
Alignment between questionnaire and picture	As soon as possible	-

Improve user location service	Probably together with FotoQuest Go update	-
Privacy through blurring	Already implemented: Automatic face blurring through LandSense QA services; number plate blurring (requires user interaction since cannot be automatically detected by LandSense QA services)	-
Create focus group (of non-students) to test app from a citizen's point of view	Testing and point amendment phase in April (target groups: employees of UBA, MA 18, collaborators of GLOBAL2000)	A sufficient number of points must be available when the app starts
Expert validation	Ongoing	-
Points can be visited and observed multiple times	As soon as possible	Feedback received from university users indicated multiple observations at the same location are a must
Restructure questionnaire to provide data for the desired output format	As soon as possible	-

→ Sustainability measures

The public app is closely connected to a political long-term planning instrument, which should ensure that the tool can be used for many years and PR can be closely connected to the STEP 2025 (Vienna's urban development plan) press releases. The development of the public app is subject to negotiations with the City of Vienna/MA 18. With few expected changes in the curriculum in the upcoming years, the student version of the app can be integrated and become a robust part of the modules for architects and potentially also other fields of study.

→ Business opportunities

What are potential business opportunities that could result from your pilot?

Versions could be created for other universities, cities or towns (maybe at a cost). Additionally, the Vienna green space monitoring campaign has sparked interest among other partners.

For whom do you plan to create value and who are the most important customers?

- Universities: A tool to enhance university modules by being a front runner in using modern technologies to collect relevant data. In addition, the data from the app helps in marking the work of the students.
- City of Vienna, MA 18 (City Development and City Planning): obtains input for LULC monitoring (photos) and feedback from citizens that can be used for improving the green and open spaces as well as future city planning.

- District administration: receives user feedback on their urban open spaces
- Experts (e.g., spatial planners, landscape planners, architects): obtain information that may be used for future planning and building activities.

Which one of your customer's problems are you helping to solve?

The stakeholder MA 18 (City Development and City Planning) has no regular monitoring system on LULC change. It will receive photos taken with the app that can be used to document LULC change. Additionally, they will get valuable feedback from the users concerning subjective perceptions of green and open spaces that are helpful for their planning activities. The rollout of the app and the publication of the results will support their aim to make stakeholders in other cities more aware of the CityOases app. Additionally, MA 18 sees the app as a means of promotion among future city planners and architects. Furthermore, it is quite an attractive tool for lecturers to try out new ways of collecting attributes of green and open spaces.

How can the LandSense Engagement Platform (LEP) serve as a channel to reach your customer segments?

The LEP will provide information about the mobile app and the download links to the Google Playstore and the Apple Appstore. It will act as a communication channel for any developments or research related to the app, and it provides a reduced web version of the map to search for points. It will also provide the interface for the download of the anonymized open data version of the observations.

For what value are your customers really willing to pay? For what do they currently pay?

In contrast to some other pilots, the Viennese pilot activity has a research-centered approach and not a business-centered one. Thus far, the customers are stakeholders that are part of the public sector, consisting of members of the administration of the City of Vienna and universities. They are currently non-paying stakeholders that bring in their expertise and knowledge as well as their needs. Even if they appreciate the app and its results, it can be assumed that they have rather low funds to pay for such an app. This might change if there is political will to adapt such an app for similar applications. Also, citizens will not be willing to pay for the app; quite the contrary as there is a need to include incentives in the promotion of the app to motivate people to contribute. However, the Vienna demonstration pilot can be scaled up to other cities, such as Amsterdam, as described in the next section.

2.1.2 City of Amsterdam

→ Storyline

Figure 9 captures the storyline of the city of Amsterdam pilot as a word cloud.

Figure 9: Amsterdam storyline captured in a word cloud

→ Target groups

Figure 10 captures the target groups for the city of Amsterdam pilot as a word cloud.

Figure 10: Amsterdam target groups captured in a word cloud

→ Engagement strategies

Awareness raising

The first phase in engaging citizens to participate in the LandSense campaign is to create awareness among the wider public. The following channels are proposed for awareness raising activities:

- Traditional media streams including local newspapers (e.g., Het Parool, Volkskrant, De Groene Amsterdammer) and radio stations (e.g., StadsFM)
- Communication streams of the Amsterdam Municipality including official webpages and municipal newspapers, which are being distributed through mail eight times a year in seven district-specific editions
- Social media campaign through a pilot-specific social media page (on Facebook and Twitter) and by using the existing LandSense social media streams
- Dedicated local Dutch website with a blog
- Identifying and linking to existing initiatives and communities; examples are listed in Table 6
- Call for participation distributed through institutional mailing lists (VU students and employees) as well as participants of the pilot.

Table 6: Initiatives that may be included in awareness raising activities

Initiatives and communities	Description
Green Office	Student-led platform to implement joint initiatives and exchange ideas in the field of sustainability
Green Living Lab	Living lab to inspire and promote healthier urban living through organizing lectures, debates, workshops and events
Sustainable Amsterdam	Stream for showcasing the approaches that contribute to sustainability in Amsterdam
De Gezonde Stad	Private foundation working with local residents to establish miniature parks on abandoned sites in Amsterdam
City Plot	Community of urban gardeners

Getting users on-board

To get the volunteers on-board, the benefits arising from active engagement should be clearly communicated through promotional materials, including showcasing the app functionalities. An effective method to initially attract participants is to offer them the opportunity to win a reward. There will be chances to win a (small) reward if people review 5 locations and there will be a larger reward when they review 10 locations.

The users who were already involved in the pilot in 2018 will also be approached to use the new app, and asked to promote it amongst their networks. Here the service focus of the app will be, primarily, to see if this is a successful motivation for engagement.

Sustaining participation

To sustain the engagement of users, it is important to provide regular feedback on their own progress as well as on the progress of the project. An increasingly common way to sustain user's participation

in active crowdsourcing projects is through gamification, in other words applying game thinking to engage the audience. The game elements proposed for this mobile app include leaderboards for achievements. To be able to enter into the competition for rewards, users will be asked to complete the quests in five to ten green space locations. For each successful quest, users will receive a certain number of points and be placed on a leaderboard. By visiting at least five locations, users will become a candidate for a lower-level reward (e.g., a book voucher). By visiting ten locations, users will become nominees for higher-level rewards (e.g., free visit to a natural site or yearly entrance to Hortus Botanicus).

Providing feedback

As registered users provide their e-mail addresses, they will receive feedback two to three times during the course of the campaign through a newsletter sent via e-mail providing a summary of the project's progress. Furthermore, users can use the maps produced with an overview of all the entries. They can also directly see other locations added and submit reviews for those locations.

Which partner will lead the engagement for the campaign?

Depending on the different phases, the roles will be distributed among the partners. The VUA will prepare the text for the promotional material to be featured on the LandSense official pages. It will be discussed with the City if there is a possibility to use their graphic designers to adapt the visual identity of the existing app to the Amsterdam context. Furthermore, it will be discussed if the campaign could be advertised in the municipal newspapers. VUA will reach out to other initiatives (listed in Table 6) to discuss potential support in the dissemination activities. VUA will create and continuously update the social media pages during the course of the campaign, as well as provide feedback to the participants.

→ Timeline & KPIs

What is the launch date of the campaign in 2019? How long do you plan to run the campaign for in 2019?

The launch of the campaign is proposed for May 2019 (exact date t.b.d.) and the active campaign should last until May 2020. In the coming months, the possibilities for linking the campaign launch with the communities and initiatives listed in Table 6 will be explored. The KPIs for the Amsterdam demonstration pilot are listed in Table 7.

Table 7: Key Performance Indicators for the Amsterdam pilot

KPI	Target for the 2017 and 2018 campaign	Was the target achieved? Provide an explanation	Target for the 2019 campaign
Number of downloads	1000	No: 814 downloads. It seems that the phase for building up a social media following is difficult, and with more time it may have been possible to reach this target.	1000. We will use the momentum from the earlier campaign to promote the new campaign, so we will not be starting at 0.

KPI	Target for the 2017 and 2018 campaign	Was the target achieved? Provide an explanation	Target for the 2019 campaign
Number of sustained users	500	No: 196 users. There appear to be major obstacles preventing people from using the app, including the fact that they had to go into the park.	500. We hope that the altered focus of the app, towards also providing a service for the user, will also encourage more sustained users.
Number of contributions per user	3	This was fixed.	5-10: we hope that the service focus of the app will help encourage more contributions.
Frequency of social media mentions	100-150	Yes. Over three social media platforms, we had >150 likes and followers.	200: We hope to gain more attention via social media.
Media mentions	n.a.	We had 3 media mentions.	5: We would like to become more mainstream with the new focus of the app.

→ User Profiles

The typical user profiles in the Amsterdam pilot are listed in Table 8.

Table 8: User profiles in the Amsterdam pilot

User profiles in 2017 and 2018 (see D.2.2)	User profile in 2019
User 1: Rosa is a 35-year-old mother of two children aged 4 and 7 who tends to visit the green spaces in her neighbourhood on a daily basis (if the weather allows so).	Rosa is a 35-year-old mother of two children aged 4 and 7 who tends to visit the green spaces in her neighbourhood on a daily basis (if the weather allows so). She would love to see other mothers also finding the great play spaces she discovers.
User 2: Daan is a 20-year-old student who uses the park nearby for jogging during the week, and as a place to meet friends during the weekend.	Daan is a 20-year-old student who uses the park nearby for jogging during the week, and as a place to meet friends during the weekend. He would love to share the best jogging routes and places to barbeque with others.
User 3: Ben is a 70-year-old pensioner who likes to spend his free time exploring the wildlife in the city parks.	Ben is a 70-year-old pensioner who likes to spend his free time walking with his dog in the city parks and would love to share the best off-leash places with fellow dog owners.

User 4: Fleur is a 29-year-old landscape architect working in the Department for Planning and Sustainability of the Amsterdam Municipality.	Fleur is a 29-year-old landscape architect working in the Department for Planning and Sustainability of the Amsterdam Municipality. Fleur would really like to encourage people to go outside, and so will add all the places she likes and thinks have a function for others.

→ Current technology

We propose to update our campaign to use the CityOases app. We will use the same app as in Vienna but modified for Amsterdam (see Figure 11).

Figure 11: Screenshots from the Amsterdam CityOases mobile app

The focus of this app will be different to the 2018 pilot, to see if this encourages engagement and involvement. The main differences with the 2018 pilot are:

- Focus is on the collaborative creation of a map of different places for specific uses. Therefore, the focus is on allowing citizens to directly provide a service to other citizens.
- App users will also be asked a short number of subjective questions so that they also provide information that can inform landscape planning.
- No locations are specified, contributors can add locations as they wish, as well as reviewing locations added by other contributions.

→ Data control and privacy

Table 9 lists the main data control and privacy issues related to the Amsterdam pilot.

Table 9: Data control and privacy in the Amsterdam pilot

Data control and privacy issues	How these are handled
What data did you collect during the 2018 campaign?	Email addresses, demographic information and answers to subjective questions
Where are the data stored?	IIASA database

Data control and privacy issues	How these are handled
Who gets access to the data?	IIASA and VUA
Do you have Terms and Conditions associated with joining the campaign?	Yes
Did you collect personal data?	Yes: email and demographics, including cultural background (voluntary with specific permission asked of the user)
Are there any significant changes for the 2019 data collection campaign?	It is unsure whether demographics will be collected during the 2019 data collection campaign

What data sources are additionally needed to run the campaign? Are these sources openly/freely available?

The additional data needed to run the campaign include a sample of locations in different types of green spaces within the study area. The set of points will be decided upon based on fieldwork and in consultation with the experts. Spatial data from the Open Geo Data portal of Amsterdam Municipality will be used for setting up the study and analyzing the results. Other openly available data to be used in the study include a topographic map of the Netherlands and reports from the statistics office. Furthermore, the Big Green Survey 2013 database, and possibly the data collected in the 2018 iteration (which are not openly available but will be shared by the City for study purposes) will be used as to assess the performance of the crowdsourced data.

Where will the data be stored? Who gets access to the data?

The data collected through the campaign will be stored within the database managed by IIASA. Full access to the data should be provided to the LandSense partners, as well as the Amsterdam Municipality. Individuals participating in the campaign should be able to access their own data in the form of summaries, while the aggregated summaries of all responses and the final report should be publically available. Researchers from other institutions should be allowed to access the data for further analysis after signing the statement of confidentiality.

→ Quality Assurance

Table 10 outlines the quality assurance process for the Amsterdam pilot.

Table 10: *The q*uality assurance process *in the* Amsterdam *pilot*

Quality assurance process	When will the process be implemented, i.e. real-time/near-real time/post-campaign
Improved GPS positioning Location accuracy is important if the specific spot should be visited. However, if the green space is considered homogenous it is not crucial.	During the campaign

Image quality Notification to take another photo if the quality is bad (e.g., blurry)	Real-time
Temporal coverage Repeated samples for the same citizens at multiple points in time to detect the changes in perception	During the campaign
Validity & reliability Assessing the internal consistency of contributions and detect outliers	During and post-campaign
Trust Confidence accumulated over other criterion concerning previously captured data (linked to reliability and validity)	During and post-campaign
Comparison with authoritative data Comparison with the data collected through the GGO 2018 survey to assess the performance of citizen science data in terms of representativeness and biases	During and post-campaign
Model-based evaluation Modelling the satisfaction with green spaces based on a set of predictors (e.g., species diversity, presence of water, presence of infrastructure/facilities, accessibility, etc.)	Post-campaign

→ Sustainability measures

If proven successful, additional opportunities for partnering with other relevant organizations and projects (e.g., the Amsterdam Institute for Advanced Metropolitan Solutions or the Atlas van de Leefomgeving) could be explored.

→ Business opportunities

What are potential business opportunities that could result from your pilot?

This pilot is research-oriented, with the aim to advance assessment techniques of human interaction with urban green spaces. If the campaign proves successful, the tool could be presented to and implemented in other cities interested in capturing real-time and location-based data on human-green space interaction.

For whom do you plan to create value and who are the most important customers?

- Citizens: a service for the community of app users - they create a map together showing the best places to undertake specific activities.
- Universities: A tool to enhance university modules by being a front runner in using modern technologies to collect relevant data. A good example showing different ways to collect data and different aspects of the social valuation of landscapes.
- City of Amsterdam: receives input for LULC monitoring (photos) and feedback from citizens that can be used for improving green and open spaces as well as future city planning.
- Experts (e.g., spatial planners, landscape planners, architects): obtain information that may be

used for future planning and building activities.

Which one of your customer's problems are you helping to solve?

For citizens trying to find nice, new places to visit in Amsterdam, there is a considerable amount of information about hotels, restaurants and the larger parks, but less so about smaller green spaces, or the specific uses for these green spaces. This app will help with this information gap.

The City of Amsterdam does a survey about the city's parks every 5 years, but they do not have information on which aspects of the landscapes within those parks affect the scores given to these parks. This app would provide very valuable extra, local, specific information that can help understand the answers given in the larger survey.

2.1.3 City of Toulouse and surrounding areas

→ Storyline

Figure 12 captures the storyline of the city of Toulouse pilot as a word cloud.

Figure 12: Toulouse storyline captured in a word cloud

→ Target groups

Figure 13 captures the target groups for the city of Toulouse pilot as a word cloud.

Figure 13: Toulouse target groups captured in a word cloud

→ Engagement strategies

How do you plan to create awareness of the campaign?

The engagement strategies for creating awareness of the campaign are outlined in Table 11.

Table 11: Engagement strategies for the Toulouse pilot

Goal	Target	Engage - Motivate - Communicate
Distinguish between residential, industrial and commercial use	UPAT, Research community	• Mailing lists: ALL IGN, Echanger, Agora, LASTIG, MAGIS • Direct link with the UPAT • Organize in-situ mapathons in Toulouse • LandSense and IGN websites • LandSense and IGN facebook and Twitter accounts
Validate detected changes	UPAT Students	• Direct link with schools of engineers (ENSG) • Organize mapathons sitting at desks • LandSense and IGN websites • LandSense and IGN facebook and Twitter accounts

How do you plan to get volunteers/users on board?

Approaches that will be used to get volunteers/users on board include the following:

- Making the contribution part of their work for local authority staff, and part of the curriculum for students
- Providing data with open licenses
- Integrate the contributions in authoritative LULC data
- Organizing mapathons for mapping LULC and validating detected changes
- Giving feedback and being reactive to problems encountered by contributors or requests that they make during the campaign
- Clearly articulate objectives and expectations IGN has from contributors and outcomes
- Target contributors and contributions: UPAT versus students; mapping LULC data versus validating changes regarding new construction, etc.

How do you plan to sustain engagement of the users?

Approaches to sustain the engagement of the users include:

- Provide regular feedback on their activities, achieved goals
- Provide social rewards for contributors. For each contribution, the contributor obtains a point. A ranking can be made and the “best three contributors” can be published
- Make their contributions accessible and visible through easy-to-use tools for downloading data
- Join local LULC data community meetings as much as possible to maintain interest, arrange meetings with LandSense contributors
- Do not forget to say THANK YOU at the end of each campaign, to stress how useful their

contributions are to IGN.

How do you plan to give feedback to the users?

Feedback to the users will be provided through:

- Organized meeting and workshops
- Newsletters (mail, forum, website) to inform about the activities, contributions and results
- Official LandSense and IGN social media for describing the activity, the contributions and the results.

Table 12 lists the leaders of the campaigns in the Toulouse pilot and the engagement activities that they will use.

Table 12: Leaders of the campaign in the Toulouse pilot

Campaign lead	Engagement activity
IGN	Campaigns to validate new construction changes detected by the LandSense Change Detection Service (CDS)
Urban Planning Agency of Toulouse Metropolitan Area and IGN	Campaign to distinguish between commercial, industrial and residential classes in the 2016 LULC authoritative data

→ Timeline & KPIs

The IGN-France campaign for 2019 will run from February to October as outlined in Table 13.

Table 13: Timeline for the Toulouse pilot

Activity	Possible launch date of the campaign in 2019
Validation of new construction sites detected by the LandSense CDS	February 2019 (during student classes) September-October 2019 (during student classes)
Distinguish between LULC classes: commercial, industrial and residential	July – August 2019

The KPIs for the Toulouse pilot are outlined in Table 14.

Table 14: Key Performance Indicators for the Toulouse pilot

KPI	Target for the 2017 and 2018 campaign	Was the target achieved? Provide an explanation	Target for the 2019 campaign
Number of LULC contributions	80% of the total amount of highlighted targets	No. Although the stakeholders showed an interest in collaborating on this theme, we encountered some	80% of the total amount of highlighted

KPI	Target for the 2017 and 2018 campaign	Was the target achieved? Provide an explanation	Target for the 2019 campaign
		difficulties, including: the use of the new tool was considered an obstacle; the test area did not cover the totality of the area of interest of some stakeholders; the local platform (PictOccitanie) relayed the information concerning the IGN pilot to its network as promised, but it did not advertise the collaborative work.	targets. The targets are limited compared with the campaign from 2018
Number of validated changes	80% of the total amount of highlighted targets	No. The points were too dispersed over the test area. The fact that a contributor had to visit points far away from one another in the field to use the mobile app (and could not do it remotely) was an obstacle.	80% of the total amount of highlighted targets. The targets are limited compared to the 2018 campaign
Number of contributors	200-500	No. It was difficult to build a citizen community.	50-100
Number of mobile apps downloads	200	No. Although we used social and professional networks (LinkedIn, Facebook, Twitter), the scale of our communication was probably not large enough. Despite the fact that the mobile app was considered by some users as user-friendly and simple, few citizens actually downloaded it.	50

→ User Profiles

There are two types of contributor profiles: stakeholder staff, and students. Examples of these profiles are provided in Table 15. Contributors carry out the following two tasks:

- Distinguish between commercial, industrial and residential classes: for each aggregated class US235, choose a new class: industrial (US2), commercial (US3) or residential (US5).
- Validate changes detected by the LandSense CDS: for each new detected construction (having the types industrial, infrastructure and residential), the contributor should validate the change and the type of construction.

Table 15: Typical user profiles in the Toulouse pilot

User profiles for 2017 and 2018 (see D.2.2)	User profile for 2019
User 1: Stakeholder Tom is working at the Departmental Direction of the Territories and he is in charge of implementing national and local agricultural policies. To make an analysis that will help to assist farmers in obtaining funds, he computes indicators by using LULC data produced by IGN. He realizes that the data are not accurate enough. In particular, it is not clear from the data if the use of a parcel is for agricultural purposes or not.	**User 1: Urban Planning Agency of Toulouse Metropolitan area** Arnaud is the head of the Urban Planning Agency of Toulouse Metropolitan area, in charge of implementing local urban policies. To analyze increases in soil sealing, he computes indicators by using LULC data produced by IGN. He knows that due to the lack of detailed information in the current LULC data, the land use classes residential, industrial and commercial are aggregated into one class (LU235). He contacts IGN to ask how this class can be improved. IGN proposes that he join the Toulouse pilot and to involve other staff in the department. Arnaud downloads the PAYSAGES mobile application, which is available for Android and iOS, and because his contributions are part of his work, he creates an account (username and password) on the PAYSAGES platform and defines his profile (age, gender, background, institution), and reads and agrees to the terms and conditions. He first decides to read the guidelines. When he starts, he makes sure that he has enabled geolocation. During the field trip he can choose one of the points of interest that are marked on the map in the app. The app will guide him to the point. When he reaches his destination, he chooses the appropriate land use class and takes at least one picture. When he has a doubt, he leaves a comment. At the end of his visits, he saves and uploads his contributions. The day after, both Arnaud and his colleagues have access to the corrected data made by Arnaud. Realizing the benefit of the detailed data, Arnaud decides to engage his team to participate in the pilot.
User 2: Student Agnès is a Masters student in the Agricultural Engineering School in Toulouse. During the first semester of her Geographic information Masters, she attends a lesson on 'Introduction to biodiversity monitoring and LULC classification', where she is required to work in teams of 4 and to detect changes in landscapes.	**User 2: Student** Louise is a student of the National School of Geographic Information Science (ENSG). During the first semester of her curriculum, she attends the lesson on 'Interpreting orthophotos for mapping and updating LULC data', where she is required to interpret orthophotos, to analyse the spatial context and vector data to identify changes in landscapes. The teacher was contacted by IGN to participate in the campaign. The teacher decides to use the PAYSAGS web application proposed in the Toulouse pilot to validate areas with construction detected by the LandSense CDS. The students are asked to connect to the PAYSAGES platform by creating an account or using their Google, facebook or student accounts. Louise is connecting to the PAYSAGES web application using her Google account. For each highlighted point in the map, she needs to validate if it is real a change or not. If yes, then she needs to select the new land use class from a list of classes. If the change is not a real change, then Louise must provide this information to the system. Louise enjoyed the application and she is happy that she could participate in an innovative European project.

For the campaigns, the following three applications will be used: LACO-Wiki, web PAYSAGES, and mobile PAYSAGES. The PAYSAGES web application is developed by IGN and is part of the LandSense User Authentication System. The application has different functionalities such as: modifying the geometry and the thematic attributes, creating and deleting features, downloading and visualizing the initial and contributed data, and modifying personal data. Contributors can connect to the application by creating a new account on the PAYSAGES platform or by using one of the accounts

available through the LandSense User Authentication System (e.g., Google, Facebook, etc.). The PAYSAGES mobile application was developed by IIASA. It guides contributors in the field to visit points and to then answer different questions about the landscape.

→ Current technology

Web PAYSAGES application

The web application is a server application developed by IGN. Figure 14 illustrates the functionalities of the PAYSAGES web application while Figure 15 provides a screenshot of the app. Contributors can directly modify the data (i.e., both the attributes and the geometry), and the updated data are then directly available on the web through a Web Feature Service (WFS). To guide users in making difficult or controversial decisions, the administrator creates a series of points to visit. For example, in-situ contributions are sent from the mobile application by users taking part in the campaign and sometimes these contributions can be in conflict. In this situation, the contributor to the online application must decide and resolve the conflict by inserting the correct attributes associated with a given feature.

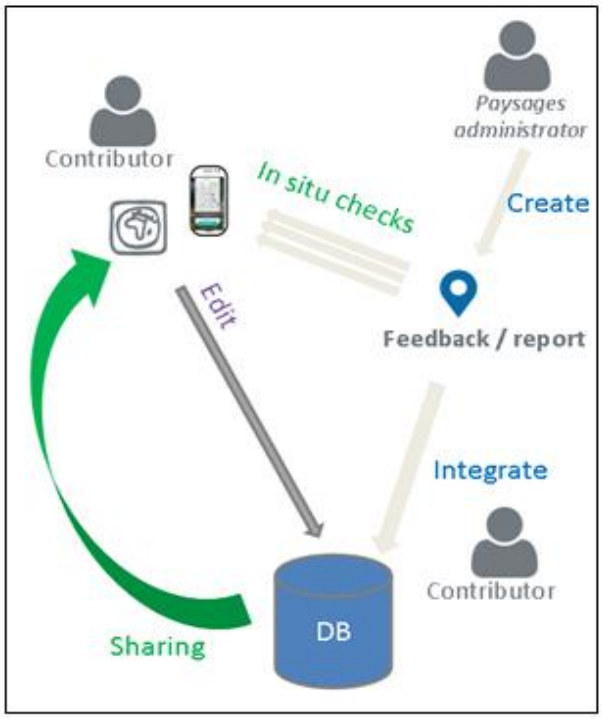

Figure 14: The main functionalities of the PAYSAGES web application

The REST API manages the contributions from both the mobile and web applications.

Figure 15: A screenshot from the PAYSAGES web application

Mobile PAYSAGES App

The design of the PAYSAGES mobile application was originally based on FotoQuest Go, which is an app for in-situ data collection. Figure 16 shows some screenshots from the tutorial when the app starts. Figure 16a shows the starting screen of the app while Figures 16b and 16c illustrate the map interface that shows the locations of the tasks, in this case tasks related to collecting information on buildings. Red markers show points that have not yet been visited, blue markers show points visited by others while green markers are points that the user has visited. The user then selects a location to visit, which turns yellow as shown in Figure 16c. The user is then told to move as close to the point as possible as shown in the tutorial (Figure 16c) and in the actual app (Figure 17a).

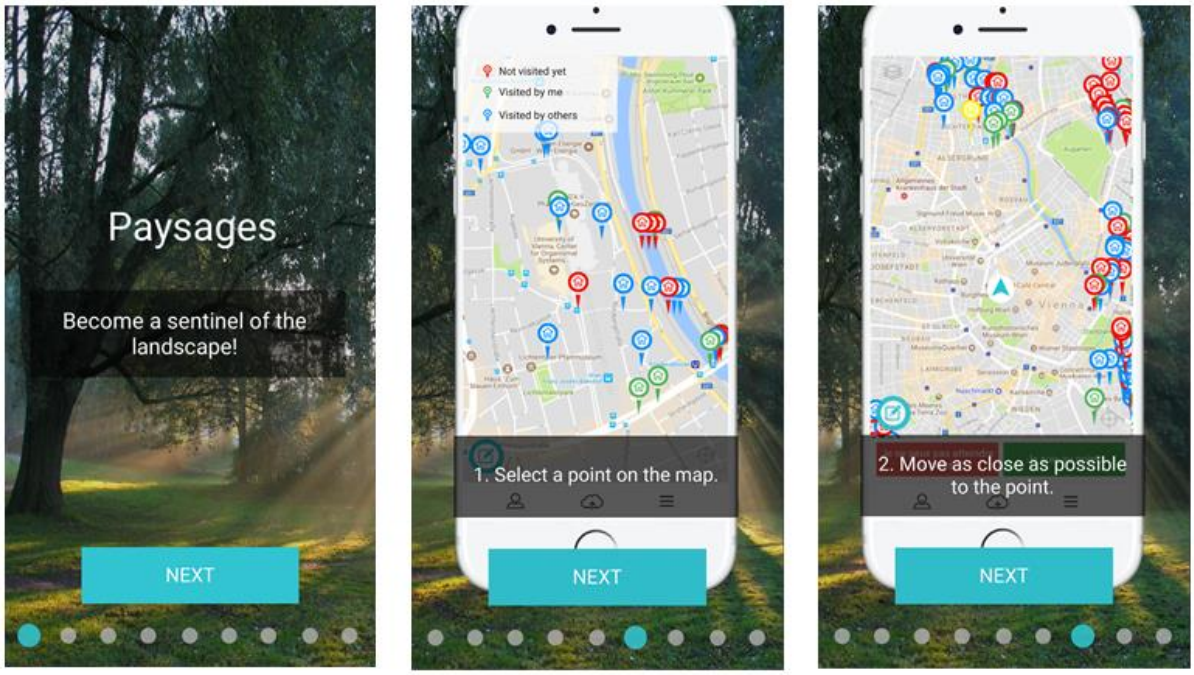

Figure 16: Screenshots from the PAYSAGES mobile app in Toulouse. (a) The starting screen, (b) a map with locations of the tasks, and (c) selection of a task on the map.

Once the point has been reached, the contributor indicates that they are at the point by pressing the button (Figure 17a) and the 'Add building information' screen will appear (Figure 17b). The user selects

the principal and secondary uses of the building, selects the number of floors and optionally takes a picture of the building. This information is then saved to the phone and uploaded later when they have a wifi or data connection.

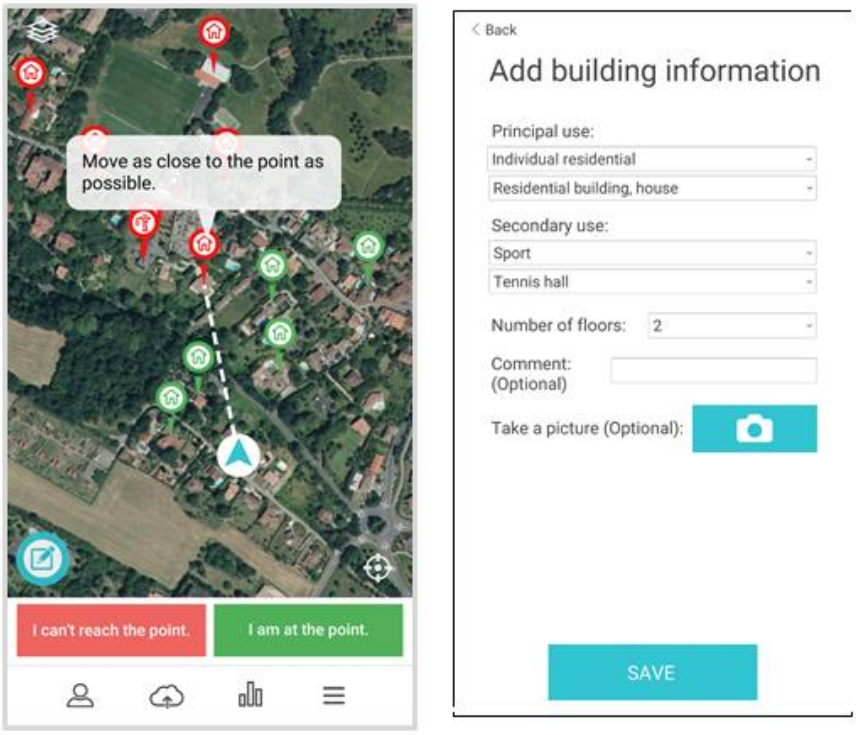

Figure 17: Screenshots from the mobile app showing (a) instructions to move closer to the point, (b) the screen to add building information after reaching the point

The app runs on both the Android and iOS operating systems and is available for download from the Google PlayStore and the Apple AppStore, respectively. The app is in both French and English; the language that appears is based on the phone settings although translations were done manually to ensure the correct meanings of the terms used, particularly those related to LULC, which are often poorly translated when using the automatic translation facilities. Although the app can work anywhere, the points shown on the phone are part of the campaigns that are related to the area of interest so points will only be shown if a user is in the test area.

→ Data control and privacy

Table 16 lists the main data control and privacy issues related to the Toulouse pilot.

Table 16: Data control and privacy in the Toulouse pilot

Data control and privacy issues	How these are handled
What data did you collect during the 2018 campaign?	• Thematic information on LULC and geotagged photos • Comments describing the contribution • Photos characterizing the contribution • Validation data. The contributor clicks on a point to validate it.

Where is the data stored?	The data are stored on IGN servers. Both applications and contributors get access to the data (must make a request). Some types of data can be modified while others can only be visualized (e.g., using a WMS).
Who gets access to the data?	IGN staff, users who make requests to download the data
Do you have Terms and Conditions associated with joining the campaign?	Yes
Did you collect personal data?	Yes. Username, emails, profession/educational level, institution (for stakeholder staff), age range, and gender
Are there any significant changes for the 2019 data collection campaign?	No

What data sources are additionally needed to run the campaign? Are these sources openly/freely available?

The data sources used in the campaign are listed in Table 17. Some of these data sets can be modified such as the LULC database and changes detected by the LandSense CDS while others can only be visualized such as orthophotos or other themes that can help contributors to determine the LULC class (e.g., road network, rivers, etc).

Table 17: Data sources used in the Toulouse pilot

Data	Edits	Visualization
LULC DB ®IGN	X	
Points generated by the CD	X	
Other themes from the BD Topo ®IGN		X
BD ORTHO ®IGN (50cm from 2019, 2016, 2013)		X
Geoportal: WMS, WFS data		X

→ Quality Assurance

The quality assurance process for the Toulouse pilot is outlined in Table 18.

Table 18: The quality assurance process employed in the Toulouse pilot

Quality assurance process	When will the process be implemented, i.e. real-time/near-real time/post-campaign
Improve GPS positioning	Real -time

Checking for values outside of an allowable range or not possible (e.g., 10 floors for a building having a 12 m height)	Real -time
Conflation methods when more than one observation is recorded at a single location	Near-real time
Review by the crowd; request reports and points coming from the CDS and quality assurance services	Near-real time
Photo blurring	Near-real time
Consistency of data with respect to data specifications and spatial context	Post-campaign
Validity and reliability of the data	Post-campaign
Reliability of the contributors	Post-campaign
Comparing with other VGI or authoritative data	Post-campaign

→ Sustainability measures

What are the potential upscaling activities for the second iteration of your campaign in 2019?

Our current strategy is to implement the same activities for the 2019 campaign but improving them and adapting the engagement/action plans based on the lessons learned in 2018.

→ Business opportunities

What are potential business opportunities that could result from your pilot?

Data will be disseminated as open data to be easily and freely reusable. Although it is difficult to quantify at this stage, open data could enable private companies to produce more reliable and complex indicators, enable monitoring of environmental changes for local authorities, but open data could also be useful for citizens. Moreover, in the environmental field, the results and benefits are not necessarily measured in monetary terms.

For whom do you plan to create value and who are the most important customers?

In contrast to other pilots, IGN and the Urban Planning Agency of Toulouse Metropolitan Area are the main customers.

For IGN, the most important goal within LandSense is to improve our response to public policies by creating more tailored LULC data to the meet the needs of the national environmental reporting of public authorities for better managing urbanization and increases in soil sealing. The second goal is to produce more accurate and up-to-date LULC data, by reducing public costs.

Which one of your customer's problems are you helping to solve?

- IGN's problems related to obtaining up-to-date and accurate information on LULC

- The Ministry of Ecology's problems, which is the supervisory authority of IGN
- IGN partners, which are LULC data end users.

How can the LandSense Engagement Platform serve as a channel to reach your customer segments?

By developing the Campaigner, change detection and quality assessment services, our customers will be able to run their own campaigns for their own specific purposes.

For what value are your customers really willing to pay? For what do they currently pay?

At present, only the State, the regional administration and IGN pay for producing LULC data. When LandSense finishes, these institutions can decide to invest in the LandSense Engagement Platform, if the implemented mechanisms for producing data in a collaborative way contribute to reducing the costs in producing and maintaining authoritative LULC data.

2.1.4 University and City of Heidelberg

→ Storyline

Figure 18 captures the storyline of the Heidelberg pilot as a word cloud.

Figure 18: Heidelberg storyline captured in a word cloud

→ Target groups

Figure 19 captures the target groups for the Heidelberg pilot as a word cloud.

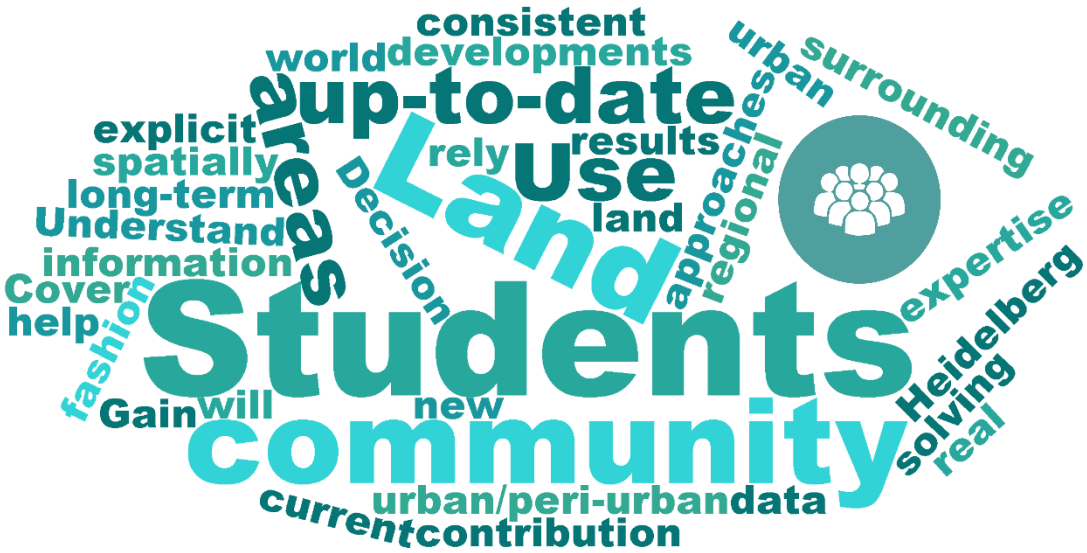

Figure 19: Heidelberg target groups captured as a word cloud

→ Engagement strategies

Engagement is led by Michael Schultz of the GI-Science group at Heidelberg University. We have leveraged/will continue to leverage existing infrastructure and communication channels of the Heidelberg mapping community such as the Heidelberg disaster mappers or the Missing Maps team (http://www.geog.uni-heidelberg.de/gis/heigit_disastermanagement_en.html). To date, two validation campaigns were run in Heidelberg in July 2017 and January 2018, involving students and OSM enthusiasts from the local community. Data were collected for Heidelberg, Toulouse and Vienna. Additionally, the scalability of our approach was demonstrated during an osmlanduse.org validation campaign for Geneva (a non-LandSense pilot city) during EuroGEOSS 2018, facilitated as a workshop event. Experts within the field of land use and spatial sciences participated. Additionally, the procedure was applied during two validation mapathons at Paris University involving students, with assistance from IGN France (Ana-Maria Olteanu-Raimond).

As outlined in the previous deliverable D2.2, the engagement strategies will continue to involve students and workshops to estimate data quality, where at least one mapathon is planned for the spring of 2019.

→ Timeline & KPIs

Table 19 lists the KPIs for the Heidelberg pilot and the methods that were used to reach these targets. Previous validation campaigns were accomplished and the scalability and transferability of the method was demonstrated for land use validation activities during the Geneva mapathon and the Paris mapathon (IGN leading). Using LACO-Wiki to identify land use and land use change was deemed appropriate. Areas where OSM-based land use can be applied successfully and where it is not suitable were identified. OSM-based land use was found to be particularly useful for urban areas, agriculture and forested areas.

Table 19: Key Performance Indicators for the Heidelberg pilot

KPI	Target for the 2019 campaign	Ways to help reach the target
Thematic mapping accuracy	85% thematic accuracy	Mapathons and engaging people to work on OSM validation; expert validation plus an algorithm and map improvement using deep learning
Spatial detail	Minimum Mapping Unit (MMU) < 0.01 ha	Usage of very high resolution (VHR) data for Heidelberg and Toulouse
Ongoing validation/Contributor agreement	Examine contributor agreement to understand reliability of individual users	Scotts PI and contributor agreement; multiple visit of individual reference points by independent contributors

→ User Profiles

For the specific case of the Heidelberg pilot study, there are three typical contributor groups and two

consumer groups. The three typical contributor groups are:

- **University Students** (Geography + others): enthusiastic students interested in contributing to OSM. Often they are already active in OSM, disaster mappers or in the Humanitarian OSM Team (HOT).
- **OSM Contributor / Geographer / Environmentalist:** A person (student, local activist and any citizen willing to contribute) motivated by improving the quality and completeness of VGI geometric and semantic information.
- **Scientist:** attending a workshop or conference who is interested in contributing to OSM.

The two consumer groups are:

- **Public Agency Worker (PAW):** A PAW whose task is the monitoring and updating of LULC in the jurisdiction of their agency.
- **Companies:** commercial organizations interested in land status and development.

One contributor group is formed of regular OSM volunteers who continuously improve and update the LULC product through their contributions within OSM. The second contributor group is Mapathon volunteers, who provide estimates of map accuracy, accuracy confidence and provide training data for machine learning based improvements to the map. Users are any persons who require up-to-date land use information, e.g., municipalities or local, regional, continental and global planning institutes. Within the planned mapathons, these groups will answer questionnaires regarding their level of experience and skills in photo-interpretation, remote sensing and LULC. Additionally, we will provide detailed image interpretation and mapping guidelines to all participants to help steer them through the mapathons.

→ Prototyping

The 2017 and 2018 prototype aims were achieved. Very high resolution (VHR) time series land use applications are currently in development and prototyped for 2019, including mapathons for quality estimation.

→ Data control and privacy

No personal data are collected. Only the results are stored and further processed. Any data collected and products generated align with the Open Database License (ODbL) employed by OSM, and all the generated data are made publicly available. EU GDPR compliance is ensured.

→ Quality Assurance

Some of the quality assurance processes for the mapping activities led by UHEI are described in Table 20. Please refer to deliverables D5.2, D5.3 and D5.4 for more details.

Table 20: Quality assurance processes in the Heidelberg pilot

Quality assurance process	When process will be implemented
Survey of contributor experiences	Pre-campaign

Good practice map validation (LACO-Wiki) + Expression of certainty: "Would other contributors agree?" Overall-, user-, producer - accuracy + confidence interval ***Stage 0 (essential reference data, fraction of total)*** Reference data created by experts to estimate contributor's reliability (Stage 1 reference data set). Sample size is a fraction of the total sample population. ***Stage 1 (reference data, total population)*** Full reference data set to estimate product accuracy. ***Stage 2 (latent reference data, fraction of total)*** Fraction of stage 1 sample population for cross-user redundant interpretation.	Dedicated campaign (Mapathon)
Latent analysis, agreement among participants	Post-campaign
Intrinsic indicators	Post-campaign

The data flow for the Heidelberg pilot is given in Figure 20. Examples of processes include (but are not limited to):

- Review by experts
- Review by the crowd
- Conflation methods when more than one observation is recorded at a single location so can calculate contributor agreement
- Measures of user trust or reliability.

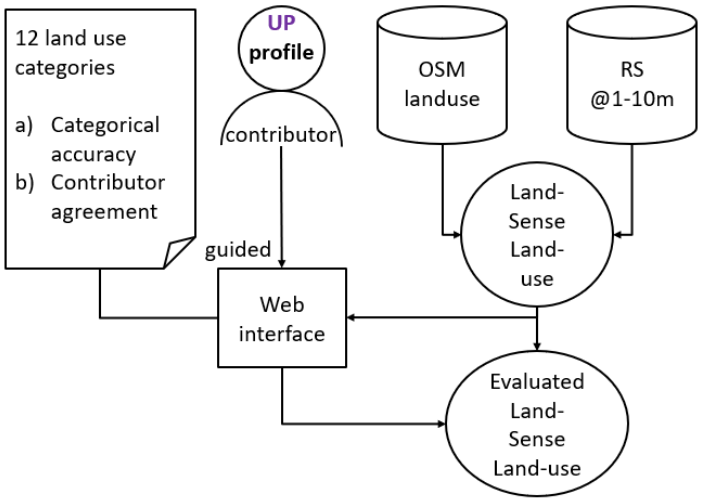

Figure 20: Data flow of Heidelberg demo case

→ Sustainability measures

What are the potential upscaling activities for the second iteration of your campaign in 2019?

Local mapping events in Geneva and Paris were held. Figure 21 shows the result from a mapathon held during EuroGEOSS 2018 (Geneva), where the new contributor agreement quality assurance technique was applied. In the future we will scale up to cover Europe and eventually the world. We

will also endeavor to improve the spatial resolution of the OSM-based land use map.

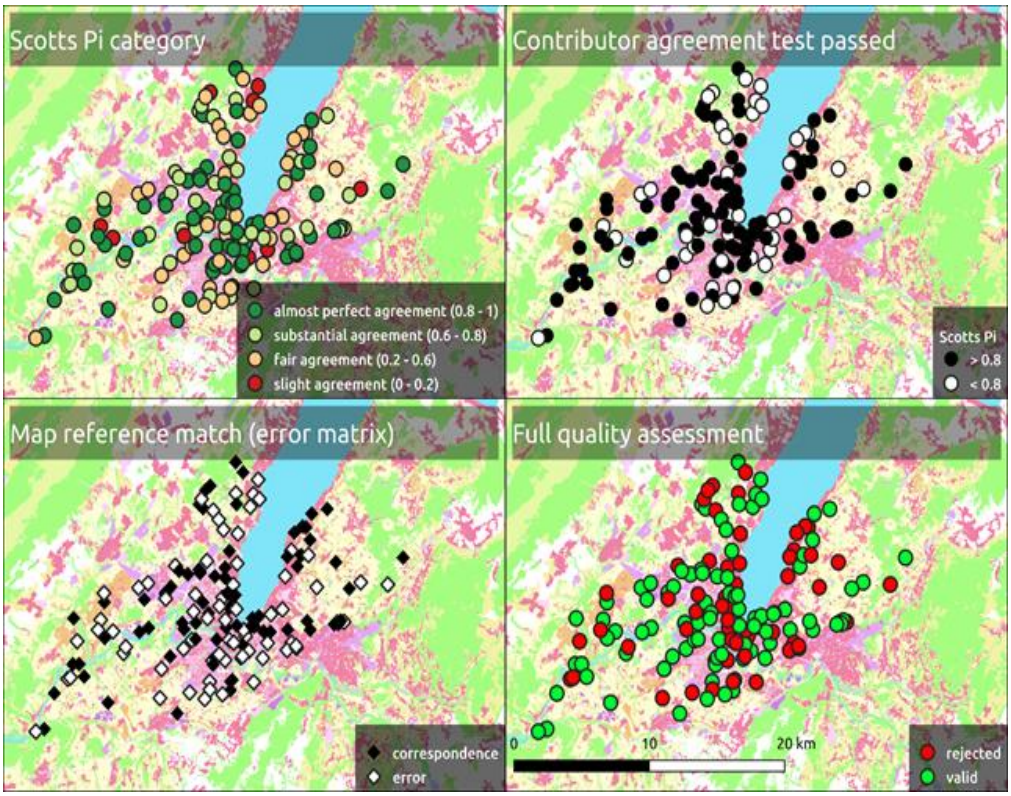

Figure 21: Example of upscaling a validation mapathon of osmlanduse.org to Geneva and implementation of the contributor agreement (Scots PI)

→ Business opportunities

What are potential business opportunities that could result from your pilot?

The potential business opportunities include providing up-to-date land use information for decision makers (i.e., companies, government agencies, etc.). Clients can decide on the spatial and temporal resolution of their desired land use products and we can provide the service to set up the product for a fee. Providing up-to-date thematic information has significant value (e.g., for land management, urban planning, land-use forecasting, etc.) over currently existing processes that offer outdated, low accuracy, thematic information.

3 Theme “Agricultural Land Use”

3.1.1 Serbia

→ Storyline

Figure 22 captures the storyline of the Serbian pilot as a word cloud.

Figure 22: Serbian pilot storyline captured as a word cloud

→ Target groups

Figure 23 captures the target groups for the Serbian pilot as a word cloud.

Figure 23: Serbian pilot target groups captured as a word cloud

→ Engagement strategies

Phase 2 will aim to drive and maximize the uptake of the CropSupport application by the key end-user group, i.e., farmers. Users will be guided over the growing season in 2019 (Feb – Oct).

InoSens will reach farmers through farmer associations, private companies engaging in outgrowing schemes, agricultural extension services, etc., building from awareness established during Phase 1. Workshops/info days will be organized in several locations, and farmers showing high interest will be enrolled in the pilot. Initially, InoSens will provide training to farmers on how to use the application, and particularly how to interpret NDVI data and outputs from the CDS. The training plan will be very flexible, allowing it to adjust to meeting needs that are identified as the pilot progresses. Thus, both group and individual training sessions will be organized, which will be adjusted to the time and schedule of the farmers. To sustain engagement and to provide constant feedback to the users, close contact will be maintained with the farmers throughout the whole campaign (e.g., through phone calls and visits), creating a personal feedback loop for all functions and aspects of the application. Also, InoSens will regularly inform the community about campaign activities via the websites and social media channels of InoSens and LandSense. Based on the experience from Phase 1, an option of rewarding the top user(s) will be considered.

The expected outcomes are to generate a large amount of high-quality crowdsourced LULC data for the 2019 growing season via the CropSupport application, to improve upon the application, to simplify the user experience and to provide highly relevant insights for designing the CropSuport exploitation strategy based on broad testing in an operational setting. Another expected impact is to bring modern EO-based technologies much closer to the farmer communities.

→ Timeline & KPIs

The timeline for phase II of the agricultural campaign in Serbia is provided in Table 21 and the KPIs are provided in Table 22.

Table 21: Phase II timeline for the agricultural Campaign in Serbia

Date of task completion	Activity	Description
31 Dec 2018	Define precise concept	The precise details and activities of the Phase II campaign were defined, along with the InoSens internal division of labor.
31 Jan 2019	Contact individual farmers and farmer organizations	Emails, phone calls, and official documents were exchanged with individual farmers and farmer organizations including face-to-face meetings.
31 Jan 2019	Prepare information packages and send them out	Informative material about the CropSupport app, its benefits, and the LandSense project was prepared.

Date of task completion	Activity	Description
28 Feb 2019	Introductory workshops	Farmer organizations that agree to facilitate contact with farmers helped to organize the workshops. The benefits of remote sensing technology in agriculture and the value of crowdsourcing were presented along with the CropSupport application. Farmers were signed up who were willing to try out the application and engage in close collaboration with the InoSens team.
20 Mar 2019	Form core group	The commitment of 25 farmers was accomplished, with all administrative tasks completed, e.g., consent forms. A plan was devised with each farmer how they will use the application in line with their needs/ambitions.
15 May 2019	Complete spring season	Data about spring activities (land preparation, sowing, seed varieties used, etc.) will be gathered up to this point. InoSens will be in close contact with the 25 farmers.
31 Aug 2019	Complete summer season	Data about the summer activities (weeding, yields from harvest, etc.) will be gathered up to this point. InoSens will be in close contact with the 25 farmers.
15 Oct 2019	Complete autumn season	Data about autumn activities (harvesting, land preparation, fertilizer application, etc.) will be gathered up to this point. InoSens will be in close contact with the 25 farmers.
30 Oct 2019	Completion workshops	Farmers will be invited who participated in an event, where InoSens will present the overall achievement of the campaign and the farmers' contributions. Possible gifts of gratitude will be considered.

Table 22: Key Performance Indicators for the Serbian pilot

KPI	Target for 2017/2018 campaign	Was the target achieved? Provide an explanation	Target for the 2019 campaign
Number of Participants	>35 high school	The target was achieved. There were over 70 active	25 farmers

	students	participants.	
Number of collected photos	1750+	The target was achieved. The participants collected 1822 photos.	150 photos
Number of activities [1]	175+	The target was achieved. The participants collected data related to 344 activities.	15 [2]

[1] This metric refers to data related to the farm activities such as date of sowing, fertilizing, harvesting, etc.
[2] This metric refers to 15 data sets, where each set will contain information for different parcels throughout the whole 2019 growing season.

→ User Profiles

The user profiles (Table 23) will remain the same as those defined in the Phase I activities (2017/2018), i.e., members of the farming community.

Table 23: CropSupport user profiles

User profile 2017 and 2018 (see D.2.2)	**User profile 2019**
User 1	Jelena leads a fruit farmers' co-op in Serbia along the border with Hungary. The small co-op grows peaches and apricots, which are sold to local juice producers. Peaches and apricots are particularly susceptible to infections and pests. Although not every tree is always affected, every tree is treated with pesticides. Jelena and her partners find it more expensive to check each tree individually for infections and pests instead of simply treating all of the trees. One night Jelena is contacted by a large juice producer who wishes to sign a contract with her. However, he has one condition: Jelena must lower the use of pesticides. One way of doing so would be to treat only those trees that are affected by infections and pests, instead of all the trees. She tells the juice producer that she simply cannot afford to check each tree and act in a targeted manner to reduce the overall use of pesticides. The fruit producer informs her about CropSupport; he's heard about it by subscribing to InoSens' newsletter ever since he took part in one of their agro-accelerator programs. Next week Jelena tells her colleague farmers to take pictures of their orchards and upload them through the CropSupport application. In return they receive NDVI and CDS-based data and are able to understand which parts of their orchards need pesticide treatment. This allows them to save on pesticide costs while fulfilling an important part of a very lucrative contract.

User 2	Djordje is a dairy farmer in the northern Serbian village of Susek. He has 20 heads of Holstein Friesian cattle, which are fed on a variety of pastures around the village. However, the Holstein Friesian breed can be sensitive to the quality of grazed lands. One day spent on a pasture that is of poorer quality can lower Djordje's cow's productivity, and for a small farmer like Djordje, this lowered productivity has far reaching consequences. Furthermore, Djordje has no way of knowing the quality of the pasture beforehand, given that the pastures are closely located but spread around a rugged peak of the Fruska Gora Mountain range. A similar situation applies to other dairy farmers in the village. Djordje does not apply any technology in his farming, but he is tech savvy in his private life, owning a smartphone and PC. One night he reads an article about the CropSupport application on a local agricultural news website. He finds out that there is a way for him and his fellow farmers to come together and solve the problem of not knowing which pasture to take their cattle to feed on. Farmers download the CropSupport app and snap geo-referenced shots of their pastures. They upload the pictures and in return receive a multitude of satellite-based data, which allows them to understand the types of grass, their quality and quantity in each pasture. This allows the local dairy farmers to let their cattle graze on the best pastures, while allowing other pastures to regenerate. This leads to an efficient cycle for using the pastures where their functioning is constantly monitored. The local municipality learns about the effects that CropSupport has had on effective pasture use in the area. Other farmers are encouraged to use CropSupport during regular municipal meetings. Very soon, almost all cattle farmers in Susek are using CropSupport to organize and coordinate their grazing.
User 3	Dejan works for the Agricultural Extension Service of the Autonomous Province of Vojvodina. He often visits farmers across the country and advises them on a multitude of issues. Dejan specializes in work with smallholder farmers who own up to 1.5 hectares. These farmers' lands are small enough for them to know the very specific characteristics of their fields. They've also been farming these fields for generations. When Dejan tells them about the CropSupport application, they are hesitant. They have little need to receive any additional data about their land since they know it very well. However, during one visit to the farmers, Dejan started noticing that his farmers were beginning to complain more and more about the issue of illegal landfills forming on their lands. They complain that other farmers illegally dump waste on their fields and that it is affecting the safety of their production, as many of these waste piles include pesticide and fertilizer

	packaging. Moreover, these smallholder farmers are left with the costs of cleaning up these illegal landfills. The smallholder farmers informed the local authorities. But the local authorities are hesitant to act as the farmers cannot provide an overview of where these landfills are appearing. Each farmer calls in separately to report an illegal landfill. Authorities are unable to understand where the landfills are, nor how many there are. Hearing this, Dejan proposes to the farmers that they start taking pictures of their land and uploading them through the CropSupport application. In return, the CropSupport application will provide them with pictures of their land and with the locations of every illegal landfill. This would allow them to track their locations and provide the authorities with a single comprehensive report about the location of the landfills. The plan worked, and the farmers were happy to inform Dejan that the local waste management company sent personnel and equipment to clean up all the landfills. Unfortunately, this has not stopped other farmers from illegally disposing their waste. So Dejan and his farmers regularly upload pictures of their fields through the CropSupport application. In return, they are provided with the locations and size of illegal landfills. Once a month the farmers get together and are able to submit a comprehensive report to the authorities who are then obliged to take necessary measures. The information provided by the CropSupport application is beginning to alert the local authorities to the full breadth of the illegal landfill phenomenon. Realizing that this problem is impacting local agriculture, local authorities are encouraging other farmers to use the CropSupport application so that more and more data becomes available about the location and size of illegal landfills.

→ Current technology (mobile apps, webapps, other platforms)

The CropSupport application was successfully tested during the Phase I campaign (2017-2018), where functionalities of the application are described in detail in Deliverables D2.2 and D4.2. After completion of the Phase I activities, small modifications to the CropSupport application were made based on feedback from the Phase I participants. These modifications are described in the sections that follow.

Modifications to the CropSupport web application

The users reported that there was no possibility to edit the shape of a parcel once it is drawn. They were only able to delete it, which meant that all associated data would be deleted as well. Therefore, InoSens' technical team developed additional functionality, i.e., "Edit Layers", which allows users to edit the parcel shapes (see Figure 24).

Figure 24: New functionality "Edit Layers" was added to the CropSupport app based on user feedback

The users pointed out that the background Google map over which they delineate parcels was outdated and usually did not respond to the current crop rotation scheme. Hence, some users had not been able to precisely delineate their parcels. InoSens' technical team solved this problem by allowing users to delineate their parcels over updated NDVI maps (see Figure 25). Namely, once a user decides to create a new parcel, they can use different and updated layers (i.e., NDVI maps) to precisely delineate a new parcel.

Figure 25: New functionality to help users draw their parcels more precisely

During the Phase I Campaign, the users suggested that the Google map pinned icon, which represents the photo of the parcel, should indicate the direction from which the photo was taken. Namely, the users found it difficult to decide the exact location of the parcel (e.g., is it on the left or right side of a road). InoSens' technical team resolved this issue in accordance with the user requirements (see new functionality added as shown in Figure 26).

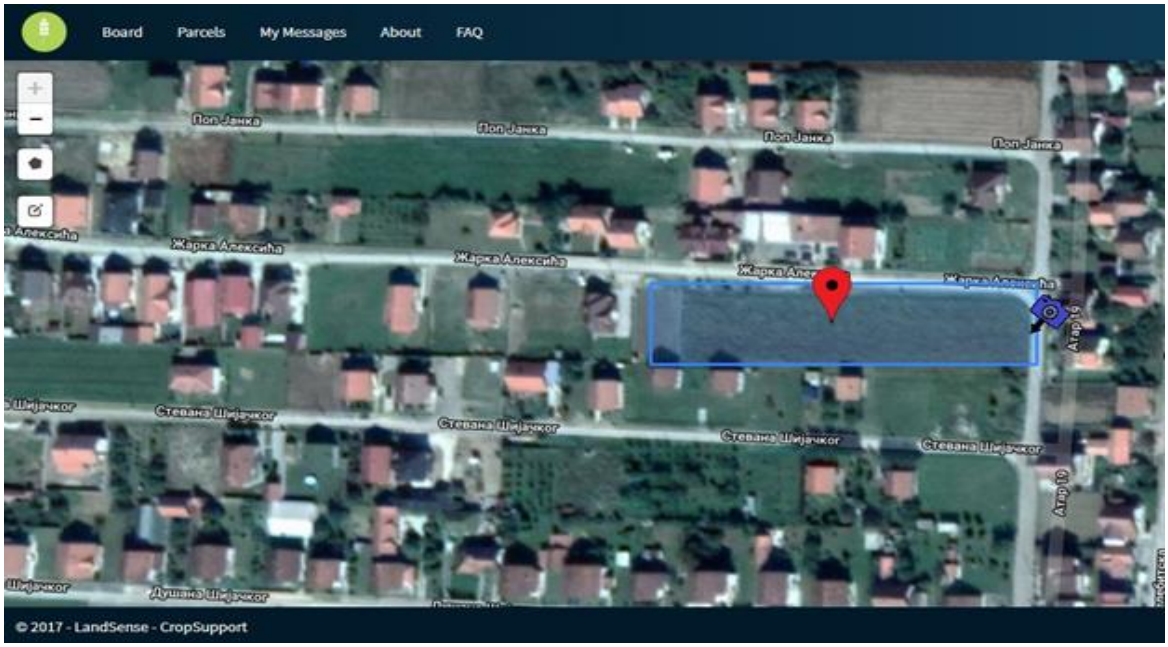

Figure 26: New functionality added to indicate the image direction based on user feedback

Modifications to the CropSupport mobile application

The users suggested adding new functionality to the CropSupport mobile application, i.e., the possibility to enter farm activities (which was only possible to do via the web application). The InoSens' technical team resolved this problem by adding new functionality to the CropSupport mobile application (see Figure 27). In addition, the users can to take a photograph and directly relate it to a certain activity.

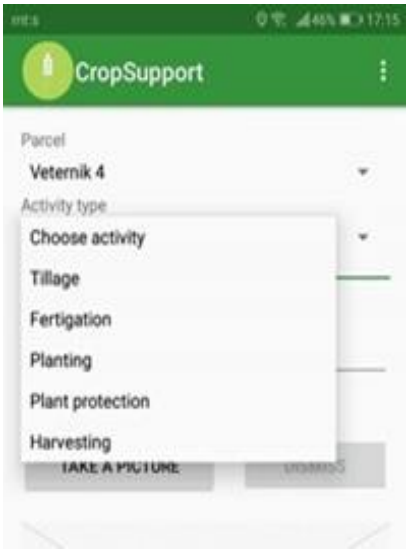

Figure 27: New functionality called "Activity" added to the CropSupport mobile application based on user feedback

Therefore, to share data about their crops and farm management information within the Phase II campaign, the farmers will use the improved CropSupport application. The application will be accessible through the LandSense Engagement Platform (LEP) and supported with new services, i.e. the CDS. Also, in-situ data streams will be shared via the LEP.

→ Data control and privacy

Table 24 lists the main data control and privacy issues related to the Serbian pilot.

Table 24: Data control & privacy for the agricultural campaign 2019, Phase II in the Serbian pilot

Data control & privacy	**How these issues are handled**
What data will you collect during the 2019 campaign?	Data that will be collected by users during the campaign are: • Parcel location (parcel borders/limits, i.e., occupying area), • Image of the parcel (date, time) • Information on the LULC of a parcel (i.e., crop type) • Farm-management activity related to a parcel (e.g., date of fertilization, irrigation, etc.)
Where are the data stored?	Data are stored in InoSens' PostgreSQL database
Who gets access to the data?	InoSens and users of the LandSense Engagement Platform
Do you have Terms and Conditions associated with joining the campaign?	Yes. All users of the CropSupport application have to agree with the Terms and Conditions before they join the campaign.

Data control & privacy	How these issues are handled
Will you collect personal data?	Personal data collected from the users: • First name, Last name • Email address (integrated via the LandSense Federation) Note: InoSens has adopted the principle that the "user must be under control", meaning that the user must approve the release of their personal data to the CropSupport application.
Are there any significant changes for the 2019 data collection campaign?	No

→ Quality Assurance

The quality assurance and quality control concerns linked to the VGI within this demonstration pilot are related to the quality of the data shared by the farmers while using both smartphones and web applications (e.g., data entry accuracy; adequate spatial position of a farmer while taking a photograph; use of smartphone with minimal technical requirements; frequency of data entry).

There is an initial assumption that the data provided by the farmer is truthful so as to establish a collaboration and synergistic working relationship between the LandSense team and the farmers. The Cropsupport application is intended to exchange truthful data, leverage mutual benefits, and establish trust between the parties involved. However, unintentional entry of wrong data is possible due to farmer IT illiteracy, pure technical performance of the mobile devices, etc. As such, a system of data quality control and checks should help prevent such scenarios.

The types of quality assurance that had been implemented as part of the Phase I campaign were described in detail in deliverable D2.2. For the Phase II campaign, the determination of when the quality assurance process should be implemented (i.e., real-time/near-real time/post-campaign) and lessons learned during 2018 campaign are presented in Table 25.

Table 25: Quality assurance process*es for the* Serbia*n pilot*

Quality assurance process	When will the process be implemented, i.e. real-time/near- real time/post-campaign	Any lessons learnt during the testing in 2018?
Processes related to positioning/GPS	Real-time	N/A
GPS on/off on a user smartphone (a photo contains all the metadata only when the GPS option is switched on)	Real-time	N/A

Quality assurance process	When will the process be implemented, i.e. real-time/near- real time/post-campaign	Any lessons learnt during the testing in 2018?
Measures of user reliability (parcel borders, crop info)	Near real-time or post-campaign	Background Google map over which parcels are delineated was outdated. Problem was solved by InoSens' technical team (see Figure 25).
Synchronization/Upload of photos taken by farmers to the server and the web application	Real-time/near real-time	N/A
Does a photo match the crop field drawn in the web application?	Real-time and post-campaign	N/A
Correctly drawn polygon (crop field)	Post-campaign	N/A
Right description of the crop type and crop phenological information	Post-campaign	N/A

→ Business opportunities

There are two potential business opportunities identified from this pilot. The first one is the commercialization of the tested and validated services, targeting farmers and governments (paying/monitoring authorities for agricultural subsidies). Secondly, the commercialization of the acquired in-situ data is a potential business opportunity, targeting all EO data seekers (e.g., researchers, SMEs, etc.). Activities from CropSupport intend to create value for several groups including famers, government agencies, EO-data seekers and other actors along the value chain (i.e., agronomists and agri-tech companies). CropSupport can also directly help to solve key questions for stakeholders, such as how to best optimize the use of fertilizers and other inputs, and how to improve crop classification transparency.

Additionally, the LEP represents a hub that gathers a vast number of relevant stakeholders involved in EO and in-situ data collection. As such, the platform will serve as a direct channel for reaching customers interested in the exploitation of CropSupport services. Also, the platform will enable customers to use the CropSupport application, either as a single solution or in combination with other LandSense services.

4 Theme “Forest and Habitat Monitoring”

4.1.1 Spain

→ Story line

Figure 28 captures the storyline of the Spanish pilot as a word cloud.

Figure 28: Tasks in the Spanish pilot captured as a word cloud

→ Target groups

Figure 29 captures the target groups for the Spanish pilot as a word cloud.

Figure 29: Target groups in the Spanish pilot captured in a word cloud

→ Engagement Strategies

How do you plan to create awareness of the campaign in 2019?

SEO/BirdLife is leading the engagement, in partnership with the European Solidarity Corps (ESC), and a Life project called 'Followers'. The main goal of this project is to increase awareness of the Natura 2000 Network and raise awareness of conservation through involvement of a minimum of 300 young volunteers from the ESC. The activity of the participants involved in the different actions of the project will be broadcast globally to let everyone know about the project itself and the results obtained.

'Followers' will allow opportunities to work together with scientists, professionals from the Spanish Ornithological Society, the oldest conservation association in Spain, and other volunteers from all over Europe, which will help expand their cultural and social skills. They will be able to acquire new skills that will be useful for future employment. These volunteers will be involved in several campaigns related to IBAs, which have played an important role in the designation of the Natura 2000 sites in Spain.

In 2019, we will use the BirdLife and LandSense regular communication channels (website, newsletter, social media, etc.) to present the case for the 3 planned campaigns:

- **Campaign 1 (Data collection):** "Conservation Status of the Spanish IBAs"
- **Campaign 2 (Communication):** "The Most Threatened IBAs"
- **Campaign 3 (Communication):** "What's threatening your local IBAs?"

How do you plan to get volunteers/users on board?

In 2019, SEO/BirdLife will organize a range of activities to promote LandSense and recruit volunteers:

- a **LandSense article** in the SEO/BirdLife magazine: https:/www.seo.org/landsense/
- a **LandSense Presentation** at the Spanish National Ornithological Congress organized by SEO/BirdLife
- **Life Followers**: https://followers.seo.org/en/.

How do you plan to sustain engagement of the users?

SEO will produce yearly reports of monitoring and census results and will distribute them to bird monitoring surveyors and IBA caretakers. We need to find innovative ways of encouraging volunteers to keep the data coming in. SEO's network of volunteers is vast and funds are very limited to bring them all in for training and best-practice sharing. Given the funding constraints, we plan to organize several webinars to explain how the mobile app works and how people can contribute. Ranking volunteer contributions, and raising volunteer profiles based on their contributions are options to explore, as well as showcasing their work in BLI's magazines.

How do you plan to give feedback to the users?

There are a number of ways in which feedback will be provided to the users including:

- The mobile app will inform users about the state of their observations, and threats happening in their area that have been reported by other users, etc. The app will also inform them when they enter a Natura 2000 site or an IBA.

- The results from the Bird Monitoring Programs and IBA reports are sent yearly to volunteers by email and are in the SEO/BirdLife bulletin.
- BirdLife Datazone section for LandSense: http://datazone.birdlife.org/info/citizenscience/landsense
- World Bird & Biodiversity Database
- Articles in the BirdLife Magazine
- Articles in SEO/BirdLife's own magazine "Aves y Naturaleza".

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Which partner will lead the engagement for the campaign?

SEO/BirdLife will lead activities in Spain. BirdLife Europe will coordinate data flows and communication.

→ Timeline

What is the launch date of the campaigns?

The launch date for the campaign in 2019 will be April if the mobile app and the web app are finalized. We will link the data collection to the ongoing bird counts organized by SEO every year. The idea is that birdwatchers already using SEO/BirdLife apps (https://www.seguimientodeaves.org/) will also download the Natura Alert app and use it to monitor threats to biodiversity and habitats during their field trips. Events include:

- National Breeding Bird Survey (SACRE): we will use this important event to test the LandSense app. Bird survey campaigns run for different periods of time, but usually last, on average, for 3 months. This campaign will run from April 19 to June 19.
- Winter Bird Counts (SACIN): from November to February next year
- Noctua: nocturnal bird counts
- Birds and Climate
- Spring Atlas, Winter Atlas
- Migra: bird migration counts
- Waterbirds.

During 2019, the 12 Spanish IBAs in Danger will be presented to the media, which could be a good opportunity to showcase the LandSense app. The Global IBAs in Danger Initiative is described here: http://datazone.birdlife.org/site/ibasindanger

How long do you plan to run the campaign for in 2019?

The campaign in 2019 will run from April to December. The Key Performance Indicators for the Spanish pilot are listed in Table 26.

Table 26: Key Performance Indicators for the Spanish pilot

KPI	Target for the 2017 and 2018 campaign	Was the target achieved? Provide an explanation	Target for the 2019 campaign
Number of IBAs revised	At least 10 wetland habitats updated in 2018	No, the mobile app was not available	469

KPI	Target for the 2017 and 2018 campaign	Was the target achieved? Provide an explanation	Target for the 2019 campaign
Number of IBAiD updated in 2018	At least 3 IBAiD updated	No, the mobile app was not available	3
Number of IBA habitat threats updated in 2018	Habitat data for at least 20 IBAs are updated	No, the mobile app was not available	20
Number of alerts validated in Spain	At least 4 alerts addressed (challenge to quantify target without seeing how often alerts are launched in Spain)	No, the CDS was not available	4

Provide a brief timeline for campaigns that will run post-2019

In 2019, there will be 2 campaigns focused on communication and 1 on data collection:

- Jan-Dec, Campaign 1 (Data collection): Conservation Status of the Spanish IBAs
- Nov-Dec, Campaign 2 (Communication): The Most threatened IBAs
- Nov-Dec, Campaign 3 (Communication): What's threatening your local IBAs?

Based on lessons learned in the 2018 campaigns, the BirdLife team will be able to improve on the results.

→ User profiles

Typical user profiles for the Spanish pilot are listed in Table 27.

Table 27: User profiles for the Spanish pilot

User profile 2017 and 2018 (see D.2.2)	User profile 2019
User 1: Antonio is a 45-year-old IBA Caretaker Antonio is a keen birdwatcher and has been volunteering for SEO/BirdLife during the past 9 years. He requested to become an IBA caretaker because he lives close to this wetland IBA and enjoys visiting it almost every month and counting birds. He knows the site by heart, so it is easy for him to detect changes. Last June, he read an article about LandSense on SEO's bulletin and decided to participate in the online survey to share his opinion about the use of mobile apps and remote sensing to monitor changes in the habitats. He doesn't fully understand the process and he likes writing his observations in a notebook, but he became curious about the power of citizen science. When SEO launched the campaign "Join the Army of Caretakers!" Antonio felt proud to be one of them and was encouraged to share his knowledge with others. He downloaded the mobile app and realized how easy to it is to use, and is glad that his observations will be ready to use when he completes the annual IBA report on threats and habitat conditions, which he will send to SEO/BirdLife.	Same

User 2: Cristina is a 28-year-old naturalist Cristina joined the SEO/BirdLife volunteer network two years ago to participate in the annual Bird Monitoring Counts. She is in charge of some plots close to her grandmother's village, within one hour's drive from Madrid. She signed up for the LandSense Newsletter after reading a tweet from SEO talking about one of the meetings, since she likes learning about technology and use of remote sensing applied to nature conservation. A couple of days before the official launch of the Breeding Bird Survey Campaign, she received an email from the Coordinator explaining how to download the LandSense mobile app and how to collect the information. She already uses 3 apps for the bird counts, but none of them allow her to report threats or changes in the habitat! She downloaded it and sent a message to the Volunteer Whatsapp group suggesting people to use it to later compare the number of threats in each site. They find it easy to use and they love the ranking table, but they would like to suggest some changes to the list of threats, so they contacted SEO, who implements the changes via the IIASA app developer.	Same
User 3: Andrea is a 35-year-old outdoor enthusiast Andrea lives very close to Sierra Nevada National Park and she has a very active life. She goes running 3 times during the week, and during the weekend she likes hiking, climbing and dedicating some time to nature photography. She is concerned about the lack of rain this year and how it is affecting one of her favourite spots, a wetland. Some days ago, she heard about the Wetlands Day, so she decided to participate in the event to learn a bit more about the topic. She met volunteers and staff from SEO/BirdLife who showed her the new mobile app that will make a difference in threat reporting in Spain. She realized she can contribute a lot of information to try to stop the degradation of the areas she usually visits. She shared info about the event on Facebook and Twitter and decided to become a member of SEO/BirdLife to support their work.	Same

→ Current technology

a. Mobile app: Natura Alert

Although the official launch of the app was planned for spring 2018, the development took longer than expected. Taking into account the feedback provided by the BirdLife community and external testers, we decided to go a step further in order to improve the user experience in both iOS and Android versions.

A new eye-catching logo was designed and the app now includes some dynamic welcome screens to guide users through the different functionalities of the app (Figure 30). The app design significantly improved once harmonized colours were added and the screens were tailored for mobile screen sizes. The automatic Microsoft translations were revised and improved by native speakers. Natura Alert is now available in English, French, Spanish and Indonesian, but the intention is to translate it to many other European languages in the future. Figure 31 shows the registration screen, the Terms and Conditions (which users must agree to) and a screen from the questions asked of the users.

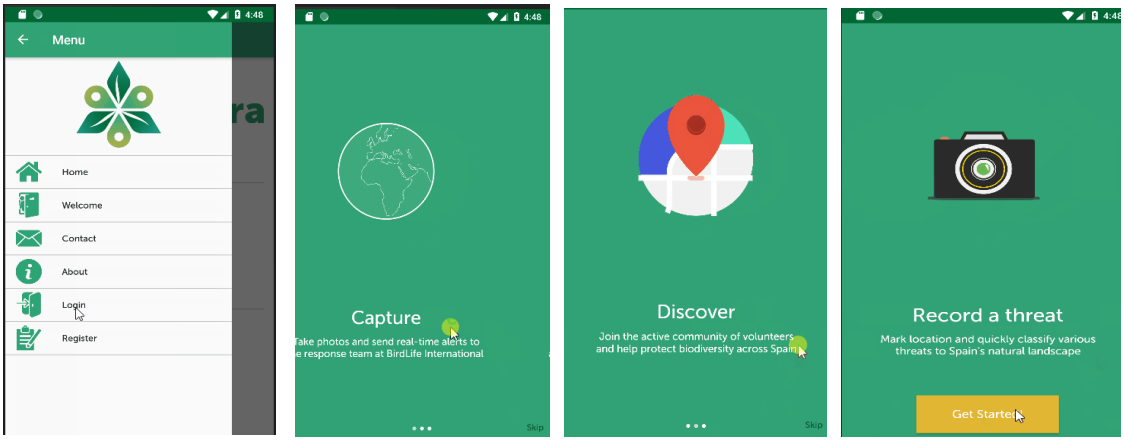

Figure 30: Screenshots from the Natura Alert including the new welcome screens

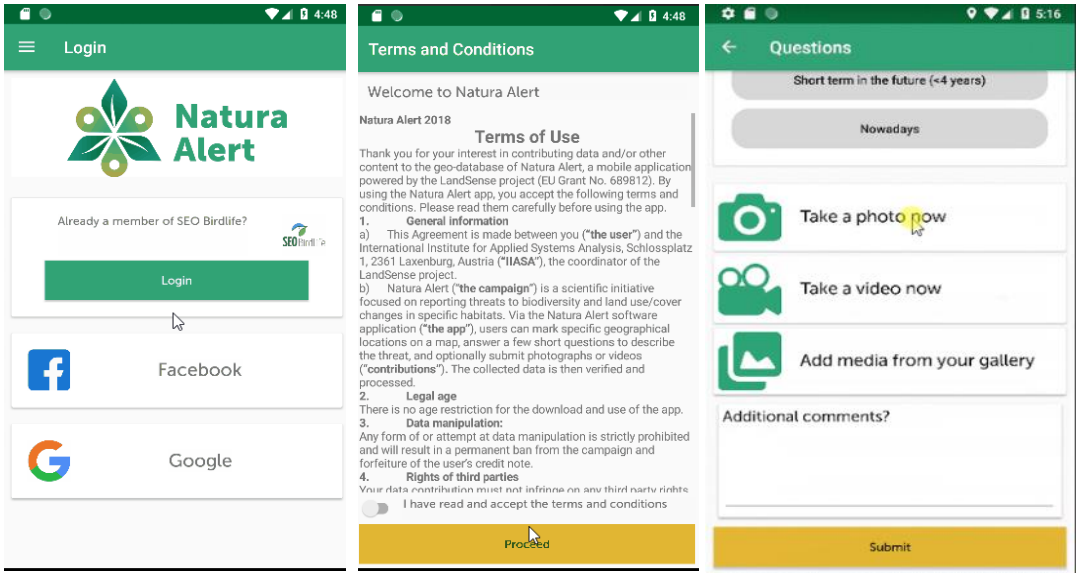

Figure 31: Screenshots from the Natura Alert app including the registration, the Terms and Conditions and questions in the app

Moreover, some of the **functionalities** were re-designed and improved as outlined below:

- **Record:** A user marks the location of the threat and reports it by choosing one option from a set of buttons or dropdown menus (**threats, severity, scope and timing**) (Figure 32). The different questions are based on the internationally agreed **IBA monitoring form**, which is used worldwide by BirdLife partners to monitor the state of IBAs and Natura 2000 sites. Numerous improvements have been implemented as follows:
    - The **set of questions** is different depending on your location: there are extra questions if the user is reporting threats from within an IBA or Natura 2000 site.
    - Users can **take a picture** or upload a picture using a pin to mark the location of the threat, but in addition, they can now also upload **videos**.
    - In the previous version, the mobile app would only send a "Thank you" message to inform users that the submission was successful. The feedback has now been improved by providing a **score for the reported threat.**
    - A new screen was developed to allow users to **view all their reported observations** and upload them or delete them. This functionality will allow users to **work offline**,

since they will be able to store observations when the internet is not available and upload them later.

- Users are now able to see **observations reported in other sites in the world**.
- The data collected will be shown on the map and in the **Natura Alert web app**, to allow users to access the information and compare observations. However, the contributor's name will not be made public. This information will be essential for SEO/BirdLife to identify threatened areas that may need **local action**. If a significant number of threats are reported within IBA boundaries, the data will help the IBA caretaker and IBA national coordinator to produce the most up-to-date IBA monitoring report and support any policy and advocacy actions needed.

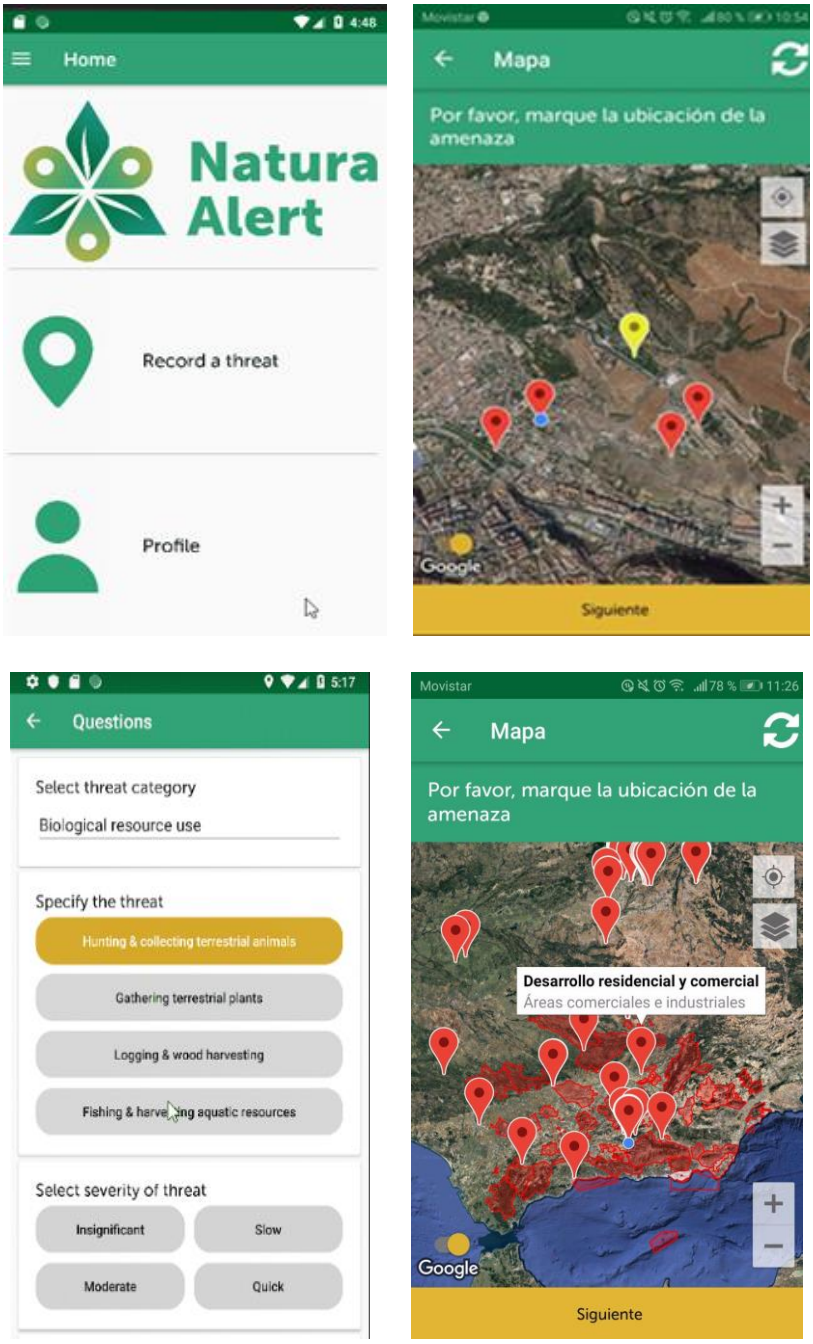

Figure 32: Screenshots from the Natura Alert app to report a threat

- **Protected Areas/IBAs/Natura 2000 sites**: this functionality was simplified and integrated within the map under the Record a threat screen. Now the user is able to add layers to the base map, i.e., the IBA polygons, the Natura 2000 polygons and the satellite view (Figure 33). Users can click on the polygons and the name of the IBA or Natura 2000 site is displayed. In order to reduce the size of the app, it was decided to show users only polygons that are within a 200km radius. We will also allow users from around the world to download the IBA/Natura 2000 data set from their country to work offline and reduce the app size.

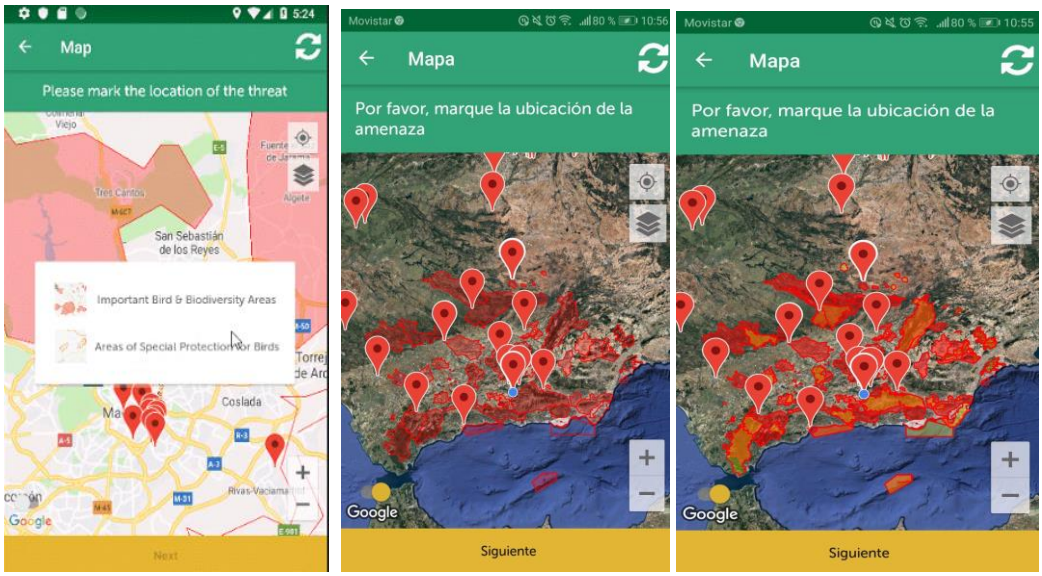

Figure 33: Screenshots from the Natura Alert app showing the IBAs and Natura 2000 sites

- **Profile**: a new screen was developed to allow users to visualize all their reported observations and upload them or delete them (Figure 34). This functionality will allow users to **work offline**, since they will be able to store observations when the internet is not available and upload them later when they are connected. Users are also provided with feedback on the total number of reports provided by the Natura Alert community in Spain.

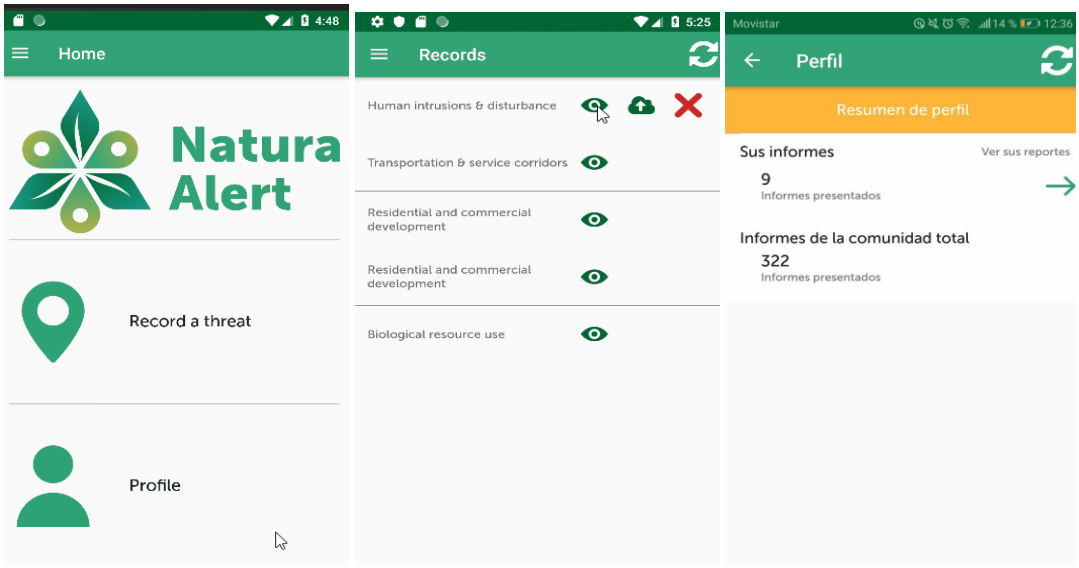

Figure 34: Screenshots from the Natura Alert app showing the 'Profile' features

- **Alerts from the CDS in Spain:** different options were discussed to test the CDS:

    - agricultural changes
    - energy production activities (mining and quarrying, oil and gas drilling
    - renewable energy infrastructure within protected areas or IBAs)
    - discrimination of espalier vineyards from other vineyards to study how the populations of threatened species are being affected within Natura 2000 sites
    - discriminate residential and commercial developments in coastal zones
    - detect changes or dynamics within wetlands
    - etc.

  The conversion of dry crops or pastures into irrigation crops was identified as one of the most relevant LULC changes at present in Spain. This is a very hot topic in the Spanish conservation scene, since the conversion is rapidly affecting the steppe bird populations in different Natura 2000 areas. These birds are classified in Annex I of the Birds Directive as in decline, threatened or impoverished according to the latest reports from EIONET. These species include the little bustard (*Tetrax tetrax*), Dupont's lark (*Chersophilus duponti*), the common sandgrouse (*Pterocles alchata*), the black-bellied sandgrouse (*Pterocles orientalis*) or the stone curlew (*Burhinus oedicnemus*). Other Annex I species that are stable but whose breeding areas are in decline would also benefit, such as the great bustard (*Otis tarda*) or the crane (*Grus grus*). A number of NGOs (SEO/BirdLife among them) and research institutions have joined forces to create awareness of this issue by creating the Platform for the Conservation of Steppe Birds and their Habitats. In this framework, LandSense could be the perfect platform to test the changes using Sentinel-2 imagery and then provide latitude/longitude coordinates where users will validate changes close to their location. However, a number of technical challenges were found so it has been decided not to include this functionality in the app at this stage.

  There are two potential case study sites for the CDS:

    a) IBA 211 Puebla De Don Fadrique - Las Cañadas (Figure 35)
    b) IBA 276 Llanos de Olivenza-La Albuera, Badajoz y Villalba de los Barros (Figure 36)

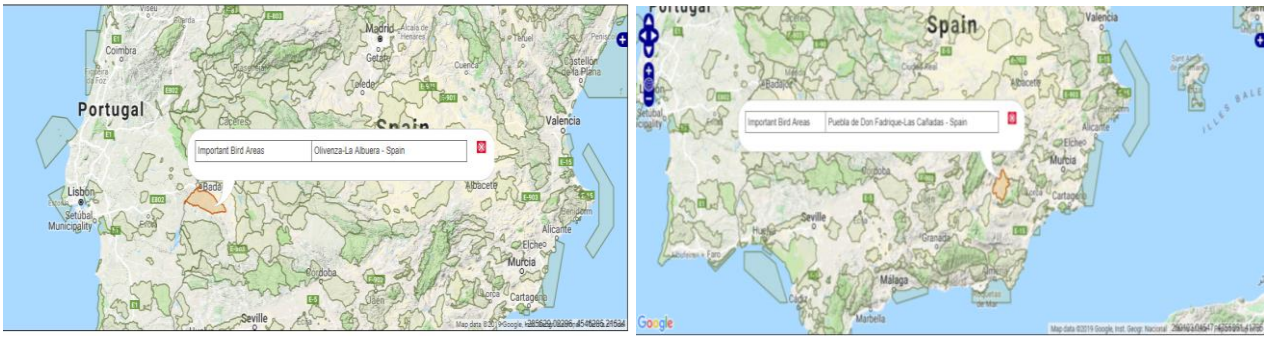

Figure 35: Location of IBA 211: Puebla De Don Fadrique - Las Cañadas as a potential case study site for the change detection service (CDS)

Figure 36: Polygons showing new irrigation crops in the IBA 276 Llanos y Complejo Lagunar de la Albuera

Results of the change detection analysis

The time series behavior from a variety of indices that are sensitive to moisture and vegetation have been investigated. However, distinctive patterns could not be found in these indices within the field parcels. Discussions on the CDS are ongoing.

b. Natura Alert Web-based app

Although the web-based app was planned to be launched in the summer 2018, the development is still ongoing. The first version of the web app (Figure 37) will be launched in April 2019 to match the start of the monitoring programs of SEO/BirdLife. The web app has been designed with three main types of users as outlined in Table 28. The aim of the Natura Alert web app is to become the backbone of **IBA/Natura2000 site monitoring in Spain**, as it will collect and analyze threat information data provided by the citizens. This tool will facilitate vital knowledge sharing between the volunteer network and BirdLife staff. There is a potential to **scale up by creating a long-term sustainable tool useful for other European BirdLife Partners**.

In a nutshell, this web-based app will not only make a real difference in the information flow from volunteers to BirdLife Partners by reducing the amount of time they invest in feeding the databases, but also by **facilitating the communication and feedback among them.**

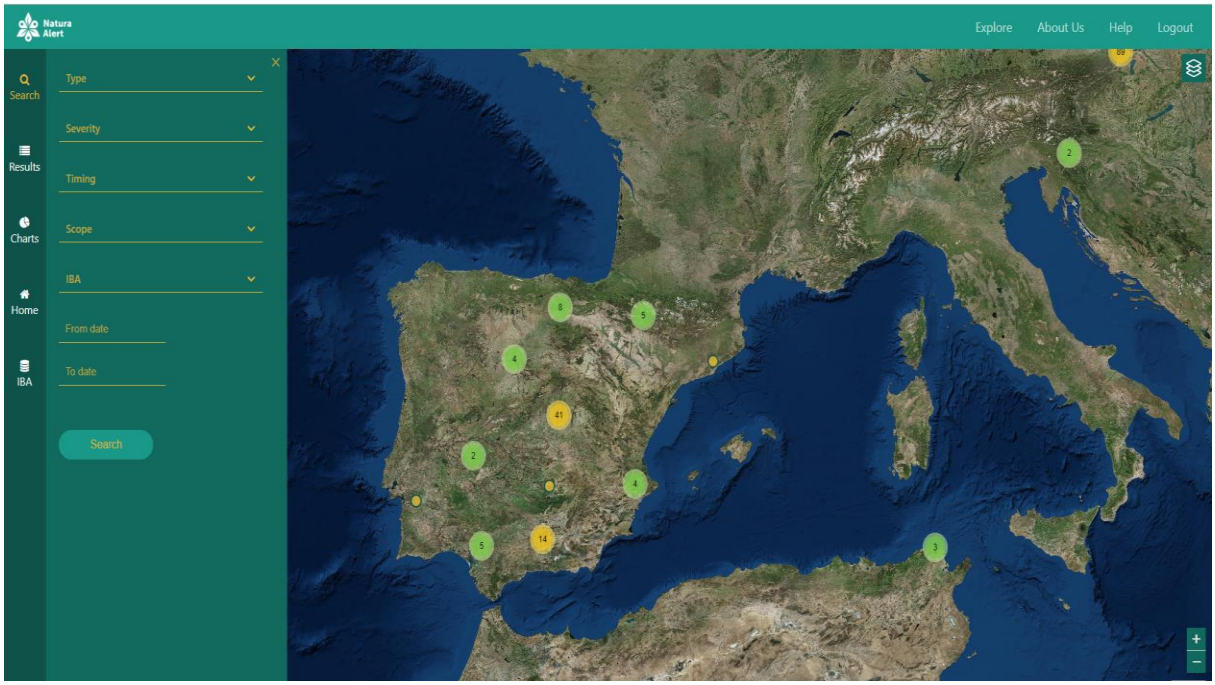

Figure 37: Screenshot from the Beta version of the Natura Alert web app developed by Sinergise

Table 28: Types of users of the Natura Alert web app

Non-registered User	**Visitors** to the Natura Alert web app
Registered Users	**Registered User Type 1: Existing monitoring volunteer** (with an account in the SEO database) or register via the mobile or web app (SEO, Google or Facebook)
	Registered User Type 2: IBA caretaker (SEO database)
	Registered User Type 3: IBA National Coordinator

In order to improve the user experience and the feedback provided to the volunteers, dashboards will be available to the users. According to the consultations we run, most users would like to check their data and visualize the results (see, e.g., the types of visualization tools shown in Figure 38). Users can also visualize the data associated with individual observations as shown in Figure 39.

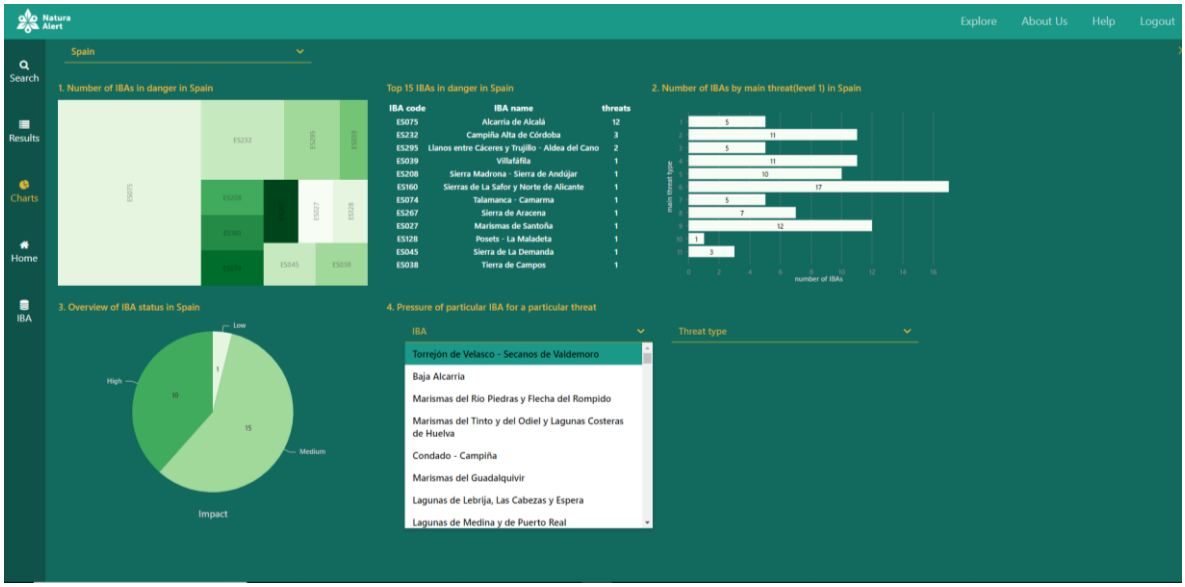

Figure 38: Visualization tools from the beta version of the Natura Alert web app developed by Sinergise

SEO/BirdLife highlighted the importance of having a specific section for IBA caretakers to revise the reported observations within the IBAs that they are in charge of. IBA caretakers will be able to produce an IBA annual assessment based on the observations from the mobile/web app and their own visits to the site. The IBA monitoring form will be used as the basis for this assessment report.

Once validated by the National IBA coordinator (SEO/BirdLife staff), the information will be fed into the global BirdLife database (WBDB).

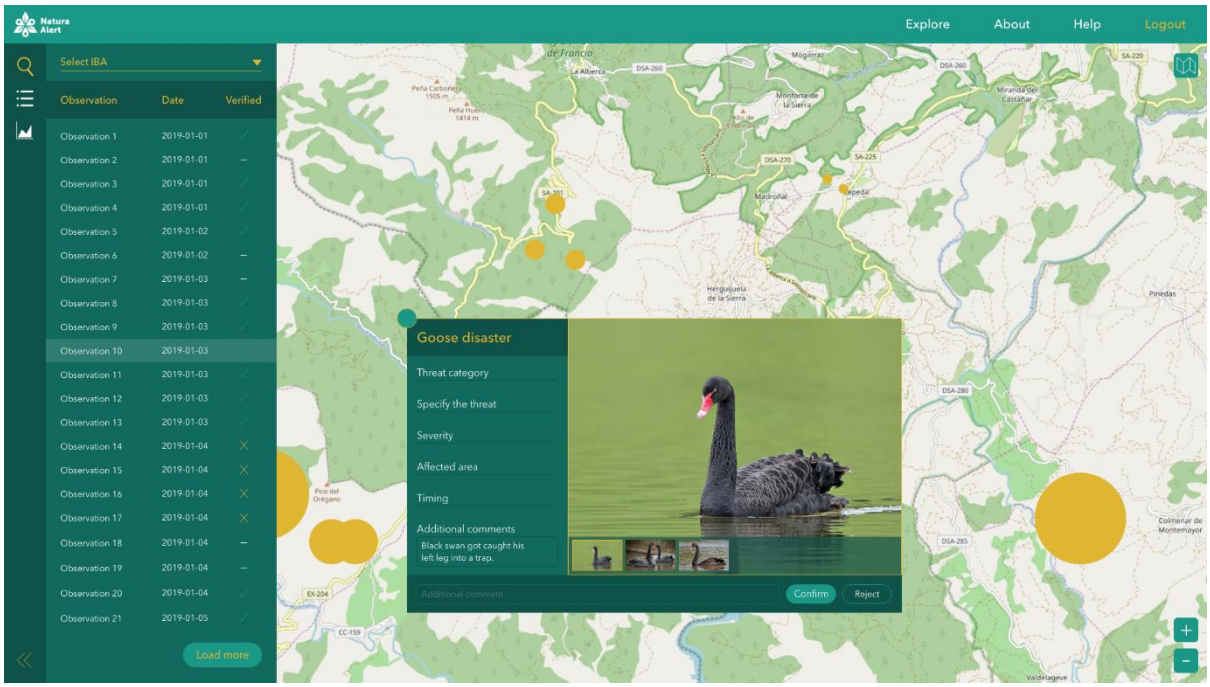

Figure 39: Screenshot from the Beta version of the Natura Alert web app developed by Sinergise showing one of the observations

→ Data control and privacy

Table 29 lists the data control and privacy issues in the Spanish pilot and how these are handled.

Table 29: Data control & privacy in the Spanish pilot

Data control and privacy	How these issues are handled
What data did you collect during the 2018 campaign?	Although the campaign was not officially launched due to the delays in the mobile app and web app development, numerous testers collected threat observations in different countries: Spain, Indonesia, Georgia, Portugal, UK. The data sources we used were: • IBA boundaries (available) • Natura 2000 sites boundaries (available) • SEO/BirdLife volunteer database (available) • Sentinel 2 imagery (available) • Metadata from smartphones (i.e., latitude, longitude, azimuth, etc.) The data that are collected through the mobile app consist of threat observations, pictures of the site and/or the threat. Some personal data will be needed for the user registration (i.e., name, surname and email).
Where are the data stored?	The data are stored in a Postgres database maintained by IIASA. The physical location of the database is Germany. The servers are from the Cloud Hosting company called Hetzner. The only way to store and retrieve the data is through the API: https://naturaalert-api.dev.geo-wiki.org/docs/index.html. The Natura Alert mobile app stores the data locally and uploads the data to the API. The web app uploads and retrieves the data from the API.
Who gets access to the data?	• Visitors to the Natura Alert web app • Registered User Type 1: Existing monitoring volunteer (with an account in the SEO database) or registered via the mobile or web app (SEO, Google or Facebook) • Registered User Type 2: IBA caretaker (SEO database) • Registered User Type 3: IBA National Coordinator
Do you have Terms and Conditions associated with joining the campaign?	Yes, these are available in the mobile app. SEO/BirdLife volunteers will be automatically logged into the app by simply using their SEO username via the LandSense Federation system. Their observations will be filtered by their SEO profile (IBA caretaker or volunteer of the monitoring programs).
Do you collect personal data?	Users that are not registered within the SEO user database will have to register and provide their name, surname and email. Additionally, the LandSense team is aware and compliant with GDPR.

→ Quality assurance

Table 30 lists the quality assurance processes that are being used in the Spanish pilot.

Table 30: Quality assurance processes in the Spanish pilot

Quality assurance process	When will the process be implemented	Any lessons learnt during the testing in 2018?
Users have the ability to select remote sensing triggered alerts and validate these as true threats. A process is needed to assess the quality of these validations, which need to include: • Proximity to the alert with the hypothesis that the nearer a user is to the alert location, the more likely the resulting threat report will be valid • Some level of trust in the users themselves based on previous valid threats identified • Possible interpretation of the user provided photo/s.	Post-campaign	The alerts were not provided because of technical limitations
The location of the user is either derived from their current location (assuming a connected GPS input) or a selected point on a map. In the former, there needs to be some assurance on the quality of the GPS input and the latter needs some assurance on location accuracy, which could either be user provided (e.g., 'My accuracy is 500m') or be derived from the map scale of input (e.g., selecting a point from a map of the world will have a large potential positional error).	Real-time	Same
Habitat classification has the following quality assurance processes: • A set of rules that would flag some obvious errors such as selecting a marine habitat classification in the middle of a terrestrial area • Some level of assurance could be given based on previous habitat reports by other users in the same or similar locations • Some level of trust relating to the users themselves based on previous valid habitats identified • Possible interpretation of the user provided photographs • Possible comparison with land cover mapping to identify errors although the issue here is a mismatch with the habitat classification used by BirdLife (sourced from IUCN).	Post-campaign although real-time advisory warnings could be given	The new set of questions in the app targets threats to habitats and biodiversity instead of habitat classification
Review by the crowd: Some aspects of a user-provided report could be reviewed by other users including the habitat classification but this is less useful when looking at threats that can be highly temporally variable (e.g., a completely valid report of logging in 2016 should not be downgraded simply because the threat is not evident to a different user in 2017).	Real-time	The threats reported by users will be additionally reviewed by the IBA caretakers in the new web app

Quality assurance process	When will the process be implemented	Any lessons learnt during the testing in 2018?
Threat classification has the following quality assurance: • A set of rules that would flag some obvious errors such as selecting a logging threat classification in the middle of the sea • Some level of assurance could be given based on previous threat reports by other users in the same or similar locations. However, there would need to be a temporal window assigned to this assurance as threats are much more temporarily variable than habitats • Some level of trust relating to the user themselves based on previous valid threats identified • Possible interpretation of the user provided photo(s) • Possible comparison with land cover mapping to identify errors although the issue is a mismatch with the habitat classification used by BirdLife (sourced from IUCN).	Post-campaign	

→ Sustainability measures

Which associations/user groups would you like to meet at the LandSense Service Incubator event?

- Spanish SMEs interested in nature conservation to become sponsors of SEO/BirdLife (outdoor clothing, photography/optics companies, and travel agencies) and who could support LandSense campaigns
- Spanish companies committed to improving their environmental performance and impacts on nature (power suppliers such as Iberdrola, mining companies such as Cemex, etc.)
- Start-ups or tech companies, students, and other individuals interested in nature conservation and EO industry to develop new ideas for monitoring changes in habitats
- Representatives of regional authorities to establish collaboration with SEO and find solutions for the effective monitoring of the Natura 2000 network in Spain
- Land management entities from municipalities
- Market research firms with an environmental focus.

→ Upscaling opportunities

The BirdLife coordination team is promoting the Natura Alert mobile app and web app among their European and Central Asian BirdLife partners as tools to improve their data collection processes and foster volunteer engagement. So far, Portugal, Greece and Georgia are testing the app and are providing valuable feedback; see https://landsense.eu/News/44

→ Business opportunities

What are potential business opportunities that could result from your pilot?

A contract was signed between the National government and SEO/BirdLife to provide them with up-to-date information for the next reporting period under Art 12 and Art 17. LandSense-derived data (i.e., habitat monitoring, threats to biodiversity, etc.) would be very valuable as inputs to this. The commercialization of validated data, targeting regional governments, would be another potential business opportunity.

For whom do you plan to create value and who are the most important customers?

The most important customers/stakeholders are:

- the BirdLife volunteer network
- the National government
- Regional authorities, and
- Local authorities.

Which one of your customer's problems are you helping to solve?

BirdLife volunteer network

Right now there is no tool available in Spain to report threats to biodiversity in a structured way. LandSense tools will enable citizens to provide information for local authorities or request a call for action in urgent cases.

National government

Member States are required to report on the progress made with the implementation of the Birds Directive under Article 12. The reporting is focused on data related to the status of bird populations, thereby streamlining the reporting with the reporting under Article 17 of the Habitats Directive. The Article 12 report contains information on the status and trends of bird populations together with information on the main pressures and threats. The report further contains information related to the impact of the Natura 2000 network and conservation measures. Therefore, the results derived from LandSense should feed the reports provided by the National government to the EC.

Regional authorities

The effective management of national parks and Natura 2000 sites requires a significant amount of data not always available because of limited resources or time constraints. LandSense could provide information about threats and LULC changes to Regional authorities to support the decision-making process.

Local authorities

There is a need for better and timely information about threats that should be acted upon. LandSense tools will help local authorities make better informed decisions. The contextualized presentation of the data provided by citizens will be the main hook to our customer segments. A European platform that offers reliable and up-to-date information related to habitat and threat monitoring should be of great interest, if well promoted.

4.1.2 Indonesia

→ Story line

Figure 40 captures the storyline of the Indonesian pilot as a word cloud.

Figure 40: Storyline for the Indonesia pilot captured as a word cloud

→ Target group

Figure 41 captures the target groups for the Indonesian pilot as a word cloud.

Figure 41: Target groups for the Indonesia pilot captured as a word cloud

→ Engagement Strategies

How do you plan to create awareness of the campaign in 2019

At the national level, Burung Indonesia has a membership network of 90 members that are located in Flores, Java, and the Sulawesi Islands. We connect with them mostly using newsletters and social media. These communication channels will be used to present cases of community-based forest and habitat monitoring in West Manggarai, Flores Island.

At the local level, awareness will be built through Focus Group Discussions with the West Manggarai Regional Planning and Development Agency; West Manggarai Community Empowerment Agency; West Manggarai Forest Management Unit; West Manggarai Agriculture, Horticulture and Plantation Agency; West Manggarai Environmental Agency; Village Authorities; and Local Conservation Groups (LCGs). The findings from the monitoring must be addressed and resolved immediately. Thus, the commitment of these agencies in responding to the monitoring results needs to be mainstreamed into their working plans. Figure 42 shows photographs of discussions had with the local village authorities.

Another strategy is to include monitoring activities in special events at the district level, such as the celebration of Indonesian National Independence Day. Pro-environment activities during that special occasion is actually a common thing as the community used to do the “village cleaning” on that day. This year, we will try to mainstream the community-based monitoring into National Independence Day events and make good memories for the community members on that special day.

Figure 42: Discussion with Liang Ndara village authorities regarding their support to community monitoring and LCG members at Golo Damu village discussing monitoring results

How do you plan to get volunteers/users onboard?

Burung Indonesia will participate in the West Manggarai Village Innovation Exchange in June 2019. The Village Innovation Exchange is a forum for the dissemination and exchange of community initiatives or innovations developed at the district level. This event is an integral part of the district innovation management. The purpose of the event is to bridge the needs of the village government in finding solutions to problems as well as suggesting initiatives for village development activities in the context of more effective and innovative use of the village funds.

According to Law Number 6 of 2014 on Villages, 70% percent of the village fund shall be allocated to community empowerment and environmental purposes. Therefore, the citizen science applied in the

forest and habitat monitoring program will facilitate the village government in complying with the Indonesian Law on Villages for its budget management.

Through this exchange forum, Burung Indonesia will invite other village authorities and local communities in West Manggarai to join the effort in forest and habitat monitoring and replicate the commitment in four pilot villages. Burung Indonesia will invite representatives of LCGs from LandSense to the 4 pilot villages to showcase their work as well as the leaders of those villages to share information about how this monitoring program feeds into the Village Development Plan.

How do you plan to sustain engagement of the users?

The following actions will be implemented to sustain user engagement:

- A meeting with village authorities from targeted villages to share lessons learnt and to explain the benefits of incorporating the monitoring program in the Village Development Plan
- The involvement of the village leaders and village officers in monitoring activities will add enthusiasm to the Local Conservation Groups (LCGs) in conducting monitoring
- In September 2019, a workshop on lessons learnt in the monitoring program will be organised for Local Conservation Groups in 4 targeted villages. We will be gathering feedback on how helpful the app is, hurdles that they face in the field, and the use of the web app
- Providing an opportunity for targeted villages in presenting their monitoring efforts at the district level through the West Manggarai Village Innovation Exchange 2019
- Given the funding constraint for the monitoring activity, we will accommodate this challenge by facilitating agreement with village authorities to fund the monitoring using existing village funds.

How do you plan to give feedback to the users?

- The Natura Alert mobile app will inform users about the state of their observations, threats happening in their area that have been reported by other users, etc. The app will also inform them when they enter a KBA/IBA/protected area.
- Burung Indonesia will produce yearly reports with the data gathered by the locals and distribute paper copies in the villages. Results will be also shared on Burung Indonesia's website and social media.
- The program activities will be shared on the website of the West Manggarai Government: https://manggaraibaratkab.go.id
- Data will be fed into World Bird & Biodiversity Database (WBDB)
- Articles in Burung Indonesia's newsletters for members
- BirdLife Datazone section for LandSense: http://datazone.birdlife.org/info/citizenscience/landsense

Which partner will lead the engagement for the campaign?

Burung Indonesia will facilitate the Training of Trainers for Local Conservation Groups and village authorities to conduct the monitoring, perform data analysis, and communicate the results to relevant agencies. Local Conservation Groups and village authorities in targeted villages are our partners in leading the campaign. BirdLife International will lead the coordination process as well as the data flow and communication above the project level.

→ Timeline

What is the launch date of the campaigns?

Table 31 outlines Burung Indonesia's plans for 2019.

Table 31: Timeline for the Indonesian pilot

Name of the event	Description	Target group	Month	Expected outcomes
Training of trainers in using the Natura Alert app for forest and habitat monitoring	Training content: - KBA monitoring - Lessons learnt from other citizen monitoring that gives impact to biodiversity - How to use Natura Alert in forest and habitat monitoring (including monitoring exercise in the field) - Monitoring result reporting mechanism - Users' feedback	- Flores IBA Coordinator - Burung Indonesia staff - Local champions (LCG leaders and Village leaders) - Forest Management Unit	**April 2019**	By the end of the training, participants will be able to: - Analyze the importance of forest and habitat monitoring, with use of the example from other regions - Deliver training within their role, using Natura Alert for forest and habitat monitoring. Ensure that the experience and progress can be shared with their fellows.
Training for local conservation group members in using Natura Alert app for forest and habitat monitoring	Training content: - The importance of forest and habitat monitoring to the daily lives of the communities - How to use Natura Alert in forest and habitat monitoring (including monitoring exercise in the field) - Monitoring result reporting mechanism - Users' feedback	- LCG members - Village government officers - Member of women groups in targeted villages	April 2019	By the end of the training, participants will be able to: - Use Natura Alert for forest and habitat monitoring in their biannual monitoring activities - Follow the reporting mechanism of their monitoring result, including the documentation of the activities - Give honest feedback to the mobile apps
Forest and habitat monitoring in Golo Damu, Liang Ndara, Golo Kondeng, and Golo Desat villages	Data collection activity	- LCG members - Village government officers - Members of women groups in targeted villages	Throughout the year, twice a year for each village	- Well documented monitoring processes and results - Monitoring result analysis

Name of the event	Description	Target group	Month	Expected outcomes
Meetings with village leaders of Golo Damu, Liang Ndara, Golo Kondeng, and Golo Desat villages	Sharing lessons learnt from the incorporation of the monitoring program into the Village Development Plan	Village leaders of 4 targeted villages	April/ May 2019	- Forest and habitat monitoring program incorporated into Village Development Plan in 4 targeted villages - The contribution of the monitoring results for future potential village development is identified
Focus group discussion (FGD) on building the response mechanism	Some of the monitoring findings would need a response action from relevant government organizations. Through this FGD, we would like to build the understanding of these state actors in: · how to utilize the monitoring results according to their respective areas · validating monitoring results · giving response to monitoring results	- West Manggarai Regional Planning and Development Agency - West Manggarai Community and Village Empowerment Agency - West Manggarai Forest Management Unit - West Manggarai Agriculture, Horticulture, and Plantation Agency - West Manggarai Environmental Agency - Village Leaders - Local Conservation Group Leaders	June 2019	- Mechanism and commitment to responding and resolving monitoring results are developed among relevant stakeholders in West Manggarai - Monitoring results are validated
Meeting with West Manggarai Community and Village Empowerment Agency	Follow up the commitment of West Manggarai Community and Village Empowerment Agency to showcase monitoring results and LandSense project on their website	West Manggarai Community and Village Empowerment Agency	August 2019	- Monitoring data are showcased on the West Manggarai Community and Village Empowerment Agency website: https://manggaraibaratkab.go.id - Articles about LandSense project are showcased on https://manggaraibaratkab.go.id

Name of the event	Description	Target group	Month	Expected outcomes
Sharing Lessons Learnt in the Forest and Habitat Monitoring Program between Targeted Villages	Sharing between all monitoring implementers in Golo Damu, Liang Ndara, Golo Kondeng, and Golo Desat village regarding the hurdles faced, how to overcome them, the lessons learnt and their future hopes for the program	- Flores IBA Coordinator - Burung Indonesia staffs, LCG leaders, and village leaders of 4 targeted villages - LCG members of 4 targeted villages - Member of women groups in targeted villages	Sept 2019	- Best practices of the monitoring program in the field are documented - Feedback and inputs to the monitoring program in the field are available

Can the launch be linked to an ongoing event/community?

The data collection will be conducted throughout the year, twice a year in each village. We will link the data collection activity to some special events, such as the celebration of Indonesian Independence Day (August 17, 2019), World Environmental Day (June 5, 2019), and World Rivers Day (September 29, 2019).

How long do you plan to run the campaign for in 2019?

The campaign will run between March to September 2019. The Key Performance Indicators for the Indonesian pilot are listed in Table 32.

Table 32: Key Performance Indicators for the Indonesian pilot

KPI	Target for the 2018 campaign	Was the target achieved? Provide an explanation	Target for the 2019 campaign
Number of IBA data uploaded through app. IBA monitoring report from World Bird & Biodiversity Database	Data from IBA Mbeliling area covered by 4 targeted villages is updated	A delay in the app development has hindered this target fulfilment. IBA monitoring still conducted in a regular manner by the LCG, but it is still using the IBA paper-based monitoring form	Data from IBA Mbeliling area covered by 4 targeted villages is updated
Number of alerts validated in KBA Mbeliling–Tanjung Kerita Mese	At least 4 alerts addressed (but still difficult to write targets without seeing how often alerts are raised in Indonesia)	There is a delay in the web app development	At least 4 alerts validated and addressed by relevant government agencies (subject to change based on how often the alerts are raised)

→ User profiles

Table 33 provides a set of typical users in the Indonesian pilot.

Table 33: User profiles for the Indonesian pilot

User profile 2017 and 2018 (see D.2.2)	User profile 2019
User 1: Jihad is a 29-year-old member of the Local Conservation Group (LCG) Jihad joined the LCG 3 years ago, when an international conservation project was implementing some actions in the village. He received training in ecosystem services and how to monitor them. He is really concerned about new hotels that are being built and the degradation of the forest and its consequences for the water cycle, so he decided to participate in the workshop that Burung Indonesia organized in June 2017. He has always liked birds, so he wants to know how to collaborate with Burung Indonesia and learn how to use the mobile app, and other technologies to become a ranger one day.	Same
User 2: Rahmat is 45-year-old representative of the village government Rahmat has been working for the local village for the past 15 years. He is very excited about the tourism promotion that the National government is doing for Flores because many jobs will be created. However, he is aware of the problems they will have to face because of the lack of spatial management plans, detailed maps, and protection of biodiversity hotspots. He received an invitation from Burung Indonesia to participate in a LandSense meeting to talk about remote sensing and habitat monitoring using a mobile app. He didn't know exactly what they wanted to do, but he decided to give it a try because there might be some opportunities for the locals.	Same

→ Current technology

A. Mobile app and web app

Burung Indonesia has taken part in the development of Natura Alert by testing the app in different locations and providing comments and the Indonesian translation. The main interest is to facilitate the data collection in the field by the Local Conservation Groups. They are currently using paper forms and handing them later to Burung´s coordinator. This process is time consuming and some information can get lost, so Natura Alert presents a good opportunity for the local communities to raise issues of concern for their livelihoods, receive technology-based training and improve their workflow. Since few people have smartphones, other funding opportunities should be explored. The BirdLife coordination team will meet with Burung in April to discuss the progress of the pilot and the next steps to improve the engagement of the local stakeholders, who will also participate in the meeting.

B. Alerts from the CDS in Indonesia

In Indonesia, we have had discussions on topics such as fires in IBAs, KBAs and protected areas, logging of forested areas or protected areas, encroachment of forest for cultivation and other purposes, and

urban development in the surroundings of KBA Mbeliling - Tanjung Kerita Mese. The core area of the KBA consists of protected forest and other land uses. The protected forest borders other land uses in the hilly countryside, such as mixed agro-forests owned by smallholder farmers. It was identified that small-scale illegal logging and encroachment in protected forest areas by communities are the most relevant cases for the KBA as the communities are living very close to the protected forest. Finally, it was agreed to run the BFAST algorithm to detect changes within the KBA to ground truth them with the help of the local communities.

Results from the "Forest change detection service"

a. Wageningen University

Following a successful pilot in Ethiopia (Pratihast et al. 2014), Wageningen University developed an open-source web-based near real-time forest monitoring system in Jambi region, Indonesia. Landsat image time series (TM, ETM+, OLI) were processed to compute the Normalized Difference Vegetation Index (NDVI), and the BFAST Monitor method (Verbesselt et al. 2010) was applied on the NDVI time series for breakpoint detection. The generated forest change alerts were mapped on a web-based graphic user interface (Figure 43) available at: http://137.224.8.72/projects/indonesia/.

The forest change data can be downloaded from the web interface and loaded into GPS devices or smart phones, in order to facilitate the verification of the forest changes on the ground. The web interface also includes a database that can receive GPS coordinates, photos and drivers of forest change collected by the community in the field. This community data can be further mapped on the web interface, leading to an integrated and interactive near real-time forest monitoring system.

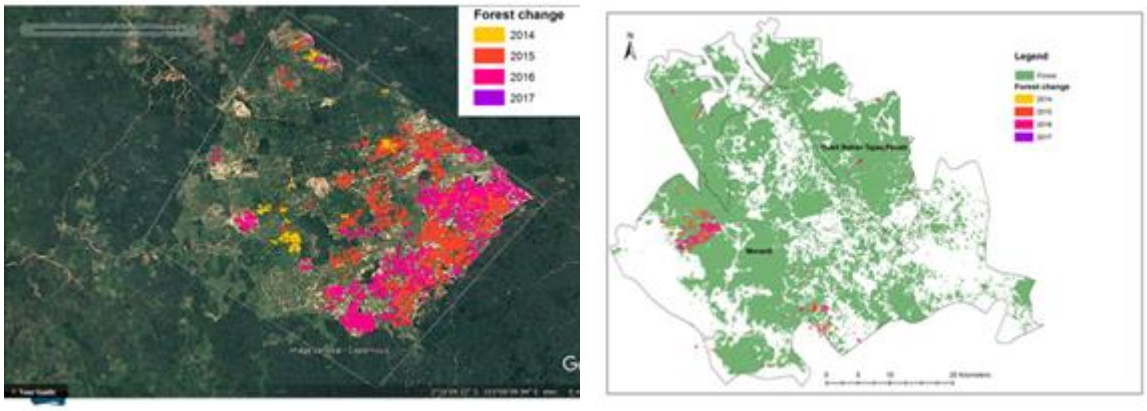

Figure 43: Forest change alerts generated using the BFAST algorithm

More recently, Wageningen University developed and published more advanced open source methods relying on the analysis of multi-sensor satellite time series, including Sentinel-1 radar data. Radar-based forest cover loss alerts have the potential to overcome challenges met by optical-based systems, such as permanent cloud cover. Multi-sensor near real-time deforestation detection was demonstrated in tropical dry forests, through the combination of Sentinel-1 C-band SAR time series with ALOS-2 PALSAR-2 L-band SAR, and Landsat-7/ETM+ and 8/OLI. Spatial normalization was used to reduce the dry forest seasonality in the optical and SAR time series, which were combined using a probabilistic approach to detect deforestation in near real-time (Figure 44). Results for a dry tropical forest site in Bolivia (Figure 45) show that deforestation events were detected more timely with Sentinel-1, than with Landsat or PALSAR-2. The spatial and temporal accuracies further improved

beyond the single-sensor results when combining observations in a multi-sensor approach (Pratihast et al. 2014).

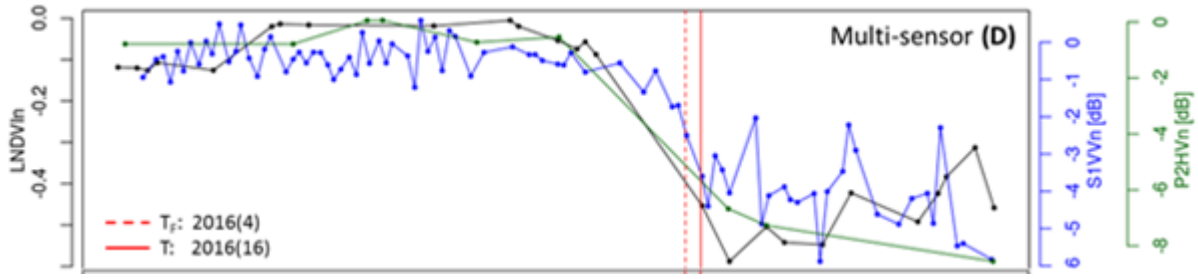

Figure 44: Multi-sensor time series combining Landsat NDVI (LNDVI), Sentinel-1 VV (S1VVn) and ALOS-2 PALSAR-2 HV (P2HVm) to detect deforestation in near real-time. The time at which the deforestation was first flagged (TF) and the time at which it was confirmed (T) are given as the day of year3.

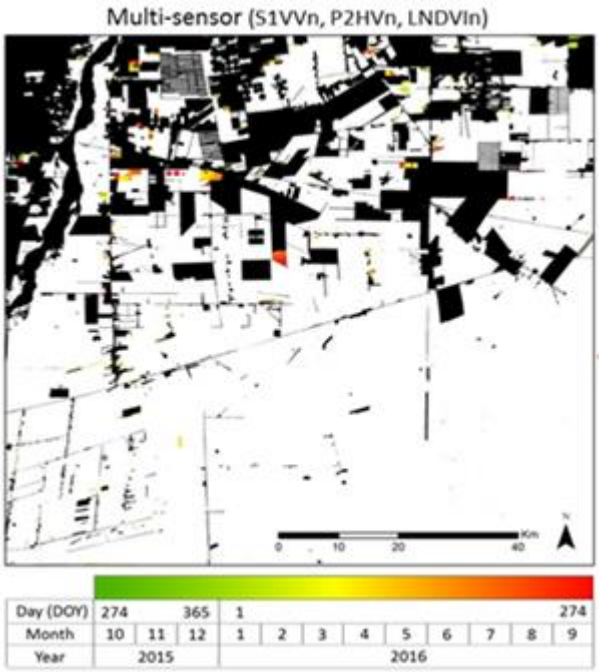

Figure 45: Deforestation events detected for a dry forest study site in Santa Cruz, Bolivia, using multi-sensor time series (Landsat, Sentinel-1 and ALOS-2 PALSAR-2) for the one year period between 2015-10-01 and 2016-09-303.

Since mid-2018 for Indonesia, Wageningen University has been exploring the development of an augmented interactive monitoring system relying on a near real-time forest cover loss alerting approach based on Sentinel-1 radar data. A first prototype of the alerting system implemented in Google Earth Engine has already been experimented for Flores Island. Further work will be conducted in 2019 to integrate participatory monitoring data streams and apply the interactive monitoring system with multiple stakeholders in the context of oil palm.

a. Sinergise

To help in the "Forest and Habitat monitoring" theme, particularly with the forest monitoring in Indonesia, Sinergise implemented a processing chain using Sentinel-2 multispectral imagery with the BFAST Monitor method (Verbesselt et al. 2010). The benefit of using Sentinel-2 is that it offers higher

spatial resolution (up to 10 m compared to 30 m for Landsat), as well as high revisit times (5-days for Sentinel-2 versus 16-days for Landsat 8), which is particularly important in areas that are often covered with clouds.

The process was run for the 'Mbeliling - Tanjung Kerita Mese' KBA on the western part of Flores island, in 3-month intervals from July 2017 onwards. To prepare the historical data for the training period of the BFAST algorithm, every Sentinel-2 tile with less than 90% cloud coverage was retrieved, resulting in over 230 Sentinel-2 tiles. The area was split into 10 patches for easier data management. Figure 46 shows how the area was split into patches, as well as how problematic the area is in terms of clouds, making change detection with optical satellite imagery particularly difficult.

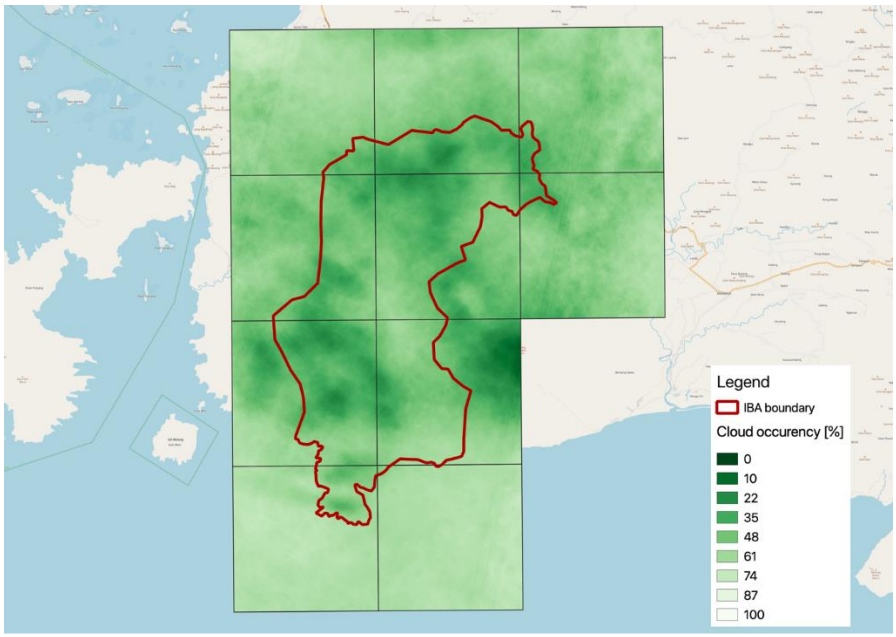

Figure 46: The IBA area split in*to 10 patches. Also shown is the occurrence of clouds over the whole data set*

The monitoring period was conducted from July 2017 to October 2018 on a monthly basis, always using the last 3 months as the monitoring period and the whole archive to that point as the training data set. The highest changes, both positive (increase in vegetation) and negative (decrease in vegetation) were extracted and uploaded to Geopedia, a spatial data infrastructure with web GIS editor/viewer for easier sharing and visualization of results. A screenshot of Geopedia, showing results for the monitoring period from August to November 2017 is shown in Figure 47. The results are accessible at http://www.geopedia.world/#T238.

Colors represent the change (red for negative and green for positive), and their saturation the magnitude of the change. As shown in Figure 48, polygonised changes contain the attributes for the monitoring period, the magnitude of the change and a link to the Sentinel Playground (https://apps.sentinel-hub.com/sentinel-playground), where one can explore the Sentinel-2 data at the location and time of the change (see Figure 49). The results can be exported in vector formats suitable for input to other GIS software as well, such as geojson as shown in Figure 50.

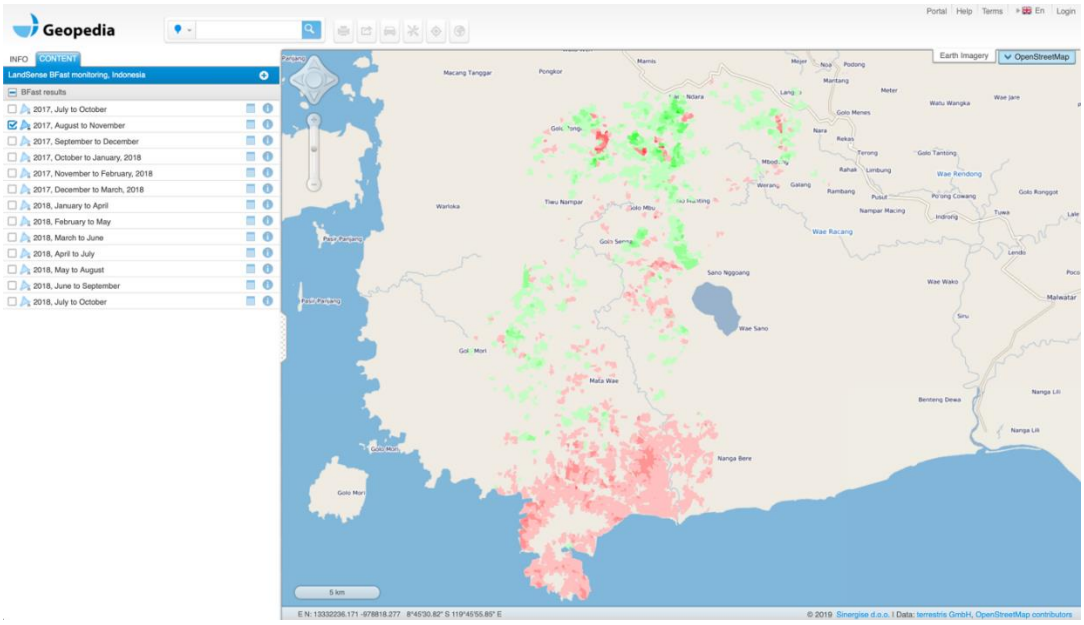

Figure 47: Red colors show negative changes (decrease in vegetation) within the KBA

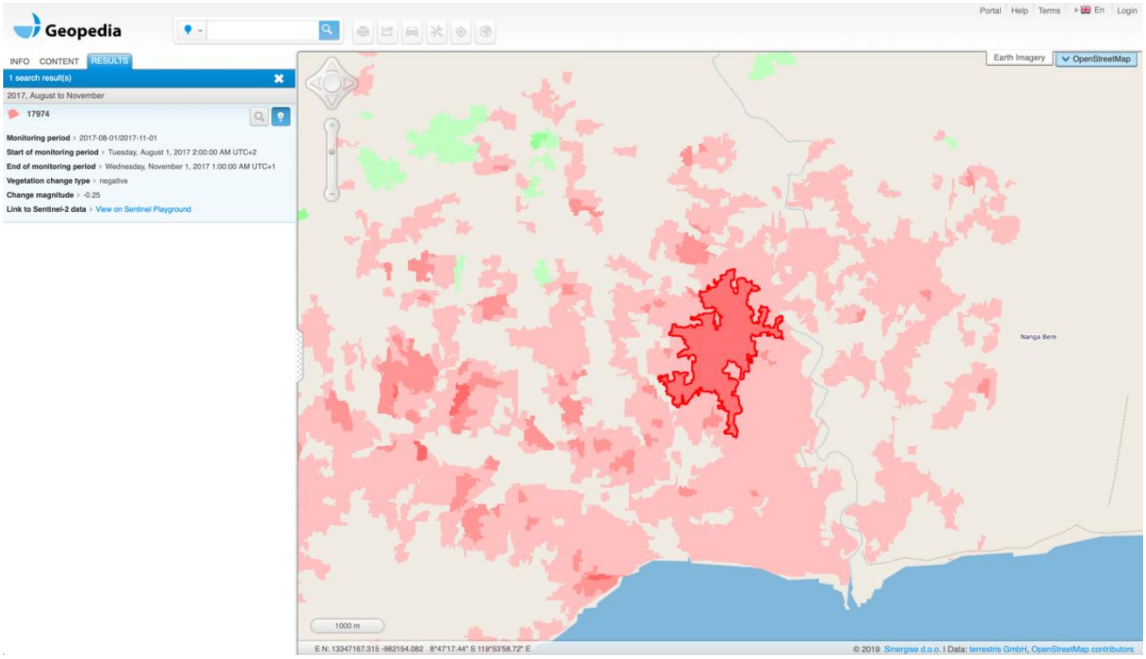

Figure 48: Each geometry has attributes about the monitoring period, magnitude of the change, and a link to the Sentinel Playground with satellite imagery for that location and time

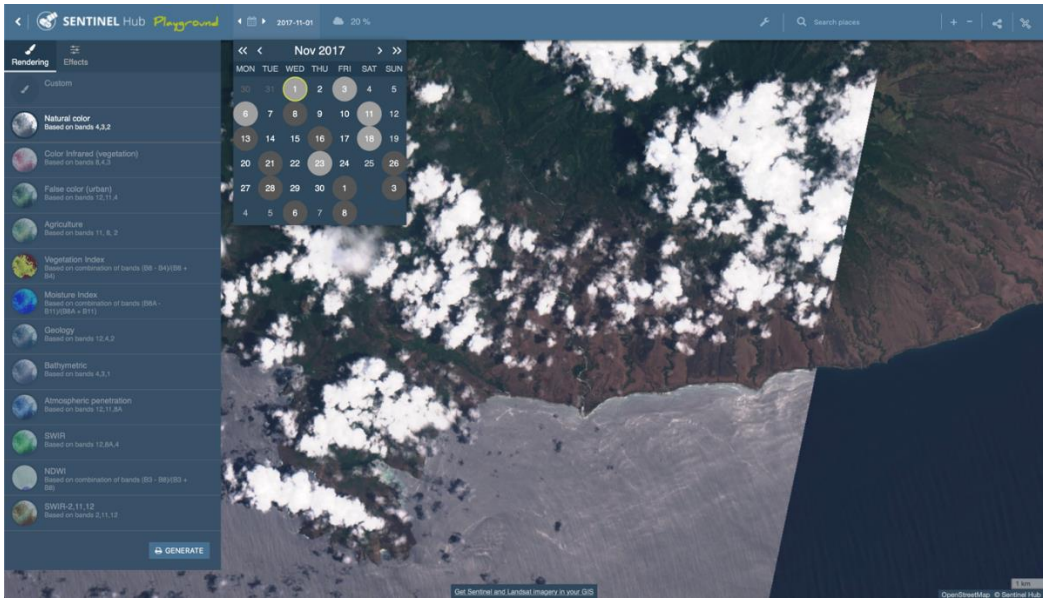

Figure 49: A screenshot of the Sentinel Playground, where users can explore Sentinel-2 data in an easy-to-use manner, moving in time to visualize changes in time

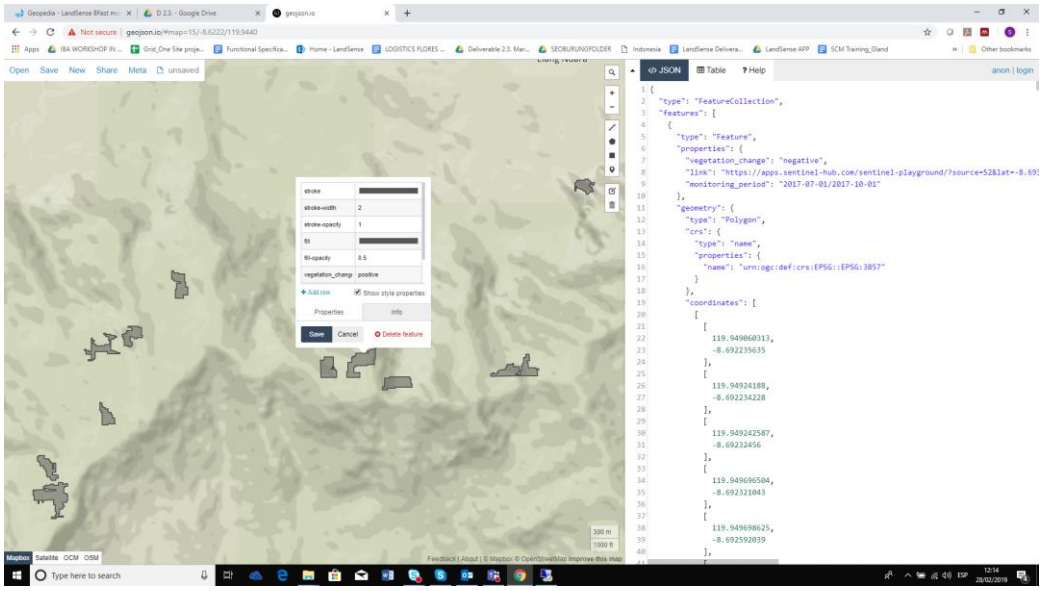

Figure 50: Visualization of the specific polygons http://geojson.io/#map=15/-8.6222/119.9440

The BFAST monitor really benefits from having long training periods; several years are sometimes needed to properly discern the seasonal patterns in vegetation. As Sentinel-2 data are only available since 2015, operationally since 2016, and in full data acquisition mode (5-day revisit) after the Sentinel-2B was launched (March 2017), the time-span of available data might not be sufficient to properly extract the seasonal patterns.

Nevertheless, some of the changes in the protected forests are timber harvesting by local communities during these last 2 months. It was about 4.5 to 25 m² for each village according to our local partner, Burung Indonesia. Since they have the coordinates of the locations, validation could be undertaken.

b. Heidelberg University

Since the LandSense CDS has not yet been fully implemented, the University of Heidelberg implemented a change detection service for monitoring deforestation. The method was found to produce accurate results (DeVries et al. 2015; Schultz et al. 2016) and is therefore a suitable device to complement the change detection service (WP3) or serve as a reference database. Thus, the results are a crucial element of the LandSense quality assurance process.

Deforestation was detected with satisfactory producer accuracy ranging from 52% to 85%, with a good user accuracy, ranging from 88% to 98%. Results are shown in Figure 51. In particular, the bulk of changes in the center of the island have been detected with good accuracy. The deforestation pattern is characterized by deforestation occurrence close to non-forested areas, suggesting agricultural expansion and charcoal production as the deforestation driver.

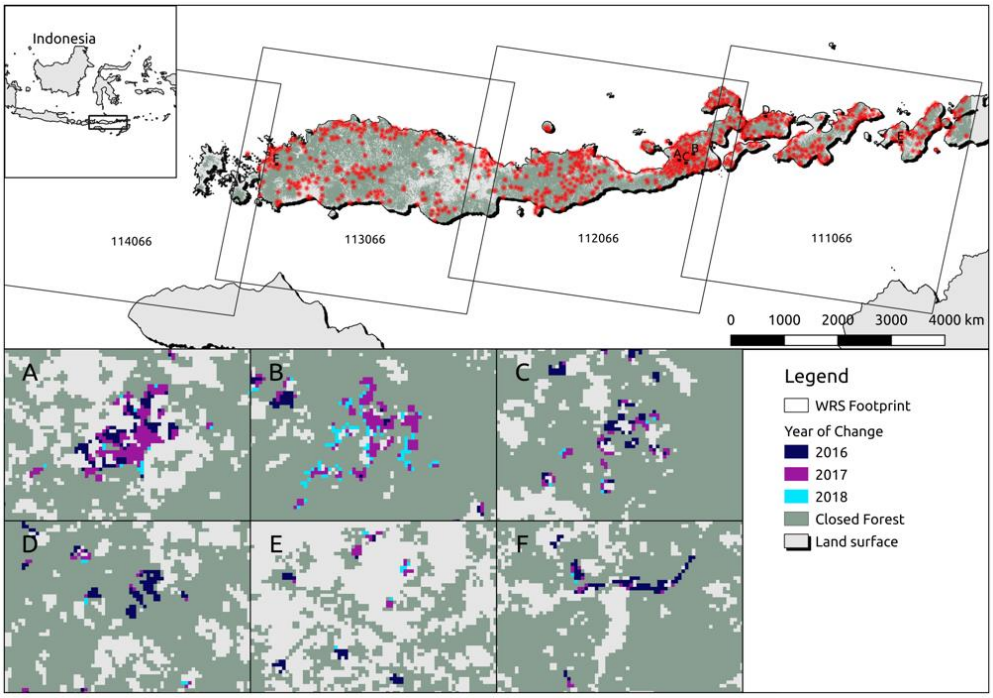

Figure 51: Results of the analyses for the deforestation change detection service from the University of Heidelberg

→ Business opportunities

What are potential business opportunities that could result from your pilot?

The West Manggarai District Government is now developing a "Green Eco-tourism Strategic Plan" that is integrated with the Flores Tourism Strategy document. The monitoring data will provide the West Manggarai District Government with up-to-date information about the forest, habitat, and threats to biodiversity. The information from this pilot will be very valuable in feeding information to the strategic plan.

In addition, Liang Ndara, as an eco-tourism village, will use the forest and habitat monitoring program as part of a nature tourism attraction. Approximately 70% of Liang Ndara visitors are foreigners. Therefore, Liang Ndara is willing to showcase this conservation action to a broader audience as well as generating income for the local communities.

For whom do you plan to create value and who are the most important customers?

The most important customers are:

- Local Conservation Groups (LCGs) in 4 targeted villages
- Village authorities in 4 targeted villages
- The Forest Management Unit (FMU) of West Manggarai

Which one of your customer's problems are you helping to solve?

Local Conservation Groups (LCGs) in 4 targeted villages

LandSense will provide a tool for the LCGs to capture their regular IBA monitoring activities in a structured way. Good and concise documentation of the threats will enable the communities to request rapid responses from relevant local authorities to validate and address the issues.

Village authorities in 4 targeted villages

Village authorities are required to allocate 70% of their budget for community empowerment and environmental programs. Until now, they have not complied to this Law because they do not have sufficient knowledge and experience in managing community empowerment and environmental programs. Therefore, an innovative citizen observatory for forest and habitat monitoring that connects local communities with an innovative monitoring mobile application will be a valuable case and lesson for their program.

Forest Management Unit of West Manggarai

The responsibility to manage and protect the protected forest areas is held by the Forest Management Unit (FMU). However, their capacity and resources to undertake forest monitoring are really low. Meanwhile, there is a need for timely information about the threats facing in the protected forests. In this case, Local Conservation Groups can help FMU to monitor the forest. Thus, the FMU can make more timely actions and sound decisions in protecting the forest.

5 Conclusion

Since 2018, each of the pilots has encountered different challenges from a technical and human perspective. Combining methodologies to aggregate innovative EO technologies, community-based environmental monitoring and information delivery systems to tackle local and regional environmental challenges is far from easy.

However, the first iteration has provided valuable lessons to all partners for the implementation of the second phase of the projects in 2019, providing a new opportunity to boost our impact as a LULC Citizen Observatory.

Acknowledgements

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