



LandSense

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

Deliverable 4.1

Demo 1: Cost reduction and data conflation in monitoring land change I



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Demo 1: Cost reduction and data conflation in monitoring land change I
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Short Description:
This deliverable reports on the activities carried out during the first iteration of the four pilots associated with the LandSense Urban Dynamics theme. D4.1 should be considered a draft deliverable as it will be updated with 2019 activities and finalized in Month 40 under D4.5
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Executive Summary

Based on the action plans from *D2.2: Engagement action plans and campaign strategies for LandSense demonstration cases I*, this report outlines the activities carried out during the first iteration of the four pilots associated with the LandSense Urban Dynamics theme. Within the last months two main clusters of learning experiences were documented during the activities conducted by the four pilots. One cluster is technical and relates to the development of the apps and/or websites as well as technical aspects of data conflation. The status of the mobile and web applications and websites are presented in an overview within the respective chapter of all pilot cases descriptions. Secondly, this report emphasizes the social learning experiences associated with communicating and engaging the different target groups. The target groups differ between pilot cases and span from the broad public in regions, cities or districts to students and academics. As such varying engagement strategies (D2.2) are required to meet the goals of the different pilots.

Some similarities between all pilots can be found as all of them contribute citizen-driven observations with authoritative databases. The strongest connection between the collected data and the authoritative database can be found in the Toulouse pilot. In the Vienna and the Amsterdam pilots, city administration (i.e. department of urban planning) are on board as stakeholders and are actively invested in the outcome of the LandSense pilots. The Heidelberg pilot will also support an official geographic information system for decision making. To build up authoritative LULC database is both expensive and time-consuming. Cost reduction effects for public bodies due to citizen-based observations has yet to be fully quantified. However, participating stakeholders have clearly stated that the data acquired from LandSense pilots will significantly enhance the quality of the LULC products, improve planning and that such information could not have been gathered within current city administration budgets.

All pilots implemented their respective strategies and activities to get their users groups on board and can now evaluate preliminary results. Additionally, not all pilots could precisely follow all steps concerning the user engagement strategies as envisaged in D2.2, and as a result, adaptations were necessary to accommodate the interest and investment of the stakeholders. Such measures are not completely unexpected because trust, understanding and insight about the requirements of different user groups need time to evolve and it is necessary to engage the target groups in an iterative process to deliver optimized solutions. Furthermore, LandSense apps must compete with other apps for the attention of the public and it is also a learning process to find methods to successfully occupy a communication niche.

This deliverable isAfter the first iteration of activities the pilots are adjusting and fine-tuning their engagement and technical strategies and are now on their way to improving for the second iteration in 2019, which will be documented in D4.5.

1 Introduction

The Urban LandScape Dynamics theme within LandSense highlights various methods and approaches as to how citizens can be involved in monitoring land change in urban and peri-urban areas, with an emphasis on land take, greenspace and landscape perception. This report describes the iterative processes and preliminary results for the real-life pilot studies in WP4 (based on the D2.2: Engagement action plans and campaign strategies for LandSense demonstration cases I). The report includes first experiences and lessons learned regarding the target groups, the first steps for on-boarding users, as well as addressing issues surrounding cost reduction and data conflation when integrating citizen observations with authoritative data.

The four different pilots within the Urban Landscape Dynamics theme include:

- City of Vienna
- City of Amsterdam
- City of Toulouse and surrounding areas
- City of Heidelberg

Each pilot description starts with an update of the storyline. This storyline is written in a style according to the different target groups (e.g. broad public, administration) and mostly a mixture between teasers and background information. Next, the report highlights achievements within each pilot keeping in mind two key issues: a) conflation of citizen contributions for Land Use and Land Cover (LULC) monitoring (both actively collected and passively integrated) with existing authoritative databases, and b) cost reductions in professional surveying and/or increase in available LULC data that could not be collected within current budgets of public administration units

The report then concentrates on the different target groups of each pilot as initially outlined in D2.2. An update of the activities with the target groups shows some changes of the selected groups and outlines first experiences - barriers as well as helping factors – in communicating and cooperating with the target groups.

The section “engagement strategies” explains the steps undertaken to create awareness of the campaign and to get volunteers and users on board. Since all citizen science activities need sustained engagement of users and as such, activities to give feedback to users and to stimulate longer-term engagement are described.

Furthermore, in this report the existing app/website/prototype are outlined followed by an overview of the current and planned uptake and performance. At the end of each pilot description a short update of the next steps for 2018 and 2019 are presented.

2 City of Vienna

Where is the coolest place to hang out on a hot summer day? How can you find the nearest greenspace or playground that is safe and well equipped?

Within the Urban LandScape Dynamics theme the LandSense team will build a mobile application for the City of Vienna that makes it possible for users to highlight their activities and express their perception of greenspaces and open spaces. Participants can interactively contribute and get feedback on the questions mentioned above – and many more. The app is centred on finding and evaluating ‘City Oases’ – the ideal places to hang out in an urban environment. Users are encouraged to evaluate predetermined points or alternatively any other location they would like to share with their fellow citizens – in the app and on social media. All participants benefit from their engagement as the collected data will be instantly available for all app users.

The heart of the data collection process is the recording of the subjective perception of the places and the relevant activities that can be conducted at those places. The locations are additionally documented by user-contributed photos. Furthermore, participants answer questions related to the suitability of a broad range of possible activities and “well-being” factors (e.g. cool spaces in summer). This approach will provide the LandSense team – and stakeholders – with a series of information regarding land cover (via the images) and land use (via activities/subjective feelings), as well as the state and setup of the area over a long period of time. Entities like the Department of Urban Planning (MA18) within the City of Vienna can use the data to improve their urban green and open spaces.

The app will be designed with up-scaling in mind – ready for multilingual use and with a set of activities and subjective feelings that fits almost every city. While in Vienna the predetermined quest point will focus on the Frei.Raum.Netz – providing the City of Vienna with vital information about the perception of one of the most important development features – other cities will be able to define their own respective regions of interest.

Achievements

The LandSense team along with the support of local partners implemented two initial test campaigns with the Frei.Raum.Netz¹ mobile application. MA18 plans to overlap data from the app with their own authoritative data. For now, data from the testing phase have been provided to the stakeholder via a direct download, however, soon an Application Programming Interface (API) will be developed to ensure timely access to the citizen-contributed data for evidence-based decision making. The acquired photos from the pilot will undergo quality assurance measures (WP5, D5.2) to ensure that they meet required standards (i.e. anonymization) for dissemination.

¹ <https://play.google.com/store/apps/details?id=com.iiasa.freiraumnetz>

As part of the STEP 2025 plan², the City of Vienna has significant interest in further developing and improving urban greenspaces and must consider the distribution, diversity and quality of such green/open areas. Additionally, the city aims to improve barrier free access for persons with restricted mobility within this green/open space network. The overarching goal is that every Viennese citizen will be able to reach the closest segment of the open space network within a distance of approx. 250m. Currently the Frei.Raum.Netz is updated by classifying the different functional types as stated within the STEP concept (ranging from type 1 lively street up to type 6 green corridor). For MA18 the activities taken LandSense pilot are similar to a user survey of the broad public and offer additional perspectives to their expert's view, which would not be possible giving the current operating budget of MA18. The public administration remarks that that the citizen-contributed photos are of particular value and insightful to their decision-making process.

In addition, the mobile app is accompanied with a set of remote sensing derived parameters to illustrate the vegetation dynamics of greenspaces. Based on Sentinel-2 measurements indicators of vegetation developments (e.g. Normalized Difference Vegetation Index - NDVI) express the average greening degree throughout the season. The phenological development can be observed and provided using a simple web-based user interface. The original resolutions of Sentinel-2 pixels with 10x10m are aggregated into sectors of the greenspace network. For each network a set of phenological indicators (start of season, end of season, length of season, current state of vegetation) are computed, stored in a database and provided for the users. These objective parameters can be correlated with the subjective inputs from the users. This will be an important information source for evaluating the effectiveness of the greenspace network.

The mobile application and the complementary satellite image processing are useful services that will be used to refine and complement planning instruments to increase living quality in cities. It can potentially support and document the progress of the STEP2025 plan and the monitoring of the green/open space network. The collected data is open data, the app is centred on finding and evaluating 'City Oases' –and the collected data will be available and easily accessible.

Target Groups

The Vienna demonstration pilot started with two trial runs of a beta-version of the mobile application with students from two different universities, studying different disciplines (architecture and landscape planning).

Table 1: Target groups for Vienna pilot

Target groups (from D2.2)	Experiences, barriers, helping factors
5th semester architecture students of Vienna	The test run of the app was part of a required course for the architecture students. The students had to record a minimum of 3 points and to answer 38 questions in order to successfully complete the course unit. The students worked in teams of 3, and in total 173 teams uploaded 378 quests in Vienna and collected about 1800 photos . Some students/groups visited up to 10 points - exceeding the minimum

² <https://www.wien.gv.at/stadtentwicklung/studien/pdf/b008379b.pdf>

University of Technology	<p>requirement of 3 to pass the class. This suggests that a certain interest in the app had been generated, with the high score list, an additional feature of the application, maybe acting as additional motivation.</p> <p>To give the students visual feedback on their work, the submitted data was translated into an emotion map.</p> <p>Students were asked to provide voluntary feedback about the usability of the application and the visualization. This evaluation consisted of conversations with the students and an online questionnaire. Despite offering some vouchers as incentives, only 19 students completed the online form. The feedback included experienced barriers and suggestions to make using the app more interesting (gamification).</p>
5th semester landscape planning students of University of Natural Resources and Life Sciences, Vienna	<p>The second target group consisted of approximately 20 students working in the area of the 10th district in Vienna; the test run of the app was integral part of a required course. In this test run the students got a shortened questionnaire that, not only focused on subjective perceptions (overall perception, noise and safety), but also on nature and wildlife. Additionally, the MA18 (City of Vienna) was keen to include activity related question that are based on a study they did about urban potential questions. The users can choose activities that are possible to do at the quest spot by choosing the corresponding icons. Another difference to the first students' version was that one point could be visited by more than one person.</p> <p>A focus group as well as an additional online questionnaire was used to collect feedback from the students. An additional online questionnaire was filled out by 6 students.</p>
City of Vienna	<p>MA18 is satisfied that their icons of activities could be used in the second test run of the app and that they will receive the pictures of the app. Currently MA18 and the LandSense consortium are planning for a test phase of the public version of the app within the City of Vienna departments and volunteers as well as the broader rollout, starting with the conceptual phase in July 2018 and the full public rollout in May 2019.</p>
Environmental Organisations (i.e. Global 2000)	<p>Global 2000 will promote the app via their communication channels and is currently actively involved in the planning activities for the testing and roll-out phase. Global2000 has also good contacts to other environmental NGOs that will be used to increase the awareness of the app beyond a broad range of people.</p>

Experiences (additionally to technical and contact related feedback):

- In both test runs, not all students fully recognized that the use of the app was mandatory. Apps are rather a new element in teaching and more associated with voluntary use in the spare time than requested part of a course.
- A data usage agreement (including e.g. copyright for photos) is necessary priorly from a very early point in collaborating with test users and end users.

- Some students experienced unfriendly responses during the photographing part of the app, because some people were on the picture (who would have been blurred out anyway). These persons approached the students and requested the deletion of the picture.
- Unintended effects might be that quarters of a city with currently low reputation might be further marginalized due to negative attributes in the emotion map. On the other hand, these negative attributes might generate a certain pressure to act to improve the situation.

Engagement strategies

Based on a series of stakeholder consultations, MA18 and the LandSense team agreed on an overall theme for the campaign and created a timeline for the full public campaign:

The overall theme of the campaign is going to be: "**City Oases – show us your favourite spots in Vienna**" (**"Wohlfühlöasen" – Zeig uns deinen Lieblingsplatz in Wien**).

The meetings led to an outline for the engagement strategy that consists of the components:

- October, 2018: planning meeting for engagement strategy with MA18 public relations department, Global 2000, IIASA and UBA for detailing steps, timeline and responsibility as well as clarifying open questions e.g. name of the app, communication of benefits (relation to heat islands, ..), feedback (suggestions from users cannot be transformed into action because of a long timeframe from planning to implementation), link to Twitter/social media, level of involvement of city's own media, STEP 2025 promotion and other suitable city events (public events, technology events, social media events,...).
- February 2019: development of a media kit including text, photos, incentives (e.g. for 1st download) etc..
- April 2019 launch of beta version (early access phase), tested with volunteers from the public, City of Vienna administration and UBA colleagues.
- May 2019: Public launch of the City Oases app. Via MA18, other districts will be informed about the app; MA18 will also contract 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 NGO, UBA will distribute via its network.

Global 2000 will lead the PR team, which will include representatives from the City of Vienna's marketing department. UBA and IIASA's press departments will also be involved in spreading the message. The team will kick off their activities in early autumn 2018 where the first meeting is scheduled following a workshop on the final technical aspects of the app in August, to ensure a shared understanding and good cooperation between the partners.

Steps undertaken to get volunteers/users on-board

Students of the Vienna University of Technology and the University of Natural Resources and Life Sciences, Vienna were already engaged for the test run of the app. Both universities will be contacted again for the public roll out. MA18 expressed their willingness to contribute to the early access phase: A set of users will get early access to the app a month before the official launch. These include volunteers from an MA18 Mailing

list, and a similar focus group of Global2000 followers. UBA and IIASA will also encourage their colleagues to become early adopters. Additionally, the first draft of a public roll-out was agreed upon:

- Different traditional and social media communication channels will be exploited and multiple waves throughout the summer will be implemented to broadcast the app
- Global2000 suggested using push-notifications and to include social-media interfaces (Twitter, Instagram, Facebook via API).
- Suggestion of newsletters e.g. with different topics like security, environment, heat & shadows (starting with 15th June 2019)

Steps undertaken to sustain engagement of the users:

- The public application will make it possible for locations to be visited more than once to ensure that the space is observed over a long period, and to provide context for the other data collected in that area.
- 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 communication strategies will be related to the STEP 2025 press releases.
- The TU Vienna is still interested to further integrate the LandSense app into their training course. 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.
- Specific campaigns will be launched with a duration of 3-4 weeks to focus the data capture of volunteers on specific topics that reflect the needs of citizens within a special time of the year (e.g. cool and shadow places during urban heat periods, ...)

Steps undertaken to give feedback to the users:

Due to restrictions by law and constitution the MA18 cannot promise users immediate improvement of green and open spaces as the responsibility lies mostly with other departments or at district level. The submitted data will be displayed in a map that will be available via the app as well as on the LandSense Engagement Platform. Users will be able to search for spots based on the possible activities and the rating of other participants.

Overview of City Oases app/prototype

From the user's perspective, City Oases is an app where they can find and share their favourite spots to hang out or for recreational activities (Figure 1). The users can search for places where they can do certain activities, or for spots that were highly rated by other people. The app will give an overview over previous ratings regarding perception and activities.

- Evaluate a pre-set Quest-Point
- Add additional/new Point

When adding a new point, the users can select the location themselves; otherwise they will be directed to an existing quest-point. They are then guided through a questionnaire and asked to take pictures of the area.

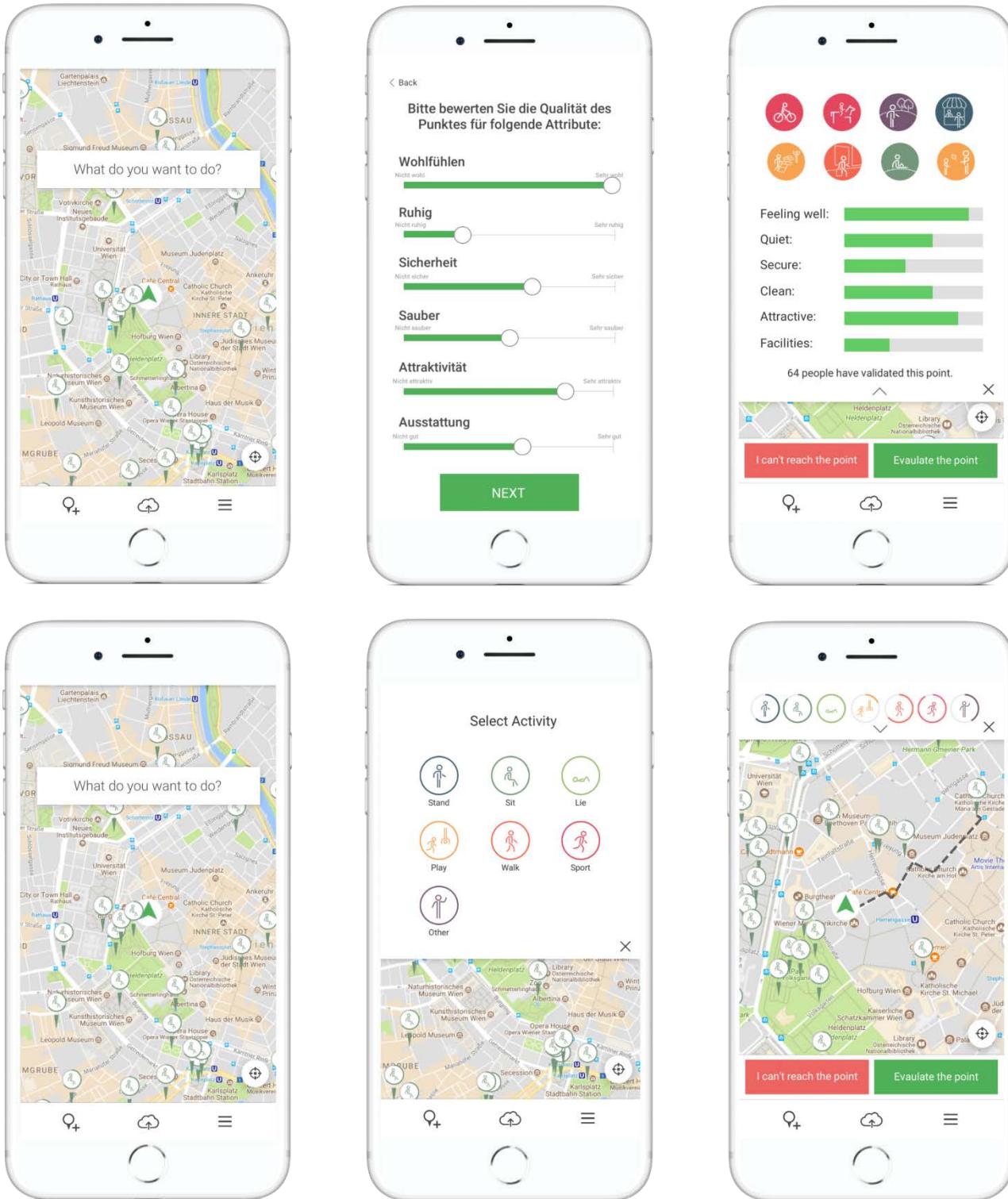


Figure 1: Screenshots of the City Oases mobile application, including functions to search for a suitable spot

The questionnaire focuses on subjective perception, nature and activities. At the end of the quest the app will encourage users to take another picture or Selfie and share it via Social Media using hash tags that reference the app and the project. Their observations will then be available to other users via the map or search function.

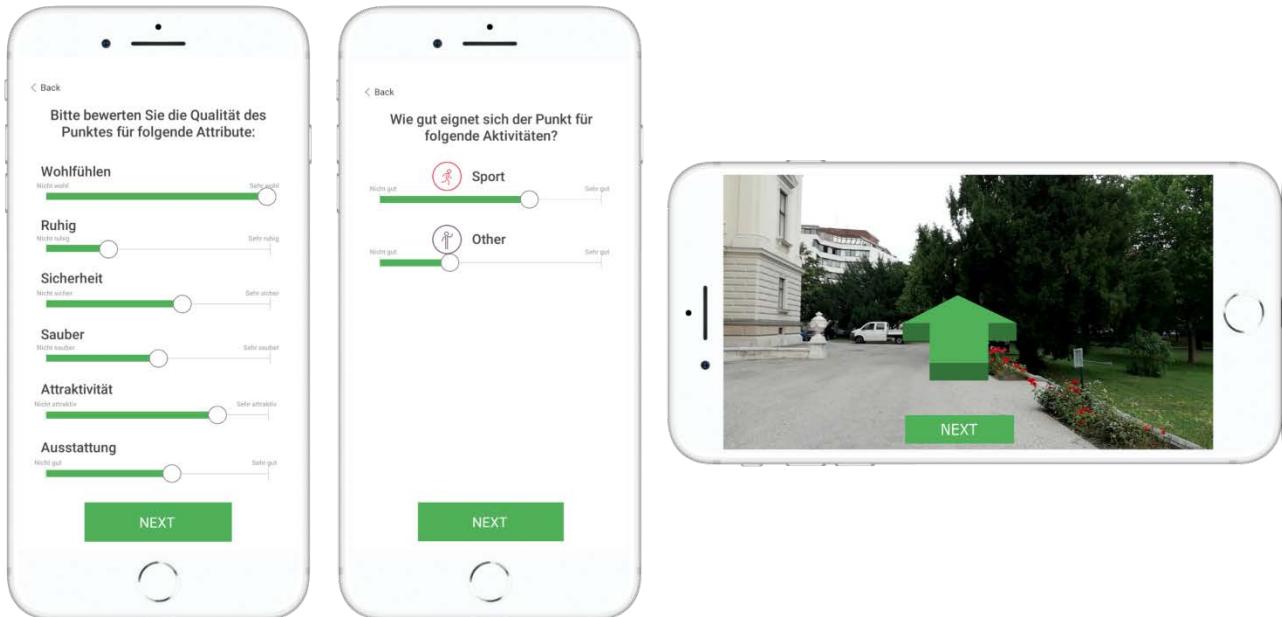


Figure 2: Completing a quest including capturing a photo with the City Oases app

Uptake & Performance Measures

Table 2 Key Performance Indicators: City of Vienna

Metrics	Achieved	Target
Number of installs	463	500 +
Number of testers/users	196*	500+
Number of observations	626	Generate emotion-map
Points covered by user	3,19 (average)	>5 per user
Media mentions	TBD	15
Social media numbers	TBD	TBD

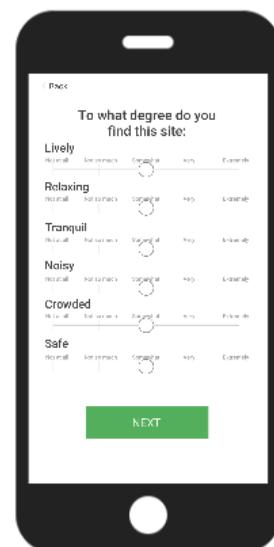
* includes the TU test where 1 user ~ team of 3

3 City of Amsterdam

City-dwellers are realising the benefits of green spaces and are flocking to urban parks to. City planners face the challenge of ensuring that urban green space is functional for all citizens. To make informed choices they need the right information and that is where the Mijn Park app will help.

Research shows that when considering the social functions of urban green spaces quality is just as important as quantity. It is easy enough to map how much green spaces there are, but how do we measure their quality? How do city planners ensure that the city's green areas are attractive, accessible and inclusive – for everyone? The Vrije Universiteit is developing an app for the LandSense project, together with IIASA, that will help city planners do just that.

The 'Mijn Park' (My Park) app asks respondents to go to several locations in a park and give subjective responses to those locations. They are then further questioned about how they use the whole park and how much they would like to see certain changes made in the park. This information provides information that can help to inform decisions about any renovations or improvements to the park.



A pilot is being conducted in the summer of 2018 in Rembrandtpark in Amsterdam where renovations are planned from 2019. The information gathered by the pilot will help to inform decisions about changes to the park. Reciprocally, more insight into how decision-makers use this information will help to inform improvements to the app. Besides using the results, the method will also be tested. That is, is such an app a good way to collect this data? This will be tested by comparing the results from the app to several other more traditional and accepted methods of similar data collection – such as surveys and observations in the park. This will help to demonstrate the usefulness and efficiency of this method for data collection.

Achievements

Questions asked in the app overlap with questions asked in the ‘Great Green Survey’ conducted every 5 years by the city of Amsterdam. Users of the app agree to their (anonymous) data being provided to the Gemeente (City of) Amsterdam. Therefore, the data provided can be conflated in the City of Amsterdam’s database about park use.

The Mijn Park app provides more detailed information regarding the park users than the current data collection methods of the City of Amsterdam. Currently the Municipality does a postal survey every 5 years from which it derives park specific information – e.g. The ‘Rembrandtparkuser’ is derived from those respondents who say they visit the Rembrandtpark most frequently from all parks. The Mijn Park app allows the municipality to more accurately derive responses from park users. This level of detail would not be possible in the current budget. Additionally, the geo-located information as well as specific park information will help inform decision making regarding renovations planned for the Rembrandtpark. This adds significantly to the current level of participation and this level of detail would not be possible in the current budget. The app offers opportunities for increased engagement and empowerment of citizens in land change issues, e.g. voting on scenarios of land change, contributions to e-democracy, etc. through the LandSense engagement platform and tools. The app is an important part of the participative trajectory utilised by the Municipality to ensure ownership of planned changes by park users. Key achievements are the collaboration between the City of Amsterdam and the VU in finalising the app and in running a publicity campaign. Also facilitating enhanced citizen participation in decision-making regarding a major change to a city park is also an important achievement.

Target Groups

Table 3 Target groups: Amsterdam

Target groups (from D2.2)	Experience, barriers, helping factors
Department of Planning and Sustainability Municipality of Amsterdam	The Department is very enthusiastic about the app. They are helping with publicity and encouraging municipality employees to take part. A meeting will be planned after the pilot phase to discuss feedback and so that the department can suggest improvements.
Residents	Residents enjoy the opportunity to express their opinions although some complain that the potential for individual input is too limited (i.e. they want to complain). Some signs of reluctance to spend time using the app (many downloads, a lot less actual responses) General feeling is that people welcome the initiative, but are skeptical about whether the municipality will actually use the information.

Organizations and initiatives with sustainability focus (e.g. Green Office, Sustainable Amsterdam...)	Some have helped with promotion of the app mainly via social media networks and are very supportive.
Students (as a part of the app testing phase)	Students were very engaged and helped with testing. Was important in bugfixes.

Engagement strategies

Steps undertaken to create awareness of the campaign including timeline:

May 2018:

- Launch in the park on the 'Day of the Park'. Served elderflower cordial made from elderflowers picked in the park. Brought it around to people lounging in the park and handed out flyers.
- Initiated social media accounts for the Mijn Park app on twitter, Instagram and facebook, and started posting.
- Made project specific website live giving background information.
- Also a page on the municipality website, linked to information about park renovations.
- Distributed posters and flyers at libraries, supermarkets, schools, old-people's homes in area surrounding the park.
- Article in the local paper.

June 2018:

- Continued posting via social media
- Posted some initial results on the website to provide feedback and encourage more responses.
- Banners hung in the park along main paths and park entrances.
- Article in Municipal (free) paper

July 2018:

- Updated intermediate results on website. Posted about it on social media.
- Continued posts on social media.
- Organised an excursion at a park-camping event in the park

August 2018:

- Updated intermediate results on website. Included some new visualisations and more results.
- Continued posts on social media. Including 'prickling' posts about intermediate results.
- Sent a feedback email to those respondents who had indicated they would like feedback. Also asking them to spread via social media and friend.

September 2018:

- Continued posts on social media.
- Interviews in park

- Market stand planned at park festival

Steps undertaken to get volunteers/users on-board

- Respondents encouraged by the message that their input will help to inform plans for renovation of the park.
- This message spread via social media, website, flyers, posters, mouth to mouth at events in the park etc.
- Prizes raffled amongst respondents
- Social media posts used to relay intermediate results and to motivate ('prickle') other park users.

Steps undertaken to sustain engagement of the users

- Almost all the respondents indicated they would like to be kept up to date on the results and the research. Therefore, feedback is provided via the website and social media, pointing to the website.
- An email newsletter was sent to respondents explaining (intermediate) results and thanking them for participation.

Steps undertaken to give feedback to the users

- Website, results page
- Posts on social media
- Email newsletter: once in September, one more planned in October
- Market stall at park festival at end of September
- 'In-depth' session planned in October with app respondents

Steps undertaken to clarify which partner will lead the engagement for the campaign

- Collaboration with Gemeente Amsterdam
- Publicity campaign planned together with relevant partner identified per action
- Regular meetings to assess engagement and to reassess required actions

Overview of app/prototype

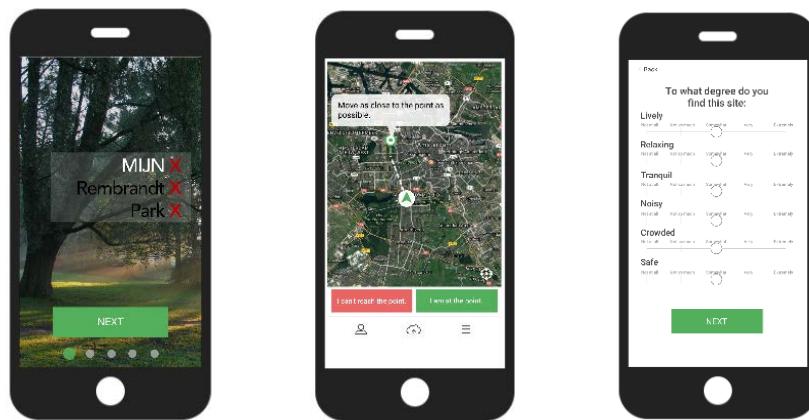


Figure 3: MijnPark mobile application

The respondents must enter the Rembrandtpark where they are directed to a first location. Here they answer a set of questions about their subjective experience and their satisfaction with the setting and facilities. They

are then directed to two other locations where they answer the same questions. Between each location they receive a ‘fun fact’ about the park. After the third location they are asked some questions about the park as a whole and how (often) they use it. Finally, they are asked to provide some personal information

The respondents can keep up to date on the results and other news by visiting the local website which is in Dutch and English. Intermediate results are visualised on the website (as well as on the LEP). The actual design of the visualisation is still in progress, but these intermediate results allows the respondents to have an insight into what people are responding. A deliberative session with app respondents and the Municipality after the pilot period will allow respondents to have some influence on the interpretation and planning effect of the results.

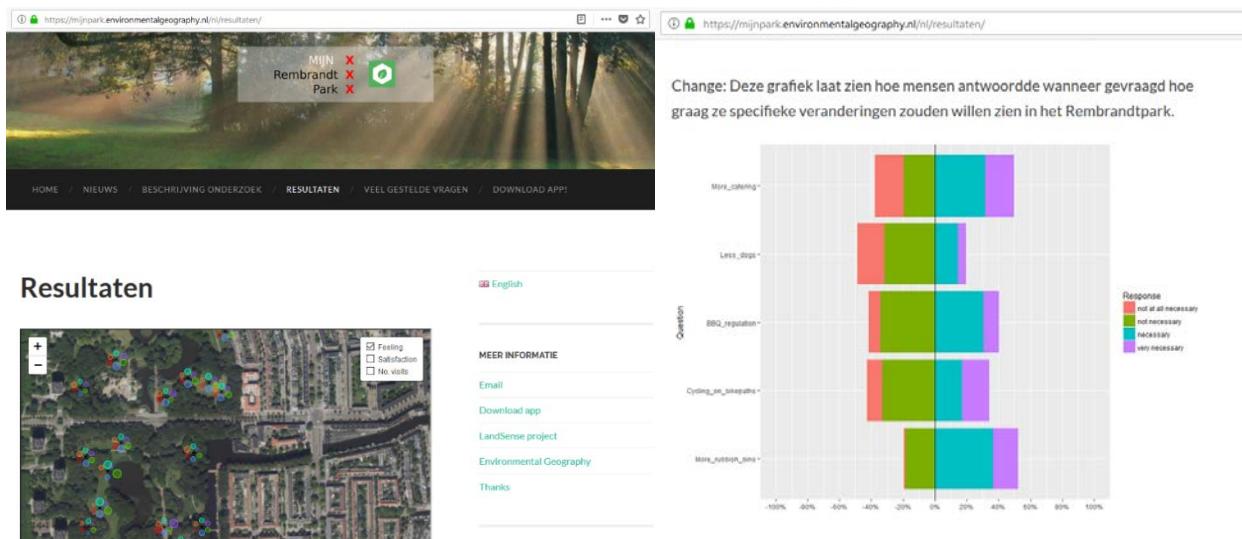


Figure 4: Visualisation of results from the Rembrandtpark demonstration pilot

Uptake & Performance Measures

Table 4 Key Performance Indicators: Amsterdam

Metrics	Achieved	Targets
Number of installs	300+	500 +
Number of testers/users	135	200+
Number of observations	450	500+
Points covered by user	3 per user	Set amount
Media mentions	3	5
Social media numbers	Instagram: 49; Facebook: 29; Twitter: 39	50+

Challenges

Summary of challenges encountered

- Engagement: Getting more people to participate, and getting people who download the app to actually follow through and fill in the app.

Next steps - plans for the 2019 iteration

- Scale up to all parks in Amsterdam, OR
- Adjust focus to assessing new or changing urban green

4 City of Toulouse and its surrounding areas

Storyline 1 for the opportunistic campaign and the PAYSAGES web application

Are you a decision-maker living the city of Toulouse or its surroundings? Do you need up-to-date and more specific LULC data to help you make strategic decisions?

With the Paysages Web Tool, you can visualize, improve, and download high-quality land use and land-cover data to use it as you please.

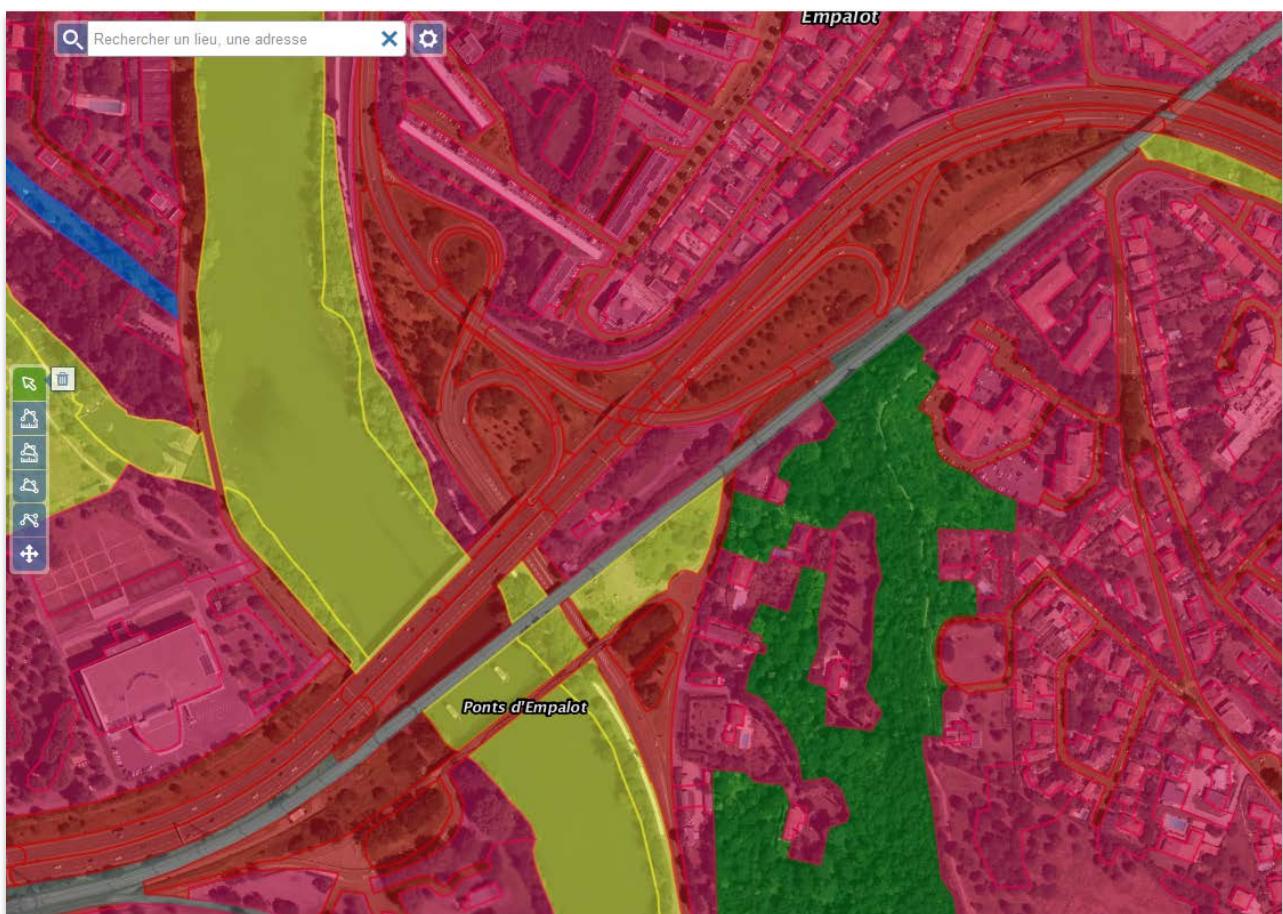


Figure 5: Screenshot of the Paysages web application

Within the framework of the Opportunistic Campaign in Occitanie Region, France, IGN has developed the PAYSAGES Web Tool.

Dedicated mostly to experts in LULC data (civil employees working for French local authorities), the PAYSAGES Web Tool aims at improving and updating existing LULC data through collaboration.

For expert there are three main opportunities:

- To indicate corrections to be made in 2013 authoritative LULC data in the former Midi-Pyrénées Region (OCS-GE 2013 – LULC data)
- To indicate the updates to be made in both 2013 and 2016 authoritative LULC data in the former Midi-Pyrénées Region
- To add and / or indicate useful information for buildings such as the number of floors, its functionality and nature, and thus improve the quality and quantity of information contained within IGN's topographic database (BD Topo).

Storyline 2 for the guided campaign and the PAYSAGES mobile application

As a citizen, wouldn't you like to stand up for the environment? To be able to do something that would help decision makers to fight against urban sprawl? Then download on the Play Store or the Apple Store the Paysages France App and start defending the environment by gathering data on land use and land cover!

Urban areas are taking up more and more of our landscapes, which negatively affect biodiversity, increases the potential for flooding and leads to higher urban temperatures because of climate change.

With the PAYSAGES mobile and web applications, every citizen and professional partner can help IGN improve, validate and expand the information it already has on LULC, which is critical for monitoring landscape change and how we manage our finite natural resources.

If you live in Occitanie region, you are very lucky: this message is for you. In the Paysages App, there are 5 main missions to complete and the challenge is to be able to indicate for different places in the Occitanie region:

- *If this or that quarry and is it still in service*
- *If the area on which one is located is an agricultural area, or if it is an area that is still in transition*
- *What is the nature of the building in front of which you are standing*

Within the framework of the guided campaign in Occitanie Region, France, IGN has designed the functionalities for a mobile application, which has been developed by IIASA based on the Fotoquest framework. The PAYSAGES mobile application is dedicated to citizens interested in LULC and environment monitoring.

The challenge for the citizens is to visit different places in Occitanie Region and, through the app, inform IGN of several issues:

- Notify if a quarry is still active, abandoned, or closed
- Validate the current land use of working in progress and agricultural areas
- Validate the changes detected by the Change Detection Service
- Add new information for buildings: number of floors, main and secondary functionalities.

The PAYSAGES WIKI

IGN-France has also developed a Wiki tool (<https://paysages.ign.fr/fr.wiki/fr/index.php/Accueil>) having the following roles:

- To keep users informed about the evolutions of the campaigns
- To share the pictures they took on the mobile application
- To help them contribute by describing and explaining IGN's databases' nomenclature.
- Let them discuss any issue on the forum

Conflation of citizen contributions on LULC and land change (both actively collected and passively mined) into authoritative databases

IGN produces many different topographic maps from detailed road networks to how the land is used for different purposes. At the same time, the information contained in these maps underlies many of the decisions made with regard to urban planning, resource management and landscape restoration as well as other environmental issues in France. The problem IGN faces is the lack of detailed information in some areas and the need to update maps more frequently, since landscape changes are happening in many places in France all the time. By going around Toulouse and helping IGN to improve the information, citizens and professionals can be involved in mapping and better managing the landscape around them.

The PAYSAGES apps are based on three authoritative databases produced by IGN: the two LULC databases (OCS 2013 and OCS 2016, and the buildings database BD Topo Univ v2. The PAYSAGES website framework is based on another IGN GIS collaborative tool called espacecollaboratif (<https://espacecollaboratif.ign.fr/>).

The Toulouse study pilot aims at modifying, updating, and eventually overwriting authoritative data with data produced by users during the campaign. The conflation of citizen contributions to the official database depends strongly on the fact that the newly updated data will be available for download.

Cost reductions in professional surveying and/or increase in available LULC data that could not be collected within current budgets of public bodies

Producing an authoritative LULC database is both highly expensive and time-consuming.

Although it is yet difficult to precisely estimate the cost reductions the LandSense project could bring, data conflation on land cover would definitely help IGN to gain a more complete database in a shorter timeframe.

Thanks to PAYSAGES, it can gather in-situ information that would be difficult to collect through other means. Informing how buildings next door are used (housing, industry, etc.) is an example of how users can help IGN. It is indeed too time consuming and expensive for IGN to collect this data only through professional surveying. In the same way, evaluating change in LULC can prove difficult only by studying GIS data. Therefore, the help of local citizens can be of benefit.,

Open access to improved public information on land take and land change

The potential to attract users also depends on what they feel they can gain by participating. Most professional partners from French local authorities wanted to make sure they would be able to download the data after they reported a change in the web application.

IGN's LULC layer OCS 2013 is already available for free, so on PAYSAGES, it is also possible to download data for free. Through dedicated APIs (<https://paysages.ign.fr/api/doc/georem>), a user can also download his/her reports as well as the contributions made by other users.

Increased engagement and empowerment of citizens in land change issues

In addition to helping IGN improve its databases, PAYSAGES's goals were indeed to try to increase engagement of citizens in land change and general LULC issues. On the PAYSAGES website, it is stated that the use of natural and agricultural areas for urbanisation has become a major challenge for our societies. The fight against urban sprawl cannot be achieved without a regular follow-up of the land use in the concerned territories. Given the issues that depend on it (soil sealing, loss of natural habitats, etc.), this follow-up is everyone's business, and therefore any citizen should participate in monitoring LULC.

What are the key achievements?

Among the key achievements are the development of two mobile and web applications, the PAYSAGES wiki as well as the implementation of a collaborative mapping campaign.

Target Groups

Table 5 Target groups: Toulouse pilot

Target groups (from D2.2)	Experience, barriers, helping factors
Local authorities and decision makers and their staff	We have involved these target groups as planned, either by email or by calling them. However, although they showed their interest in collaborating on this theme, we have encountered some difficulties to work with them. For example, the Causses du Quercy Regional Nature park did not finally use the applications because they prefer to work directly with its GIS (in order to obtain topological

	information more quickly). Employees from the local authority of the Haute-Garonne department (DDT31) passed the information onto their units. They wanted to use the system to report changes on buildings but the test area was at first restricted to the agglomeration of Toulouse (due to performance issues), so they could not contribute effectively. Finally, the PictOccitanie platform relayed the information to its network as they promised, but did not animate the collaborative work.
Students	IGN-France is in contact with David Sheeren (Assistant Professor at ENSAT Toulouse) to set up a fundraising campaign with his students in October. However, according to him, the fact that a user has to visit points in the field to use the mobile app (and cannot do it remotely) seems to be a constraint working with his students.
Research community	The information on the campaigns had been passed onto them through the CESBIO laboratory, but we did not get any particular reaction from them. We tagged them on Twitter as well, to relay information to the satellite-based research network. IGN France has also communicated to different research community (geomatics, image processing) by using their mailing lists.
Citizens	The IGN's communication department published various tweets during the summer to motivate citizens to contribute via the mobile application. We focused on our target community, particularly the network of hikers who could grab information during walks. We have also communicated through our professional and personal networks in Toulouse so that during their holidays, they contribute to the project. However, even people very involved in environmental issues have not taken the time to download the application to contribute.

Steps undertaken to create awareness of the campaign including timeline

- Identify target groups for the web campaign
- Mid-April 2018: User tests launched.
- Mid-May: Opportunistic campaign launched. Both opportunistic and guided campaigns have been presented by IGN-France during the meeting organized by IGN and its partners at Montpellier, for launching the production of LULC for the other part of Occitanie Region .
- Beginning of June: Guided campaign launched.
- June 4th: Sending emails announcing the launch to partners (local IGN agencies, ENSAT students -School of Agricultural and Life Sciences, and local authorities).
- Mid-June : Meetings and calls with local authorities' staff to raise their awareness of the campaigns
- June-September:
 - Different posts published on IGN social networks to attract users: Facebook, Twitter, and LinkedIn.
 - Emails sent to different French research communities through the mailing lists
- Organization of an internal Workshop ("Inoveille") to present the tools and the goals of the campaigns
- An article presenting the goals of the campaigns has been published in IGN Magazine
- Email to the OSM French community to inform that about the tools and the possibility to contribute to the two campaigns.

Steps undertaken to get volunteers/users on-board

We tried to make for the target groups of local authorities' staff the contribution part of their work and for students part of the curriculum. The strategy was to propose easy and free to use tools that are both user-friendly and functional.

We are convinced that if the contributions are made within a more precise framework and for a specific purpose, it could be more effective. We are trying to set up a campaign with the urban planning agency in Toulouse (AUAT) that would improve the detection of LU class 235 in the OCS-GE 2016 (LULC Database). If they agree, then cooperation with the agents of the AUAT could be organized for the second campaign.

Steps undertaken to sustain engagement of the users

In order to sustain engagement of the users, the first step is to make sure they know how to properly use the applications. Therefore we wrote a manual for the web application IGN developed (which is a bit more complex to use than the mobile one) with step-by-step explanations and screenshots.

In case the users had any problem when using the applications, they could send an email to an email address specifically created for the occasion (landsense@ign.fr) to ask for help. A Wiki was also created to provide users with any useful additional information (<https://paysages.ign.fr/fr.wiki/fr/index.php/Accueil>)

The planning of future mapping parties involving student is also currently under consideration. We think it would boost the users' interest for LULC issues while allowing IGN to directly interact with them.

Steps undertaken to give feedback to the users

The data submitted by users is immediately available on PAYSAGES and can be visualized and downloaded. Additional information regarding campaigns results, future mapping parties and any other useful information will be made available to users via the Wiki or email. We also planned to organize workshops and send newsletters informing users of the campaign's results, but given the lack of results, this task is out of scope. However, we still plan to do it for the second campaign.

Paysages web application

Once their account is created, users can indicate the updates to be made in any of the three databases (OCS 2013, OCS 2016, BD Topo (buildings). For example, they can select a building on the map and then indicate what its nature is (church, industrial building, etc.) or how many floors it has. They can also draw new objects (new buildings, for example) or modify the existing ones' geometry (update LULC polygons, for example).

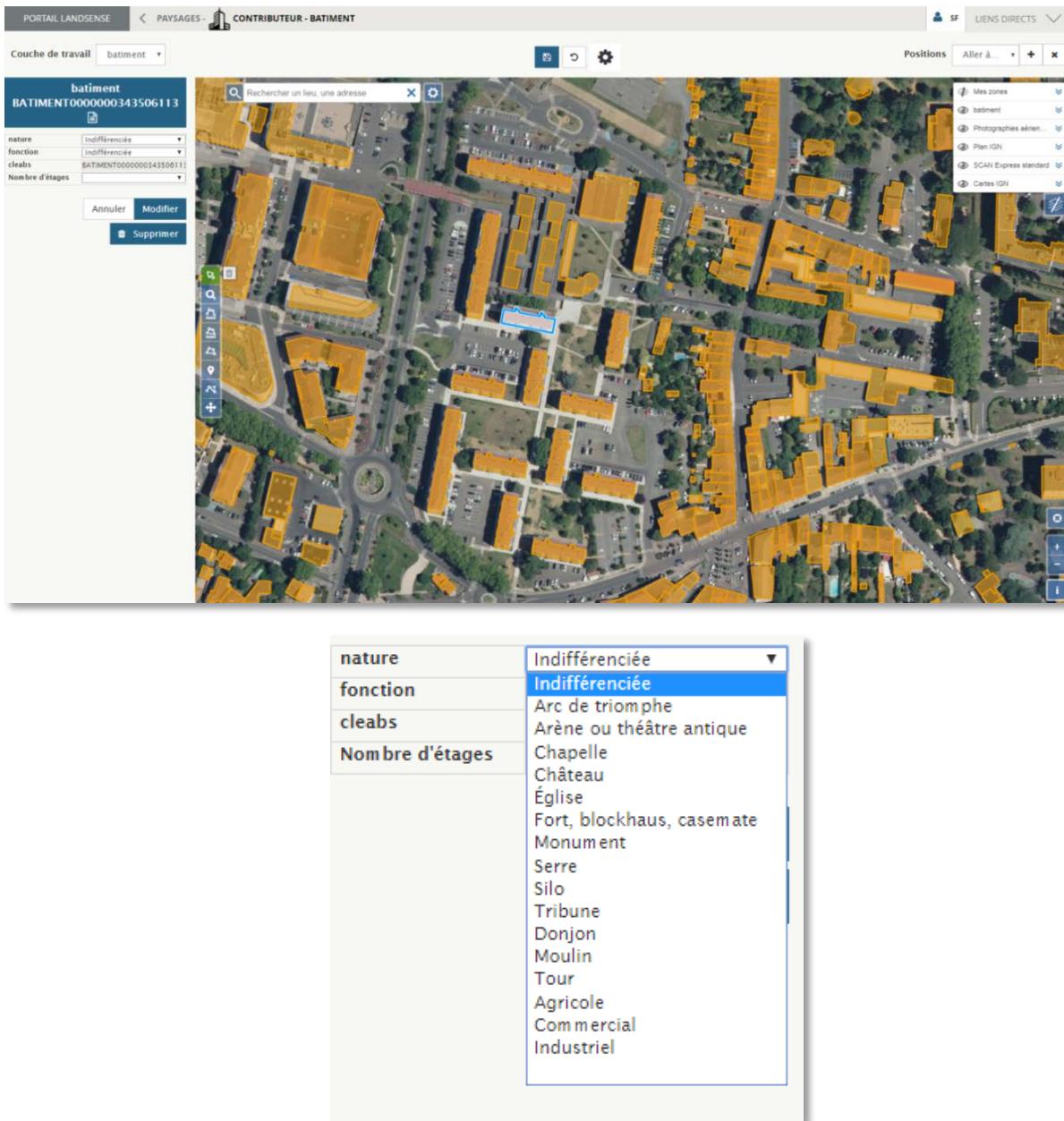
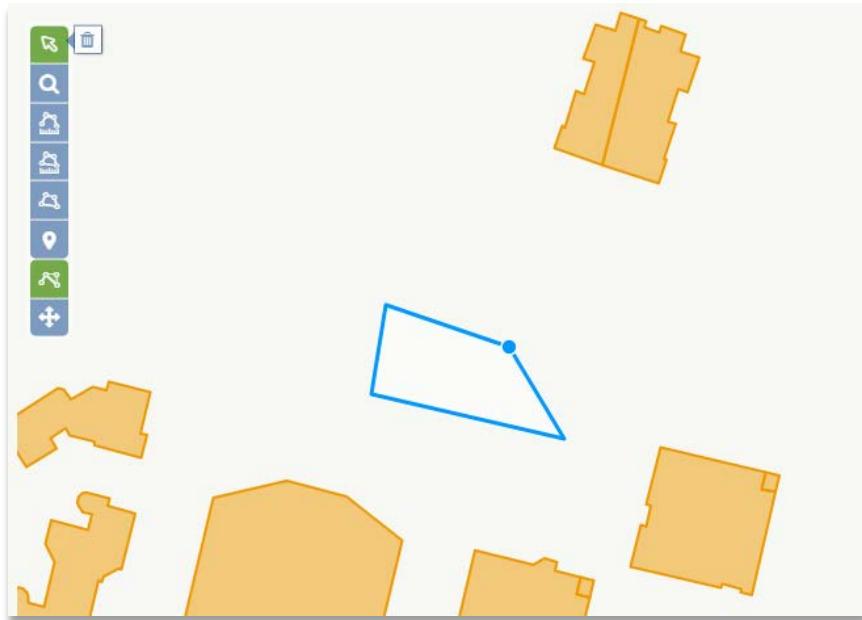


Figure 6: Selection and description of buildings in the Paysages web application



Eventually, they can have access to the history of every polygon (who indicated what, and when) :

HISTORIQUE DE L'OBJET 96A628A5-B3DF-43C9-BD53-E60801995042

La base de données contient 1 versions différentes de l'objet.

Version n°1
Date de la modification : 22 novembre 2017 à 13:46 Numrec : 1 Origine de la modification : IGN Voir la fiche complète de cette version de l'objet

[Voir l'historique détaillé](#)

[← Revenir à la fiche de l'objet](#)

Figure 7: Inclusion of new objects in the Paysages web application

Paysages mobile application

Through the app, users visiting Occitanie region can inform IGN of several issues we already described earlier. First, the user has to select a point of interest on the map. The point can be red (not yet visited), green (already visited by the user) or blue (already visited by other users). Then, he must walk to get closer to the point. Once the user is near to the point, he/she is asked different questions, to eventually take pictures of the site and to indicate any useful information by filling in the comment field.

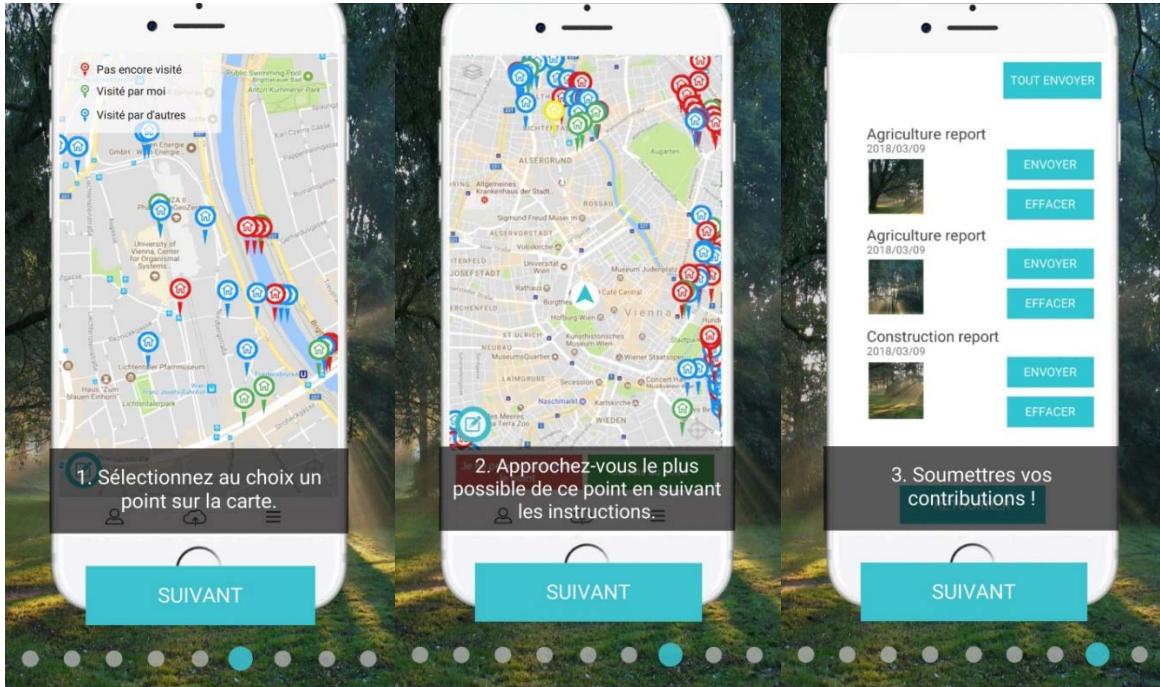


Figure 8: Paysages mobile application

Wiki Application

One of the major challenges with LULC information is to understand the metadata. To this end, the wiki represents a good way to help contributors in understanding this information. First, as a result of the infobox, important information about a particular land use or land cover type is directly accessible from the wiki. Users can add an image or advice or initiate a discussion in a specific metadata page.

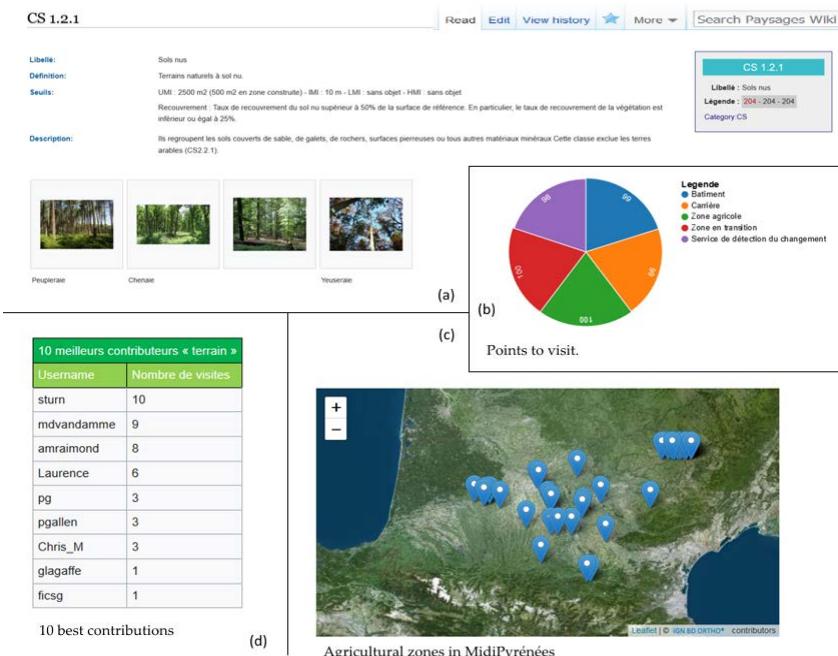


Figure 9: Paysages wiki application

Challenges

The main challenge we have encountered is the difficulty to get users onboard, as it can be noticed by the table on the Key Performance Indicators. Many professional partners showed their interest for PAYSAGES, but eventually did not use it and sometimes did not even log in once. As for the citizens, despite the fact the mobile app was user-friendly and simple, few of them downloaded and used it. The campaign will end on October 30, 2018.

Table 6 Key Performance Indicators City of Toulouse and surrounding areas:

Metrics	Achieved	Targets
Number of installs	10+	150
Number of points covered by users	12	150
Number of photos taken	14	50
Number of web app users	20	100
Number of observations	1	150

Many issues stood in the way of a successful first campaign. First, it was quite difficult to rally citizens around a topic as GIS-specific and complex as LULC. Indeed, even if people seem to be more and more interested in environmental issues, it proved quite challenging to raise their awareness on a topic relying on professional, GIS-specific data. Moreover, unlike the Vienna pilot and City Oases, the French pilot covers a much bigger geographical area. Finally, although we used social and professional networks (LinkedIn, Facebook, Twitter), the scale of our communication was probably not sufficient.

What are the plans for the 2019 iteration?

Internal meeting at IGN on October 4, 2018 to analyse the reasons for the unsuccessful campaign and to define another strategy for the end of this campaign and the second campaign which will take place in 2019.

- Organisation of a mapping party together with the Heidelberg pilot in Toulouse
- Second mapping party with students from Toulouse University on October 20. 20 students with their teacher will go on the field during 4 hours to make contributions with Paysages mobile app
- Organise a competition with prizes during 2 weeks
- Organise a Validation mapping party using the LACO-Wiki tool at IGN Engineering School for validation of transition areas classes and changes detected from the Change Detection Service

5 City of Heidelberg

Join us and contribute to the world's first crowdsourced land use map. Help estimate the quality of osmlanduse.org and support scientist by validating results.

To better manage the current pressures on land resources due to climate change and the increasing world population, timely information on land use and land cover (LULC) is essential. LULC maps are available at local, regional, and international scales and rely heavily on Earth Observation (EO) imagery and classification algorithms. However, with the emergence of Web 2.0-based Volunteered Geographic Information (VGI) technologies, a new avenue for both LULC mapping and validation has emerged. Founded in 2004, the OpenStreetMap (OSM) project represents one of the largest efforts to generate and maintain a global map of the world through a network of millions of volunteer contributors within an open source environment. By integrating OSM with machine learning and satellite imagery, more detailed LULC maps can be produced than one generated using only satellite imagery.

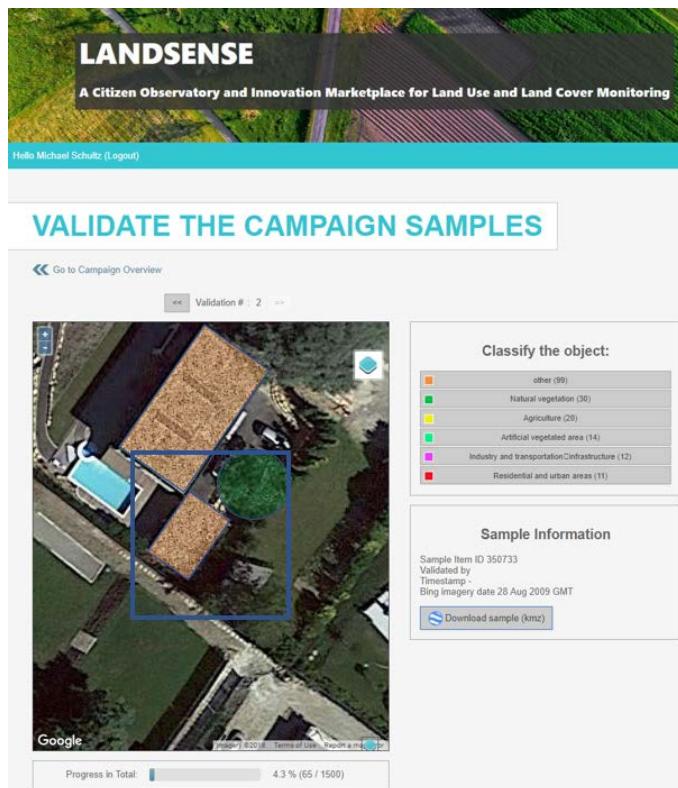


Figure 10: Validation campaign interface powered by laco-wiki.net

Using the LACO-Wiki Platform, this interactive mapathon will allow you to assess and validate a LULC map of LandSense pilot cities Heidelberg Toulouse and Vienna, which brings together data from both EO (Sentinel2) and OSM streams (osmlanduse.org). During this session you will gain first-hand knowledge on how the power of the crowd can be used to validate maps using high resolution satellite imagery.

Achievements

Land use classes which fulfill the criteria of a minimum mapping unit <1m and producers and user accuracy > 85 % are of potential application for municipality usage on city and county level. The procedure demonstrated in the pilot followed the Corine land cover compatible scheme. Thus, for application in Heidelberg class translation towards Amtliches Topographisch-Kartographisches Informationssystem (ATKIS) and usage of very high-resolution data is required.

Conflation procedure involves three actor domains: citizens, scientist and authorities. Citizens participate in LandSense indirectly by providing contributions to OSM and actively through the participation within LandSense propelled validation campaigns (UHEI pilot). Scientist participate through providing meaningful frameworks for conflation linking citizen contributions towards the requirements of authorities' land use management frameworks. They act as a mediator, filter and enhancer of citizen contributions for authoritative use. Given these definitions a four-stage conflation of City of Heidelberg pilot is envisioned:

1. Harvest existing and ongoing land use contributions through citizens passive to LandSense (successful prototypes available and ongoing development)
2. Estimate performance of these contributions through citizens active towards LandSense (successful prototypes available and ongoing development)
3. Filter qualitative and accurate land use through scientist or LandSense campaign managers (successful prototypes available and ongoing development)
4. Provide high quality only land use information for authoritative application (evaluation of stakeholders pending)

Our results are available on osmlanduse.org, currently data download is available via e-mail request. We currently implement a download functionality. Estimates of quality are available on request and are published in peer reviews journals. We created one publication which described the accuracy for Heidelberg only (Schultz et. al 2017 Open land cover from OpenStreetMap and remote sensing) and are currently preparing a publication of the results shown below. Our pilot is complimenting existing approaches provided by authorities to create better land use planning and services for everyone.

Target groups

Table 7 Target groups: Heidelberg

Target group (from D2.2)	Experience, barriers, helping factors
Vermessungsamt Heidelberg, Rhein Neckarkreis	<p>Experience: land management</p> <p>Barriers: classic bureaucratic internal barriers such as slow response rates to novelty and skepticism</p> <p>Helping factors: more communication and better understanding of their needs and day to day applications</p> <p>They have stated a clear interest in high resolution land use data.</p>

Citizens	Experience: local knowledge Barrier: lack of skill in remote sensing interpretation Helping factors: filter useful contributions by agreement measures
Students & scholars	Experience: Sufficient skills Barriers: theoretic thinking not connected to every day real world problems Helping factors: stakeholder and citizen engagement

Engagement strategies

Steps undertaken to create awareness of the campaign including timeline:

- June 2017 – Advertisement through social media and posters
- November 2017 – University seminar
- September 2018 - Advertisement through social media and posters

Three validation campaigns were performed to collect reference data for the accuracy estimation of osmlanduse.org and specifically the pilot studies Heidelberg, Toulouse and Vienna. The procedures follow best practices defined by the scientific community such as sampling design, response design and accuracy estimation procedures (refer to D5.2). Our pilot created a link of state-of-the-art practices and involving citizens to contribute to this process. We bridged the gap of collecting meaningful reference data from non-experts for use in scientific applications and estimation of crowd propelled land use creation. An all-round cycle of citizen observation generated and validated land use where Heidelberg University and IIASA facilitated the means to connect these entities.

The first campaign targeted the validation of the designated LandSense pilot cities Heidelberg, Toulouse and Vienna. The results are shown in Figure 11. The 29.06.2017 campaign was performed across 20 participants (scholars and university students) and targeted collection of an essential amount of necessary reference points to identify suitability of osmlanduse.org for professional use. Results shown in Figure 12 indicate that osmlanduse.org is particularly suitable for Heidelberg, then Vienna and less useful for Toulouse. Agricultural areas and forest and seminatural areas achieved highest accuracies. Because osmlanduse can be generated using different approaches we compared the most common approaches to identify method specific suitability.

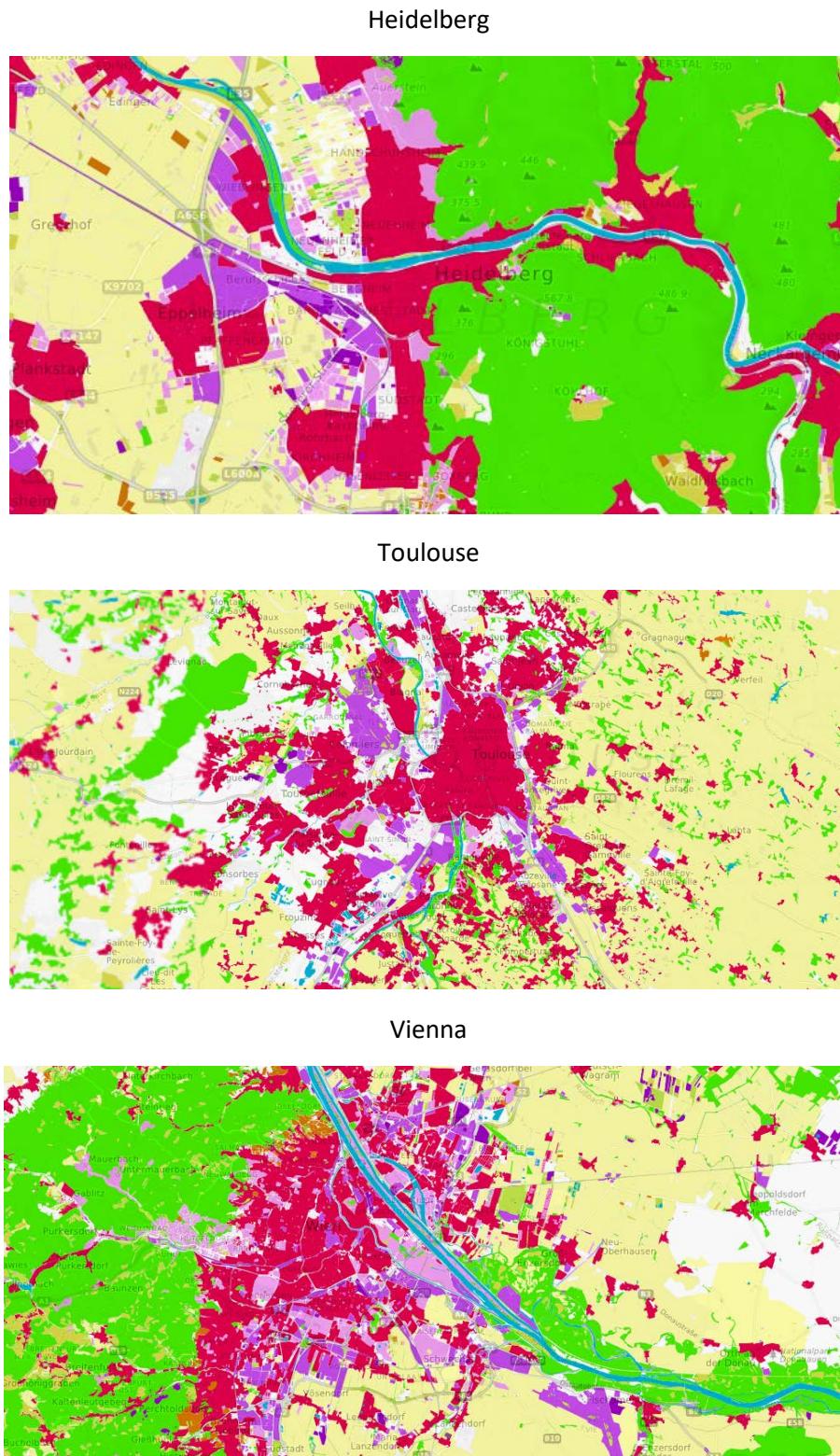


Figure 11: Crowd sourced osmlanduse products which were validated using City of Heidelberg's pilot of land use validation

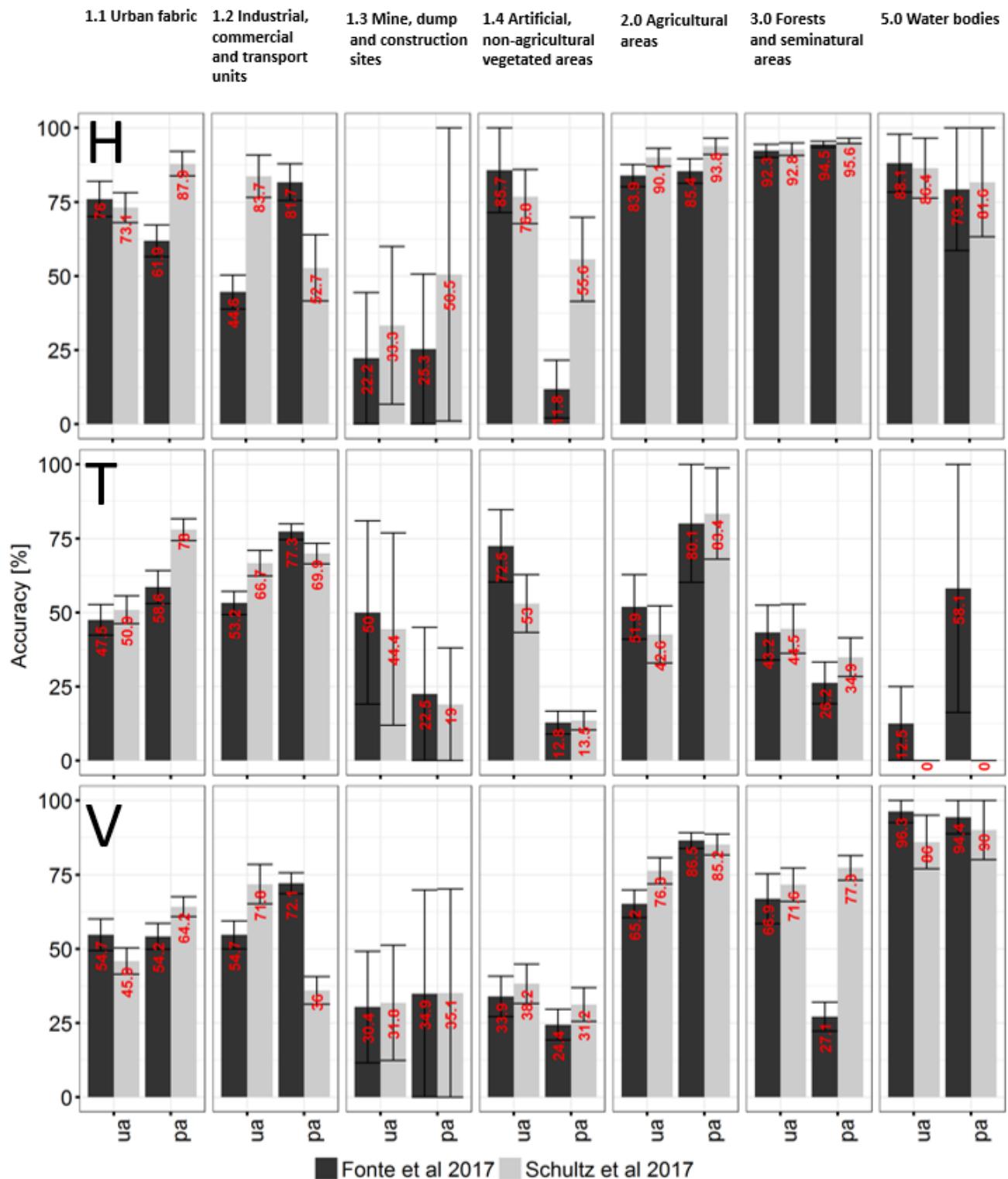


Figure 12: Class specific accuracies; ua = users accuracy, pa = producers accuracy, H = Heidelberg, V = Vienna, T = Toulouse

Our second campaign was part of a University seminar and filled missing reference points of the first campaign. The participants, 16 students, were trained in detail and thus produced reliable results suited for robust validation.

To identify agreement among users and thus strengthen credibility by understanding data uncertainties of our pilot case we recently performed a mapping campaign with 24 participants in Geneva where each reference point was interpreted at least 5 times. Thus, allowing conflicting opinions of different contributors. Figure 13 shows that usually only 44% of contributors agree on a reference point label while about 30% substantially agree. Reminding reference points are characterized by contributor's disagreement and therefore should be removed from the analysis.

Land use maps generated rely on OpenStreetMap (OSM) and Sentinel 2 data. Instead of Sentinel 2, very high resolution (VHR) data (<1m) is required and envisioned. First a sufficient number of reference points are interpreted by contributors during a validation campaign, where the amount of necessary reference points must be defined before the campaign. A lack of reference points can result in a high uncertainty of the estimation of class accuracy. Contributors do require a minimum understanding of remote sensing image interpretation, which is delivered before the mapathon activity. During the campaign a contributor is going through reference points using laco.wiki.net and results are pushed to the LandSense Engagement Platform (LEP) where they are further evaluated.

κ	Interpretation
< 0	Poor agreement
0.01 – 0.20	Slight agreement
0.21 – 0.40	Fair agreement
0.41 – 0.60	Moderate agreement
0.61 – 0.80	Substantial agreement
0.81 – 1.00	Almost perfect agreement

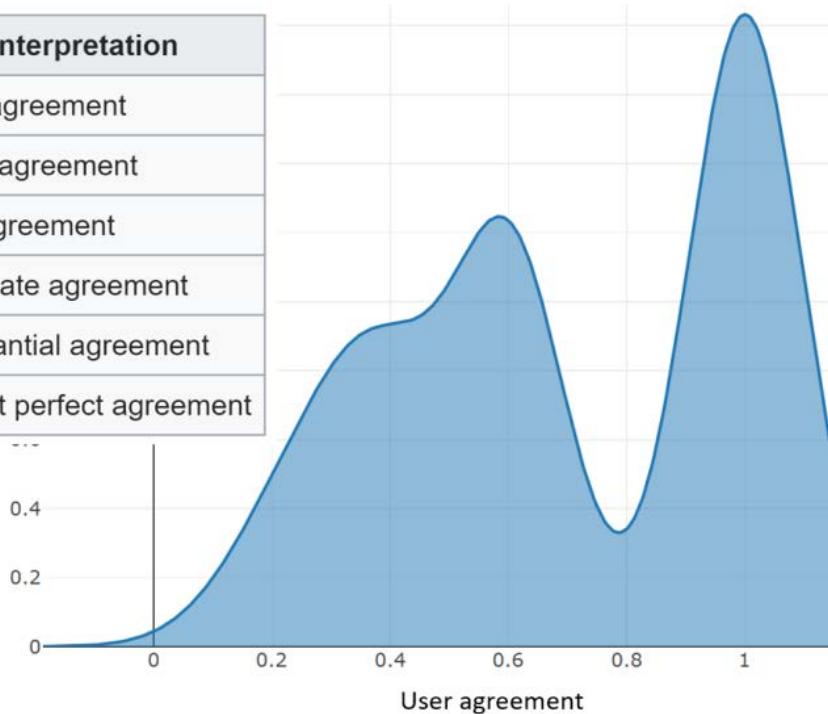


Figure 13: Contributor agreement calculated following scots PI

Key achievements

- Three successful mapping campaigns resulting in clear understanding of crowd sourced land use mapping and class specific suitability
- Understanding of validation inaccuracies through the application of agreement
- The crowd created and identified that Urban and industrial land use classes need further improvements, region specific differences and that agricultural as well as natural areas are characterized by high accuracy
- Heidelberg pilot identified that crowd sourced land use is particularly useful for rural and semi urban areas

Table 8 provides an overview of the current achievements, particularly important was the collection of an abundance of reference data (expressed as number of observations). Although the validation application is also available for mobile format usage is more convenient via the webform.

Table 8 Key performance indicators: Heidelberg

Metrics	Achieved	Targets
Number of installs	NA- Deployed in webform	-
Number of testers/users	60	> 60
Number of observations	6617	> 6617
Points covered by user	110.3 in average per user	Keep it stable
Media mentions	2	>2
Social media numbers	10	>10

Next steps - plans for the 2019 iteration -

- Increase of spatial resolution of land use maps
- Adaption of the classification legend for local case studies
- Improvement of Iaco-wiki.net for more convenient usage
- Gamification of validation process
- Collect and survey user requirements and active involvement of authoritative partners

6 Conclusions

All pilots contribute with their data to authoritative databases but have different kinds of connections with the institutions that are responsible for these databases: in the case of Toulouse the project partner is also owner of the database and has therefore the strongest link. In two other pilots (Vienna and Amsterdam) city departments are stakeholders and will actively use the data. The Heidelberg pilot will also support an official geographic information system. The activities in further defining needed interfaces for enhanced data conflation will be continued in the next months. Additionally, during the second phase of the engagement activities or the big public roll-out additional data for administrative databases will be collected and contribute to a better basis for decision making processes and land use planning.

Concerning the user engagement strategies all four pilots experienced (not completely unexpected) challenges. Not all stakeholders were as motivated as initially promised, not all students were as motivated as expected, not all inhabitants, park visitors or user groups were as active as the pilot teams wished for. Additionally, other effects could be observed e.g. significant number of app downloads still however led to low number of contributions. Environmentally sensitive persons as hikers could not be motivated to use the app etc. These obstacles are typical for many public apps and dealing with them was an important learning process for the pilot teams (that often have a rather technical/scientific than marketing background). In the Vienna and Amsterdam pilot it might be a barrier, that only perceptions, but not suggestions for improvement that can be implemented quickly can be made by the app. Both apps are not tools for complaining or for expressing wishes for changes because e.g. in Vienna already another tool for such reporting exists. In these first iterations important suggestions for further improvements of the app/websites could be collected via stakeholder suggestions as well as from reactions of other users.

All pilots discussed within their teams -and often also together with their stakeholders – the lessons learned from not so successful public relation activities and defined necessary steps to improve their engagement strategies. The pilot teams will use the last few months of 2018 and the 2019 iteration for new ways and intensified approaches to get the user groups and/or the public on board and contributing to LandSense applications.