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# Feedbacks on VGI in-situ campaign for updating LULC data

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**Abstract:**

This work is part of LandSense European H2020 project aiming to build a citizen platform for monitoring Land Use and Land Cover (LULC) data by integrating different types of information such as citizens-contributed data and proposing a set of services (Matheus et al., 2018). One of the pilot studies proposed in LandSense is to monitor urban dynamics to complement authoritative data sources. In this context, one of the goals of the French Mapping Agency (IGN France) is to study the potential of volunteered geographic information (VGI) (Goodchild, 2007) to enrich and update LULC authoritative database by engaging with citizens and several public authorities. The targeted database is OCS-GE containing LULC data (vector polygons) which is produced by IGN France for a 1: 5.000 scale use. A specificity of OCS-GE database is that both classes LU and LC are assigned to each polygon. Two distinct nomenclatures are in fact defined, each one containing three hierarchical levels. Though in the database, some of the classes are merged due to lack of in-situ information. It is especially the case for some LU classes. Another characteristic is that the database is dated (i.e. represents LULC at a given year) without intermediate versions between two releases (generally every 3 years). Thus, in this context three needs are identified:

- Detect LULC changes in order to facilitate updates in the next dated version of OCS-GE.
- Improve LULC data by dividing the merged classes in the database to better match the nomenclature.
- Update LULC data corresponding to the year of the OCS-GE (for the moment 2013 and 2016).

To fill in these needs different concepts and collaborative tools have been proposed (Olteanu-Raimond et al., 2018).

The goal of this paper is to present the defined strategy for running an in-situ campaign about LULC authoritative data monitoring and to give an overview about the data collected during the campaign. The campaign focused on five tasks:

1/ Adding new building information: primary use, secondary use, number of floors. Note that primary and secondary uses are drawn from the same list of values.

2/ Validating detected changes (CDV): outputs provided by the LandSense project corresponding to potential changes detected by using Sentinel images. Contributors are asked to confirm if a change actually occurred at the given location, and if so to fill in the new LU or LC classes.

3/ Updating the status of quarries: this task focuses on the quarry LU polygons that are in the initial OCS-GE database. Contributors are asked to indicate the status of a quarry as active, closed or abandoned.

4/ Updating the construction area LU class: this LU class corresponds to areas with work in progress. If construction work is finished, contributors are asked to update both LU and LC classes.

5/ Improving the information about the agricultural LU class: this task deals with points located in agricultural land use polygons and the goal is to indicate if points belong to an agriculture LU type (e.g. cultivated area) or not (e.g. residential area).

The study area is in Occitanie Region located in the south of France with a focus on the city of Toulouse, the south region of Toulouse, and the Parc Naturel Régional des Grands Causses. The in-situ campaign was running during four months from July to October 2018, during which contributors were encouraged to visit locations that correspond to a particular aspect of the landscape. In total, 60.321 point locations were selected to be checked. A mobile application named PAYSAGES and a semantic wiki (https://paysages.ign.fr/fr.wiki/fr/index.php/Accueil) were implemented for respectively collecting in-situ information and sharing information about data and collaborative procedures along with a community forum. Targeted contributors were citizens already involved or not in collaborative initiatives, public authorities and students within GIScience field. IGN France has triggered the campaign and the leadership was shared between academics, local territorial authorities and IGN France. Communication about the campaign was made via institutional accounts of social networks, in conferences, through professional meetings and with direct email contacts.

In total, 331 contributions corresponding to 277 locations have been collected: building (178 items), LU themes to validate corresponding to tasks 3, 4, and 5 (137 items), CDS (16 items) (see Table 1).

 
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| Theme | Number of contributions | Number of locations | Number of contributors |
|---|---|---|---|
| Buildings | 178 | 135 | 21 |
| LU validation | 137 | 128 | 18 |
| CDV | 16 | 14 | 10 |

Table 1. Summary of the contributions associated with the number of distinct locations and contributors.

Concerning the building attributes, the values are empty in the beginning of the process. There is no direct comparison with existing values prior to the collaborative contributions. Buildings have 103 unique LU values (no secondary LU). If distinct, first use and second use are mainly assigned with similar values such as “residential building, house” and “apartment building”, or “church” and “cathedral”. Though some secondary uses do not seem similar or as an extension of the first one, e.g. for the first use “hydroelectric plant” and “abbey” as second use. Some other values remain unclear, for instance, same places received multiple contributions by different authors, one would indicate a unique use and another contributor would indicate two different uses.

Concerning the tasks about change detection validation and the LU attributes, contributions modified initial values if differences between the database and the field were observed. Here is an overview of the contribution values. Among the 16 CDV inputs, they are respectively 7 items tagged as industrial and 7 items as residential. All contributions indicate a built-up cover, which is consistent with the detected types of change. The changes are from herbaceous vegetation, shrubs and forest to built-up cover. Though, two contributions indicate that no changes actually occurred in the field (built-up to built-up).

Within the 137 LU theme contributions, 79 concerned the construction areas, 50 the agricultural areas and 8 the status of quarries. For the construction area task (initially all with this LU value), 60 changes concern LC, 65 concern LU and 57 concern both LU and LC classes. Most contributions correspond to LC changes from “areas with mineral materials” and “herbaceous vegetation” to “built-up area”. The LU changes are mostly from “construction area” to “residential” and to “not currently used” (no possible edition for LC). For the agricultural area task, contributions indicate no modification in LC values, but all LU values have been modified to “residential” (see Figure 1). This raises the issue of the adequacy between contributors’ interpretations of the landscape and the defined databases specifications.


Figure 1. Example of visited locations (4 on the map) reported as changed from agricultural LU to residential LU.

For the quarries status task (LC = “areas with mineral materials” and LU = “mining and quarrying”), contributions involved no change for LC but changes for all LU values to “not currently used”.

In addition, 434 photos were taken in the field corresponding to 322 contributions (and 262 locations). 53 free text comments were also filled giving explanations concerning the contribution values (name, precise use), uncertainty (e.g. about a given class or the number of floors) and containing indications about the lack of visibility of the locations.

The results of the first campaign are promising, showing that in-situ contributions can be useful for improving and updating authoritative LULC data. Photos and texts comments, as well as other sources of information will be used in future research to assess the quality of the collected contributions (Li and Goodchild, 2012) and to generate a new snapshot for LULC database. Concerning the campaign, even if the tools were considered by most contributors as easy and friendly to use, the LULC information is a difficult topic for citizens. Contributors encountered difficulties in choosing the right LU or LC classes. One of the most important feedbacks of the campaign is the significance of the community of citizens who are willing to participate in such collaborative process. Creating a community around LULC monitoring is a difficult task and many efforts must be done to animate the community and give feedbacks to contributors. Targeted events such as mapathons (Schultz et al., 2017) or challenges would allow focusing contributors’ actions in precise tasks and explaining them expectations about the contributions (e.g. specifications of the LULC values). A second campaign within the LandSense project will be conducted in the course of 2019.