

# Monitoring of land cover change by citizens: The FotoQuest experience

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Center for Earth Observation and Citizen Science (EOCS)

Supported by the European Research Council



*Get the FotoQuest Go Europe app now!*



# Hello and welcome!

In these slides you will find a short description and comparison of the 2 FotoQuest campaigns (2015 and 2018) against Eurostat LUCAS.

The slides describe how the FotoQuest 2015 and 2018 interfaces and campaigns looked like. In the final slides, initial analyses comparing campaign results will be shown, but If you cannot wait for that here it is:

**FotoQuest 2018 did much better than 2015, and it keeps improving!**

Please enjoy and direct any questions to Juan Laso  
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**FotoQuest** is a mobile app for **citizens**  
to report land use and land cover at specific locations

The selected locations match **LUCAS:**

a Eurostat 3-yearly survey done by **paid surveyors** across Europe



**FotoQuest** interface **mimics LUCAS protocol**

....it tries to **understand citizens'** land cover/use **reporting accuracy**



FotoQuest  
Austria 2015

**FotoQuest** initial campaign: **2015**, in **Austria**.

Intermediate campaign: 2017 – Austria (to test new features).

**FotoQuest Europe-wide** campaign: **2018**



FotoQuestGo  
Europe 2018

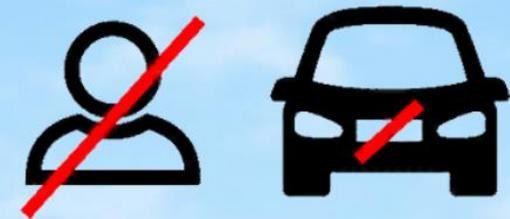


# FotoQuest uses the mobile phone GPS, compass and camera capabilities to guide participants to the selected locations

In both campaigns, the app **asked** and **guided** the user to take **pictures** in the four cardinal directions and **of the location** visited

It also only allowed to take pictures **only** once a user was **close enough** to the location or when an obstacle impeded access. It registered custom reasons such as "in private property"

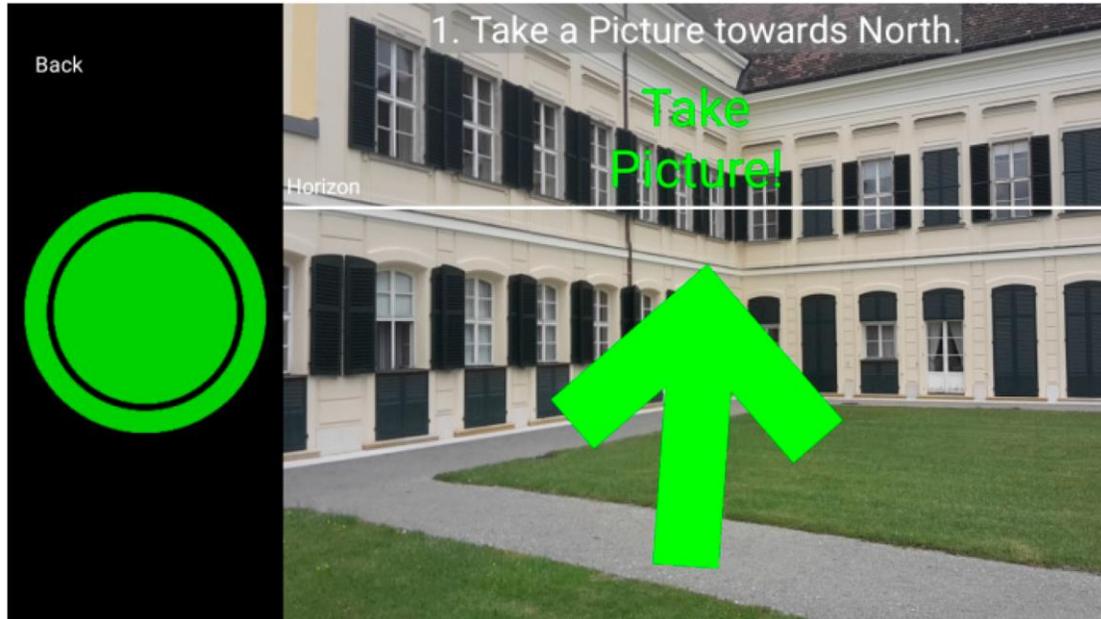
- Take photos of the landscape. Two-thirds of a picture should show the ground and one-third the sky.
- When taking photos when there is an obstruction (wall, building, hedgerow, etc.) just keep your device horizontal and disregard the rule above.
- As much as possible, avoid identifications of persons or property while taking the pictures (e.g. car identification plates or people's faces). You can also blur out parts of the images later.



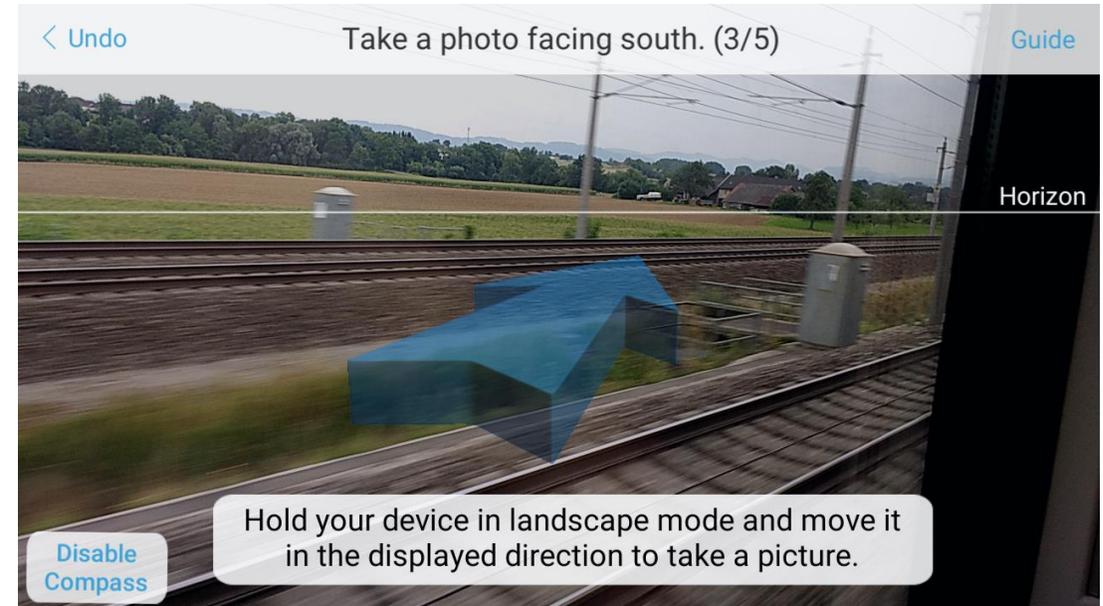
Ok

# FotoQuest: Picture taking

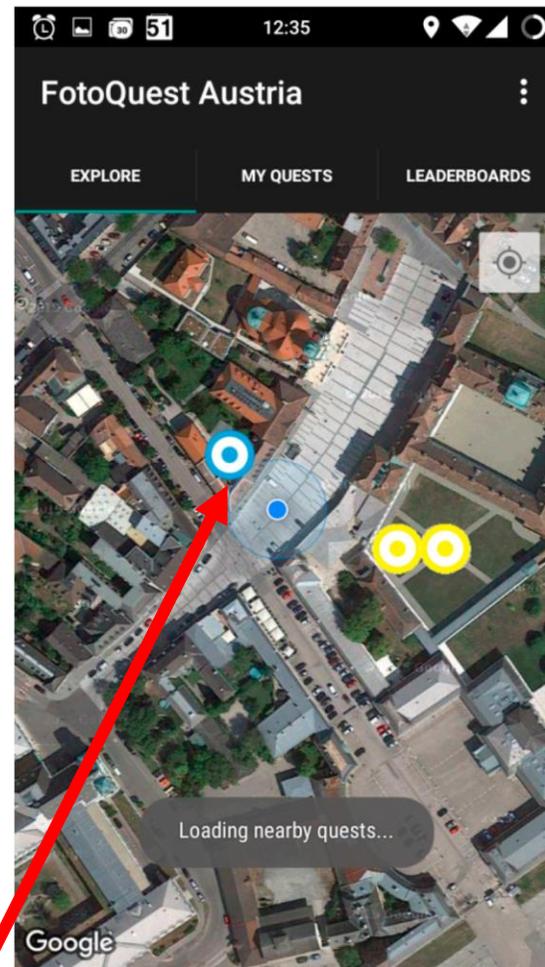
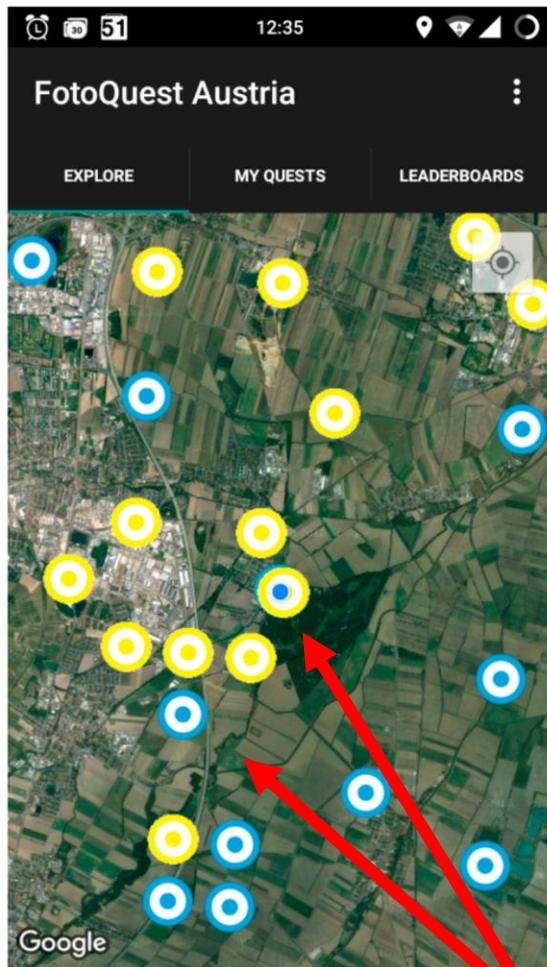
**In 2015**



**In 2018**



# FotoQuest Austria 2015: Interface



## Rewards:

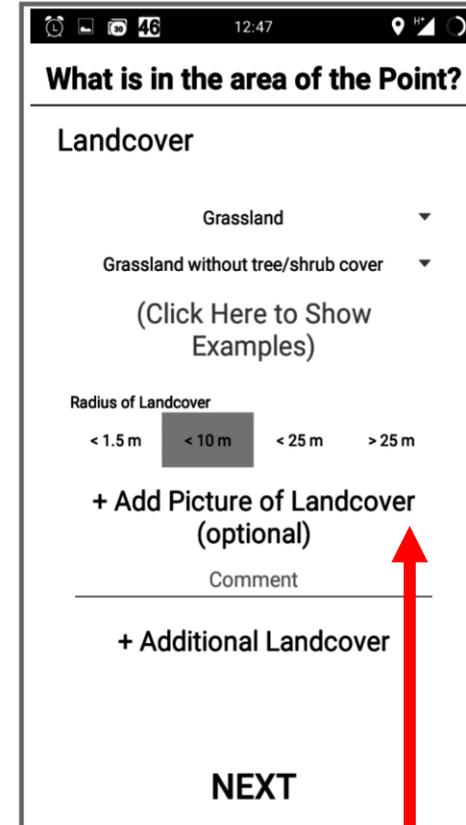
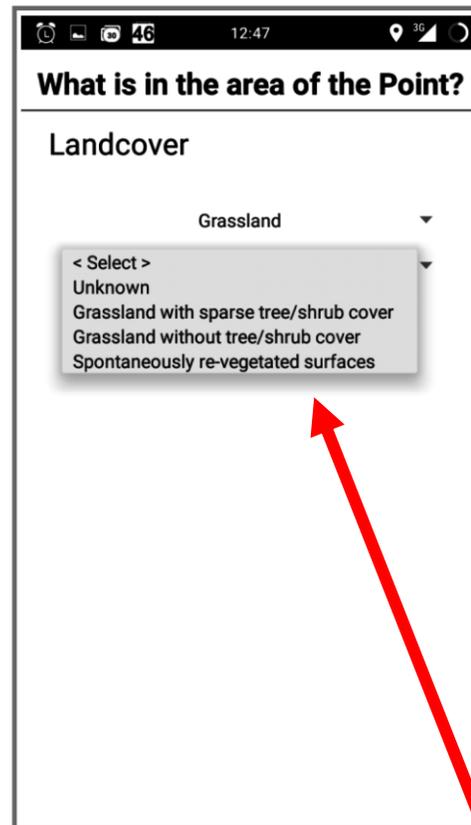
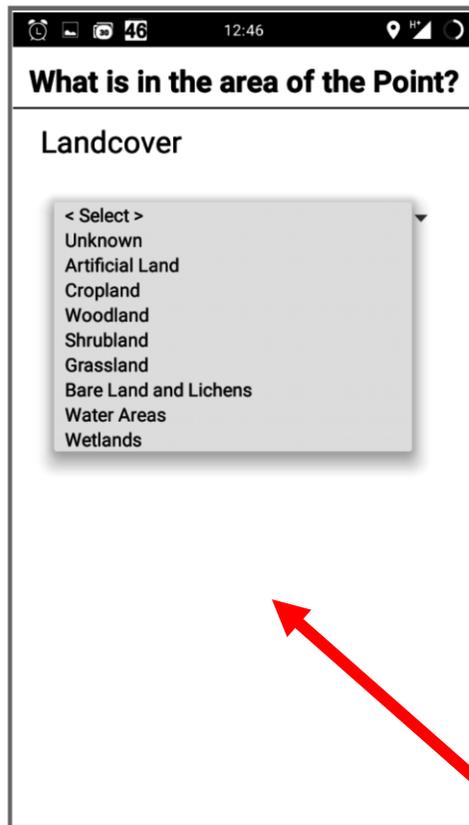
Citizens accumulated **points**

...and **prizes** were awarded at the end of the campaign to **top scoring** players (e.g. tablets, smartphone)

Available locations to visit and number of points to earn by visiting

(Figure source: adapted from *Laso Bayas et al. 2016, Remote Sensing*)

# FotoQuest Austria 2015: Land cover selection

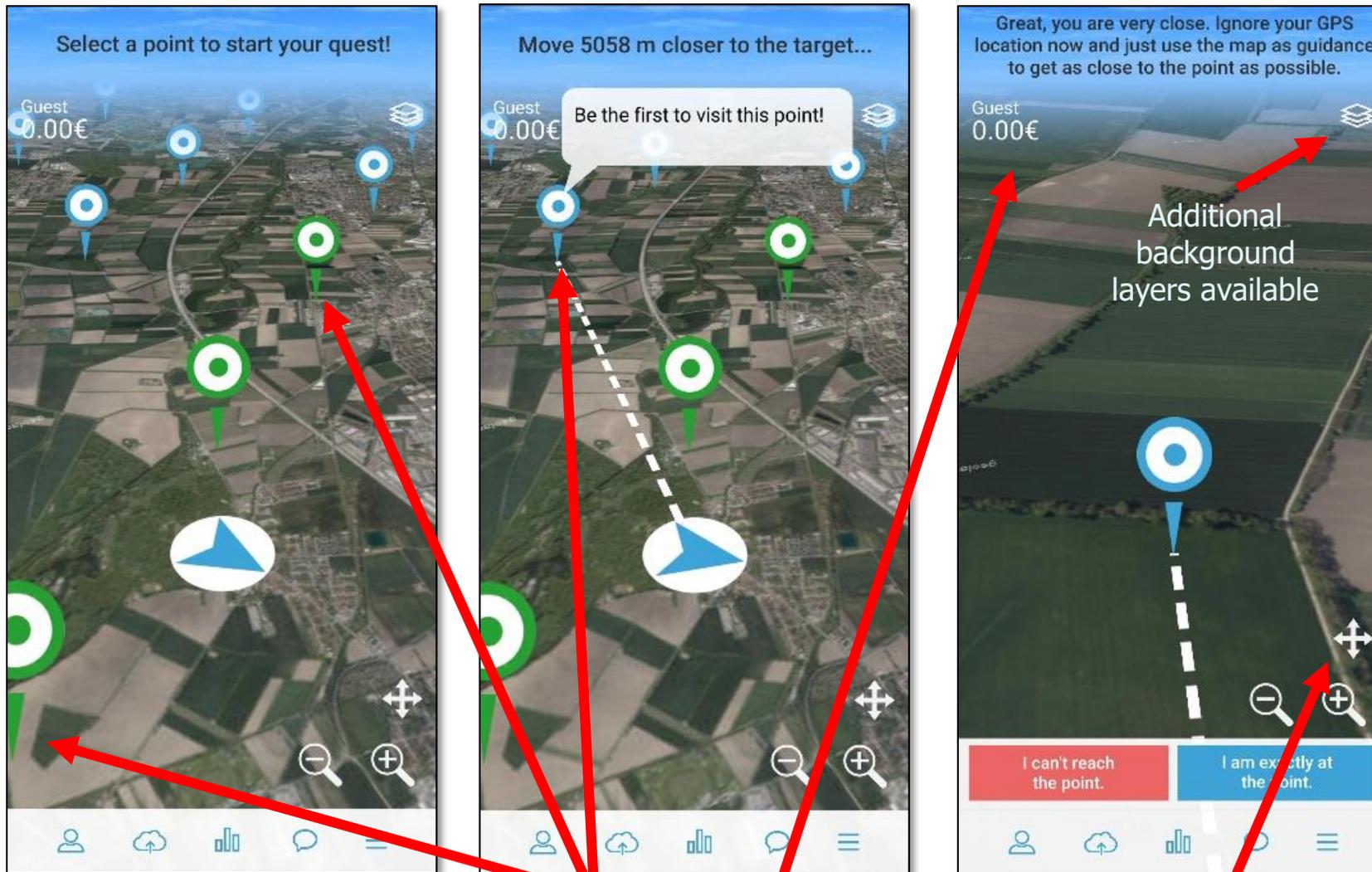


After taking pictures, users were asked to **select land cover** (and land use) at different levels, homogeneity radius of the observed land cover and could add additional land cover choices

Land cover selection at level 1, corresponding level 2 plus additional options

(Figure source: adapted from **Laso Bayas et al. 2016**, Remote Sensing)

# FotoQuest Go Europe 2018: Interface



## Rewards:

**Each location** visited awarded the participant between **1 to 3 Euros**, depending on the level of difficulty, e.g. €3 for visiting points on sites far from roads

**Weekly challenges** with 1 random point awarded **€30 Euros** to the first visitor

Available locations to visit, money (€) earned, and 2D/3D map view

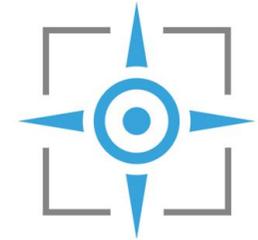
# FotoQuest Go Europe 2018: Change detection

In **2018**, users were first asked to determine if any **change** had happened

They were shown **LUCAS 2015 pictures** from each corresponding location.



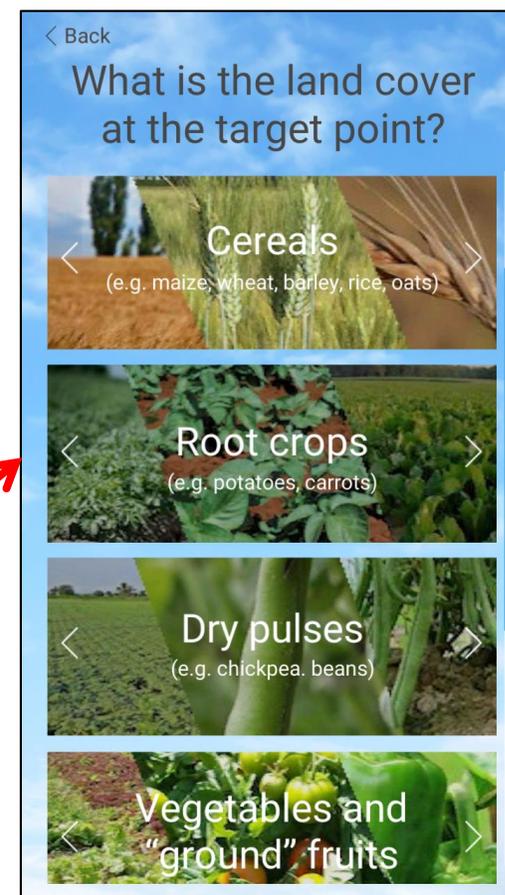
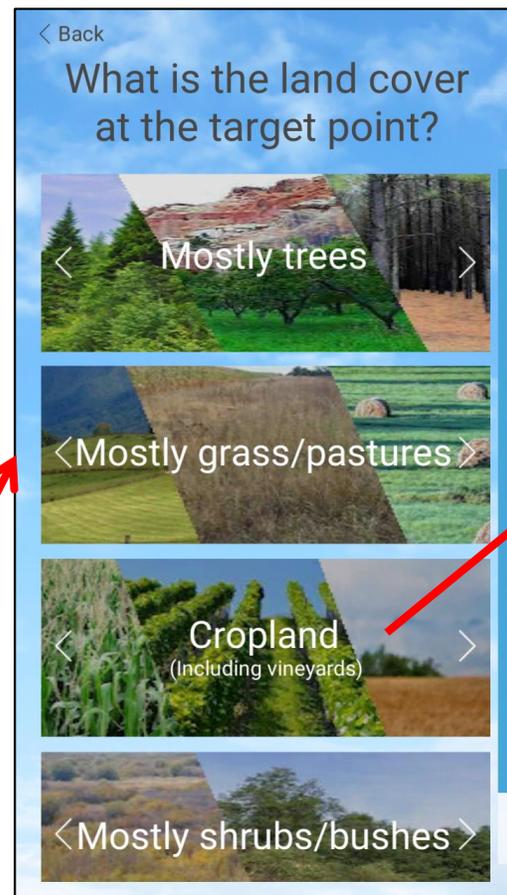
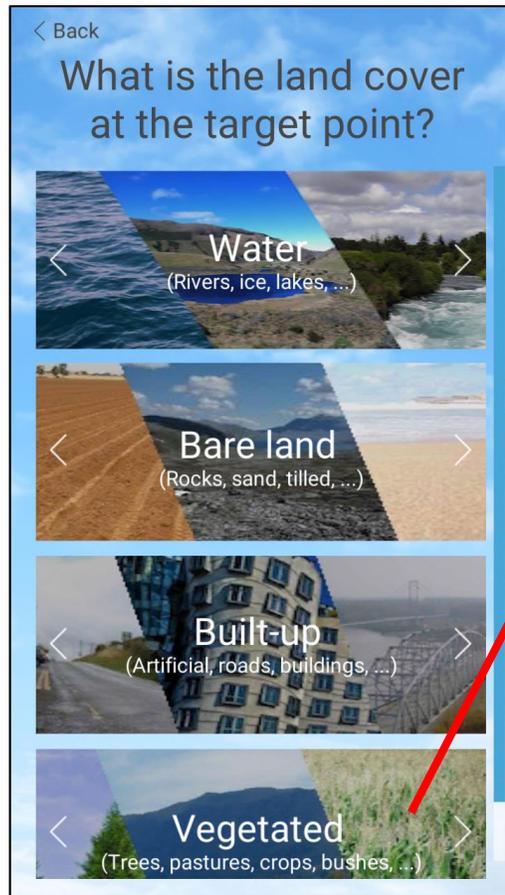
# FotoQuest Go Europe 2018: Land cover selection



FotoQuestGo  
Europe

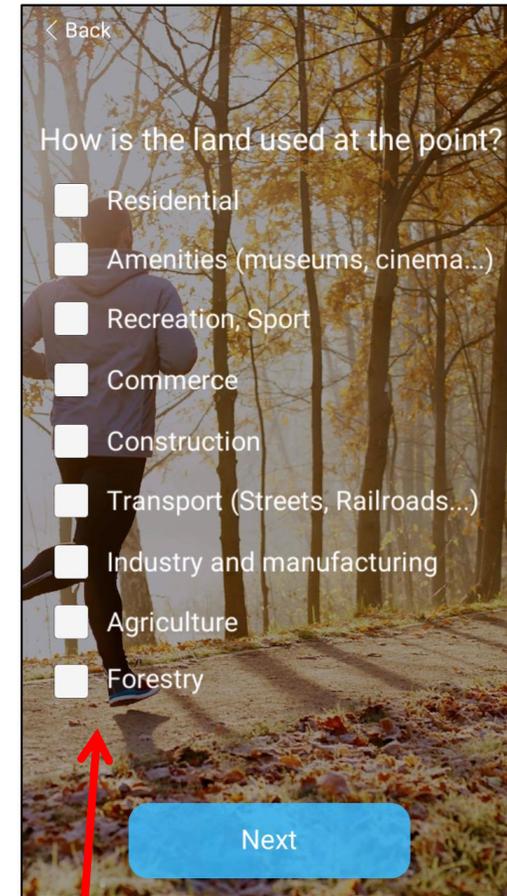
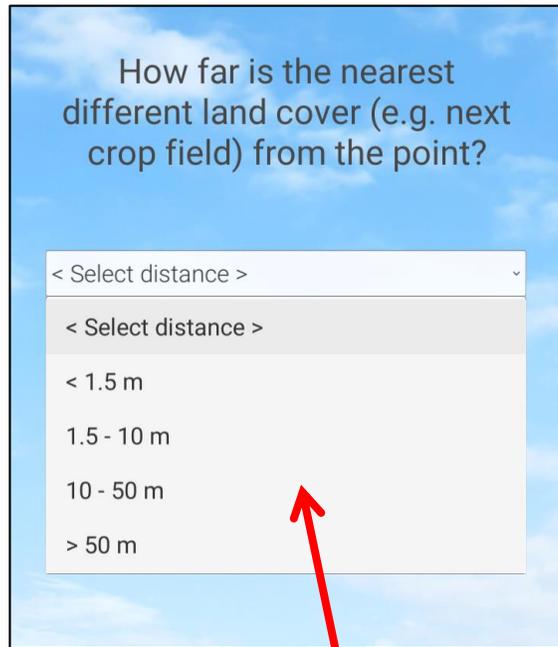
In 2018, whether **change** or **no change** was selected, users were asked to **take pictures**.

Those that selected change were asked to **select land cover** at different levels, using **picture-guided decision trees**



Land cover selection at level 1, corresponding level 2, and 3 sequentially

# FotoQuest Go Europe 2018: Homogeneity and land use selection



In 2018, **homogeneity** was asked with 4 potential categories as answers (range choices)

**Land use** selection was limited to a list of 9 options where users could **select up to 3 of them**

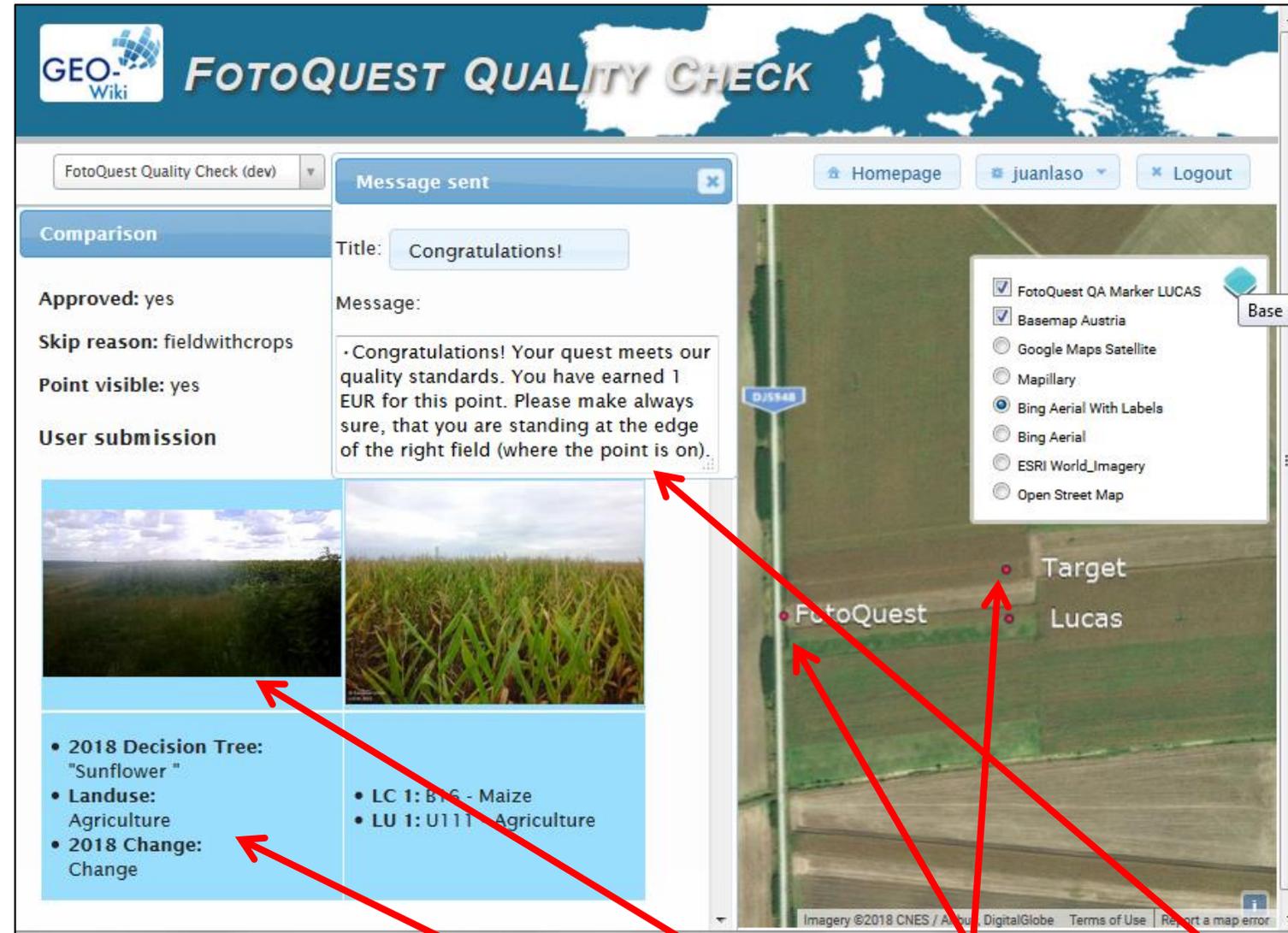
Land cover homogeneity (with examples shown) and land use class selection

# FotoQuest Go Europe 2018: NRT-Feedback



In 2018, a **near real time** system providing users **feedback in 1 day or less** on all submitted quests ran during the campaign.

The system was tested on the 2017 intermediate campaign



Geo-Wiki branch to visualize quests, compare pictures and distance, and send feedback

# Summary: Campaigns characteristics compared

2015:

- Only in **Austria**, quest could be visited more than once
- **Prizes** awarded **at the end** of the campaign, based on points/scoreboard
- Land cover decision tree not very user friendly nor guiding users
- No added layers and guides on the map
- No reference to past land cover status
- No near real-time feedback although users could communicate with IIASA
- **Massive media campaign**



2018:

- **Europe-wide**, quest can be visited only once
- **Training** was provided as videos accessible online
- **Rewards** were **immediate**, based upon approval from near real-time quality review
- **User friendly** graphical **land cover decision-tree** with mutually excluding hierarchical choices
- Several **auxiliary map layers** available
- **Change detection:** LUCAS 2015 pictures shown as reference
- Near real-time feedback and **quality control**



# Initial results compared



**76**

**Only Austria**

**1699**  
(~300 used for analyses)



**Number of users**



**Geographical reach**



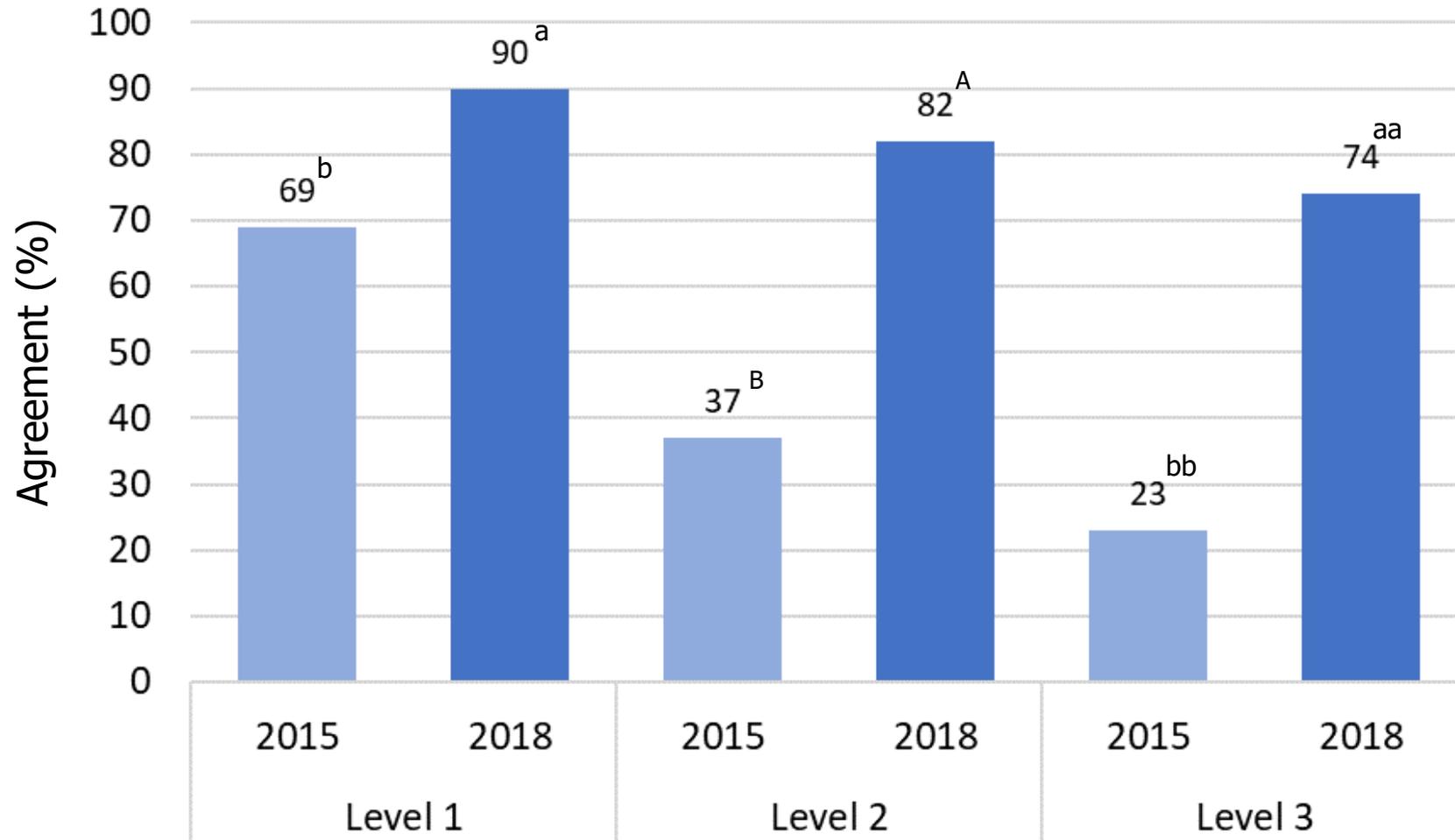
**Number of unique  
locations**

**140**

**18 EU countries**

**1612**  
(~700 used for analyses)

# Initial results compared



Land cover levels and FotoQuest campaigns

Letters show significant differences between campaigns at each level ( $\chi^2$  test,  $p < 0.001$ ,  $n_1 = 1006$ ,  $n_2 = 955$ ,  $n_3 = 696$ )

Land cover classifications done by the **2018 FotoQuest** participants were **2.9 to 3.5 times more likely to agree with LUCAS** survey results than those of the 2015 campaign

(Cochran-Mantel-Haenszel tests,  $p < 0.001$ ,  $n_1 = 1006$ ,  $n_2 = 955$ ,  $n_3 = 696$ )

# Initial conclusions and current work

- Improved protocol, visual guidance and choice restrictions (change/no change) approach allowed **2018 participants** to **have higher accuracy** than 2015 participants
- Near real-time feedback allowed some degree of quality control although more work is needed to separate effects: Participants were encouraged to participate despite sometimes not having high quality quests
- People are motivated to participate, but **promotion and support** is **needed for massive uptake**
- Cost analysis and full description of 2018 campaign (e.g. accuracy per class, effects of feedback) is being performed, but costs are clearly lower with very high quality results.

# More information on the FotoQuest Austria 2015:

Laso Bayas, J. C. *et al.* **Crowdsourcing In-Situ Data on Land Cover and Land Use Using Gamification and Mobile Technology.** *Remote Sens.* **8**, e905 (2016)

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Watch out soon for a full journal article describing the 2018 campaign and its results!

Thanks to **Michaela Busch** for her support providing NRT Feedback to participants

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Note: Unless specified, all figures shown in this presentation have the authors as sources

# Hope you enjoyed!

Please write your questions on the live chat session

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