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# FotoQuest Go: A Citizen Science App for Collecting In Situ Land Cover and Land Use Data

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# Context

- There is a **lack of in situ data** for training and validation of remotely sensed products, i.e., land use/land cover maps
- The Land Use Cover Area frame Survey (LUCAS) is one of the only freely available in situ data sets
- Takes place every 3 years, commissioned by Eurostat
- Professional surveyors visit around 250 to 300 K locations and document the land cover and land use
  - 4 photographs in 4 cardinal directions away from the location
  - 1 photograph at the location
  - Other information such as changes along a transect, soil data, etc.
- **Key question:** can we engage citizens to collect LUCAS style data to complement the LUCAS survey (temporal, spatial) and increase the amount of in situ data for Earth Observation purposes?



# FotoQuest Campaigns (+ one intermediate in 2017)

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 selection not user friendly nor guiding users
- No reference to past land cover or change
- No near real-time feedback although users could communicate with IIASA
- **Massive media campaign**

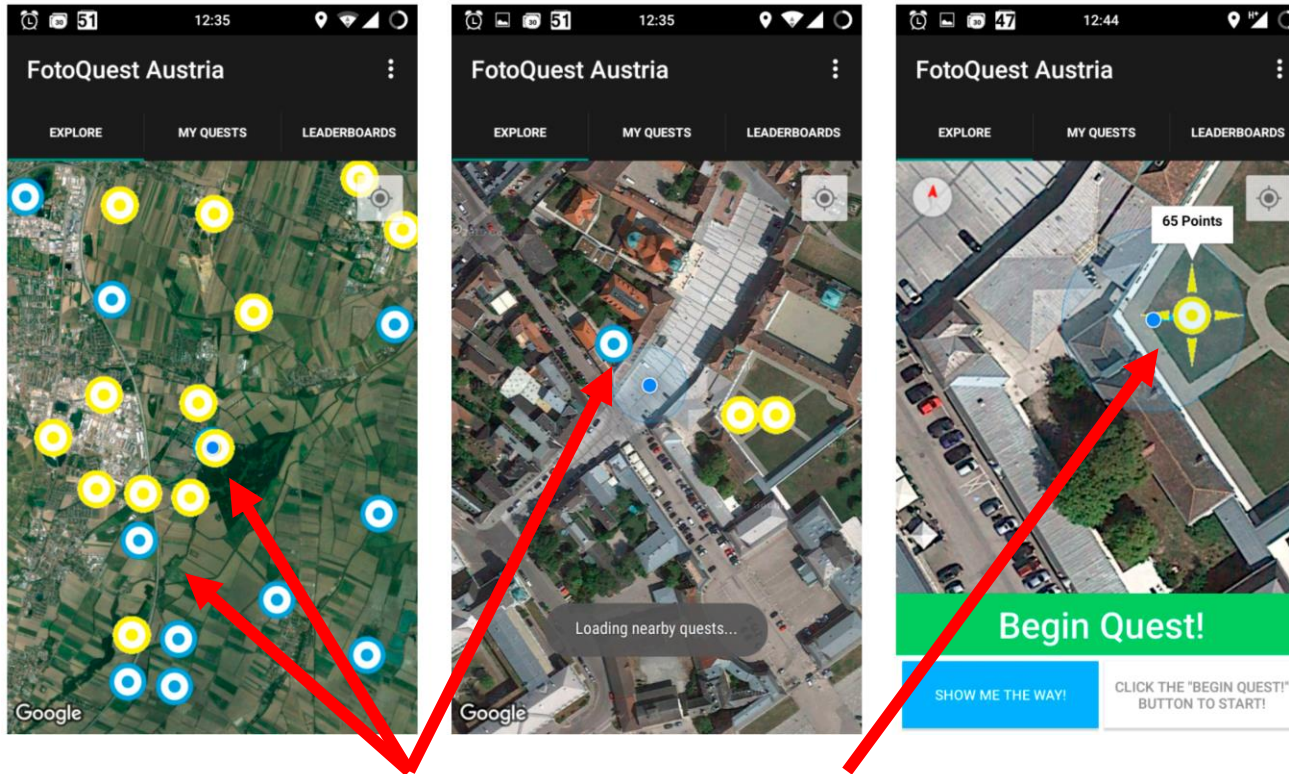
2018



- **Europe-wide**, quest can be visited only once
- **Training** was provided as videos accessible online
- **Rewards** were micro-payments, based upon approval from near real-time quality review
- **User-friendly visual land cover decision-tree**
- **Change detection added:** LUCAS 2015 pictures shown as reference
- Near real-time feedback and **quality control**



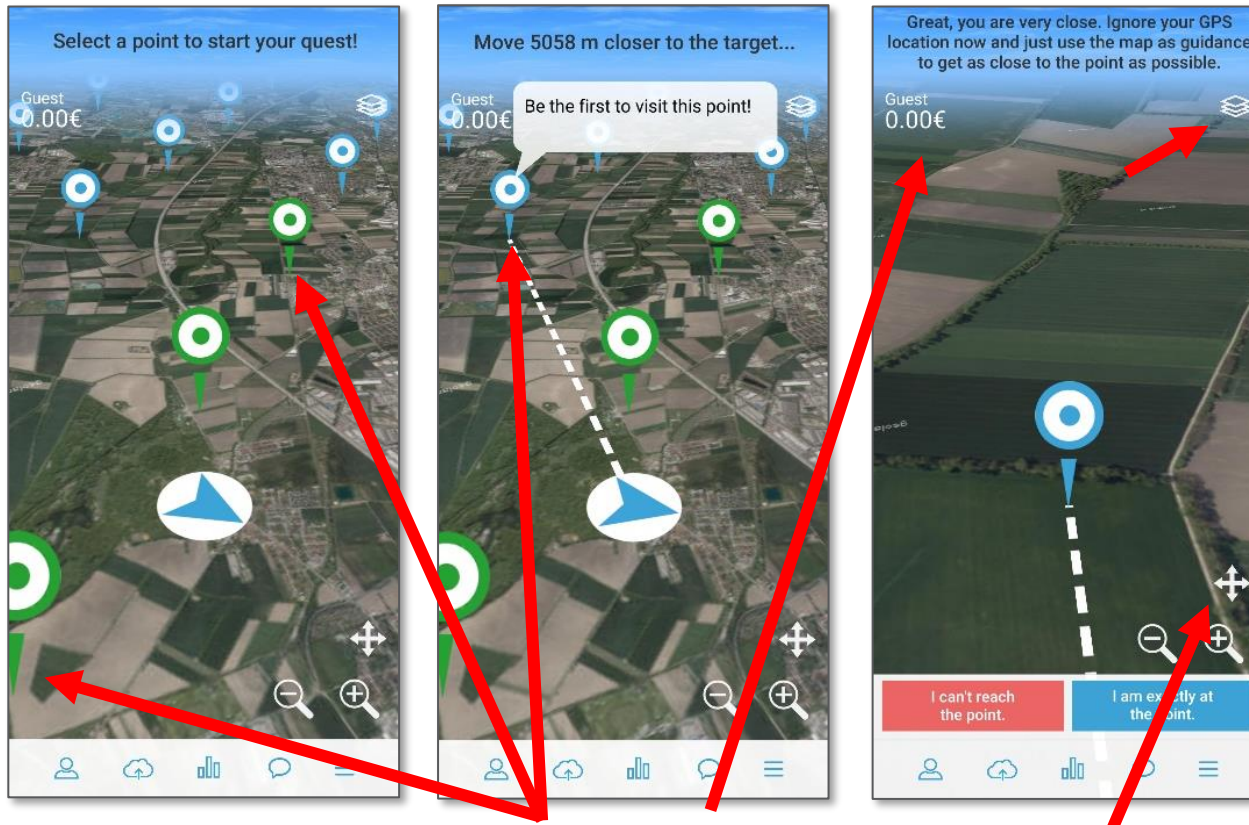
# FotoQuest Austria: First Campaign in 2015



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

- As an incentive, citizens accumulated **points** and **prizes** were awarded at the end of the campaign to **top scoring** players (e.g. tablets such as an iPad)

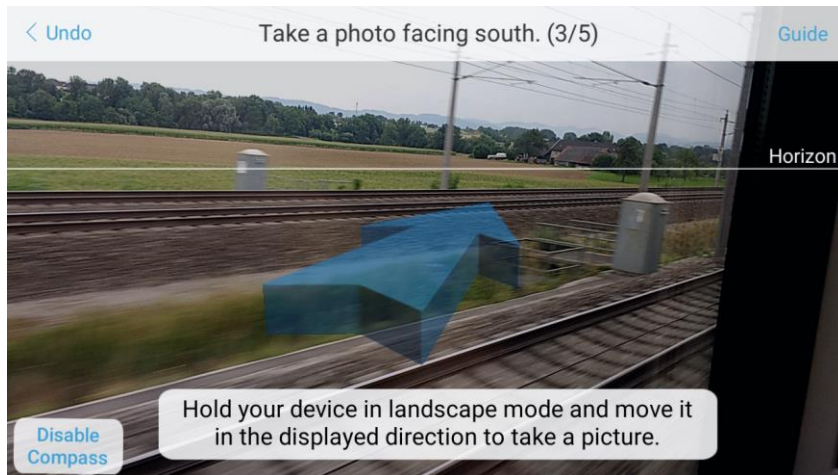
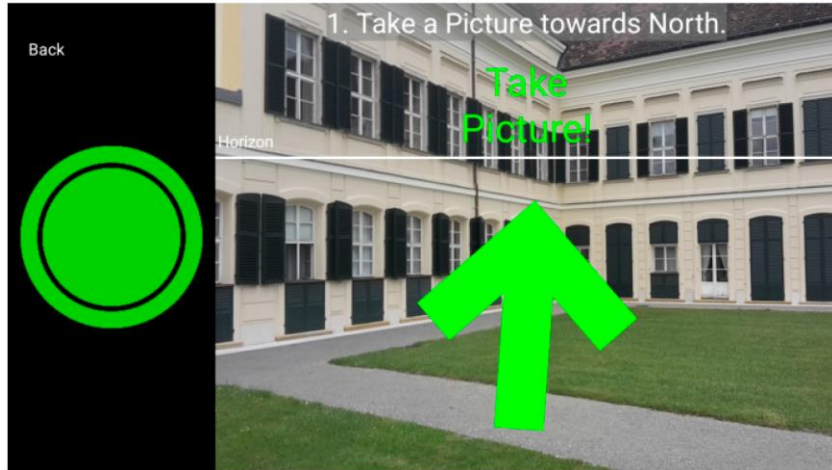
# FotoQuest Europe: Third Campaign in 2018



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

- **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

# Taking Advantage of Mobile Technology



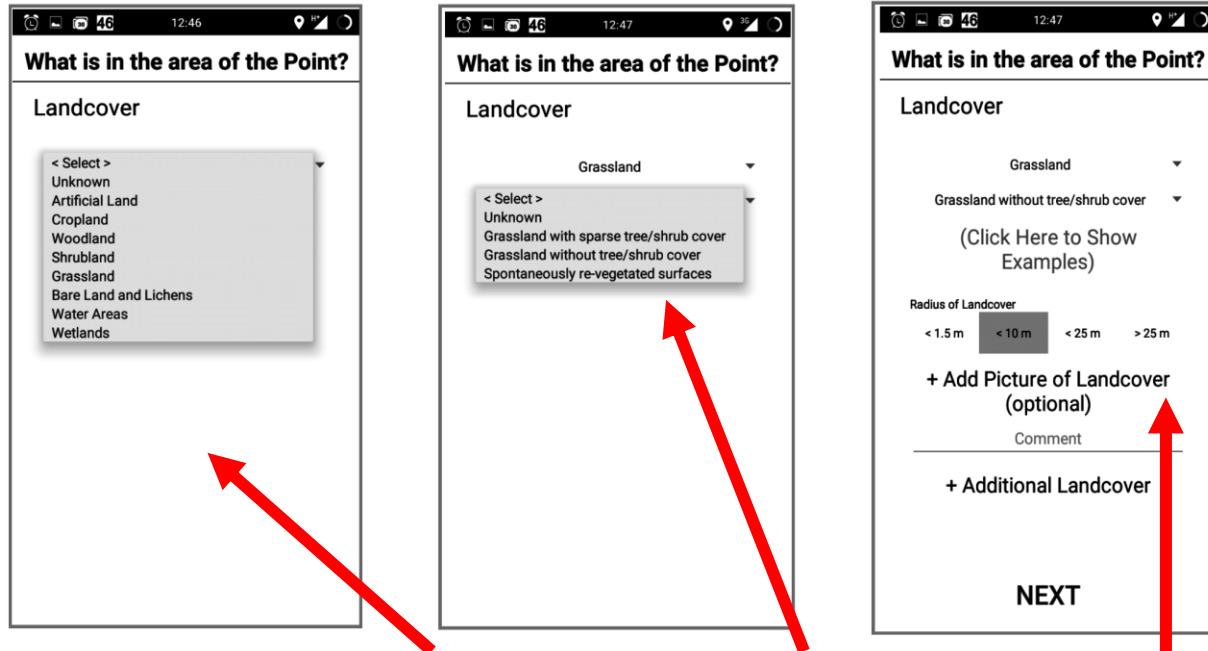
- GPS, Compass, Tilt

- 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

# Land Cover Selection in 2015



What is in the area of the Point?

Landcover

< Select >  
Unknown  
Artificial Land  
Cropland  
Woodland  
Shrubland  
Grassland  
Bare Land and Lichens  
Water Areas  
Wetlands

Grassland

< Select >  
Unknown  
Grassland with sparse tree/shrub cover  
Grassland without tree/shrub cover  
Spontaneously re-vegetated surfaces

Grassland

Grassland without tree/shrub cover

(Click Here to Show Examples)

Radius of Landcover

< 1.5 m < 10 m < 25 m > 25 m

+ Add Picture of Landcover (optional)

Comment

+ Additional Landcover

NEXT

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

- After taking pictures, users were asked to **select land cover** at different levels, homogeneity radius of the observed land cover and could add additional land cover choices
- Homogeneity makes the locations more usable for Earth Observation



# Land Cover Selection in 2018



- Land cover selection was guided through a visual decision tree

# Homogeneity and Land Use Selection (2018)

How far is the nearest different land cover (e.g. next crop field) from the point?

< Select distance >

< Select distance >

< 1.5 m

1.5 - 10 m

10 - 50 m

> 50 m



< Back

How is the land used at the point?

☐ Residential

☐ Amenities (museums, cinema...)

☐ Recreation, Sport

☐ Commerce

☐ Construction

☐ Transport (Streets, Railroads...)

☐ Industry and manufacturing

☐ Agriculture

☐ Forestry

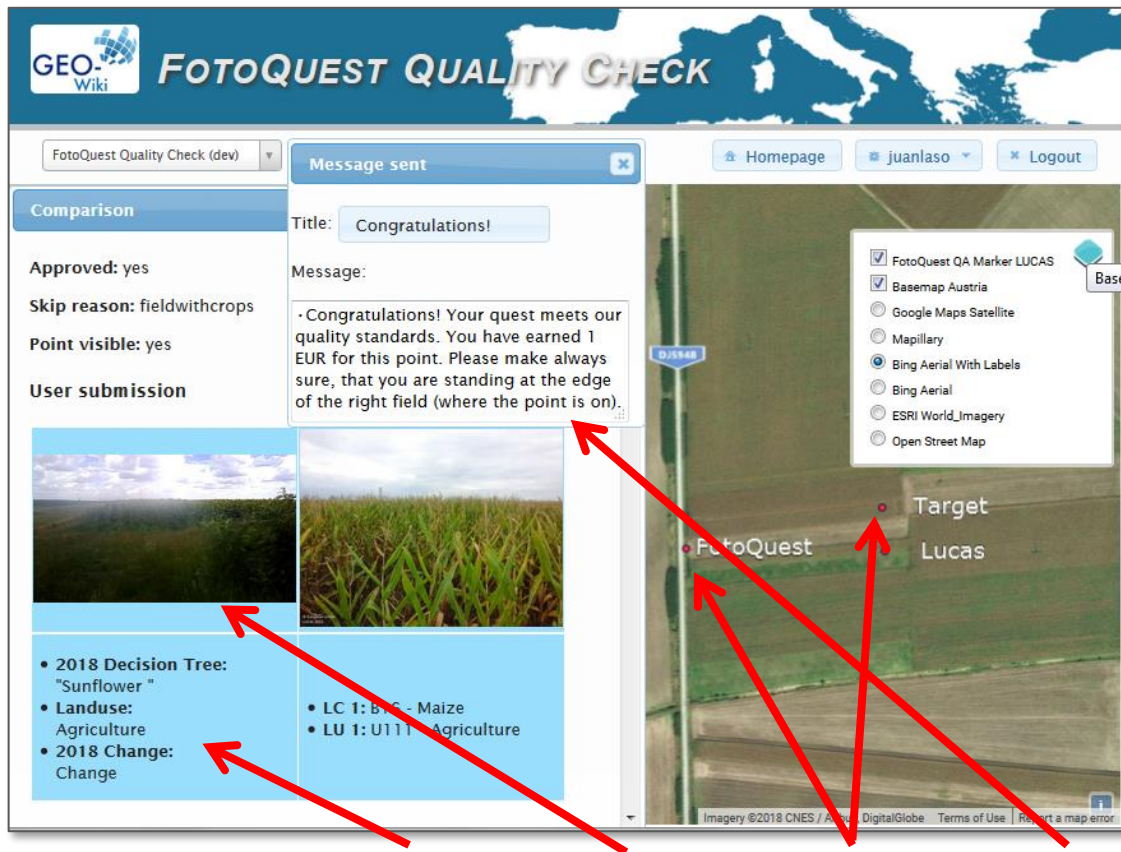
Next

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

- In 2018, **homogeneity** was selected from 4 categories
- **Land use** selection was limited to a list of 9 options where users could **select up to 3 of them**



# Near-real-time Feedback System (2017, 2018)



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

# Comparison of Campaigns



**76**

**Only Austria**

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



**Number of  
players**

**Geographical  
reach**



**Number of  
quests**

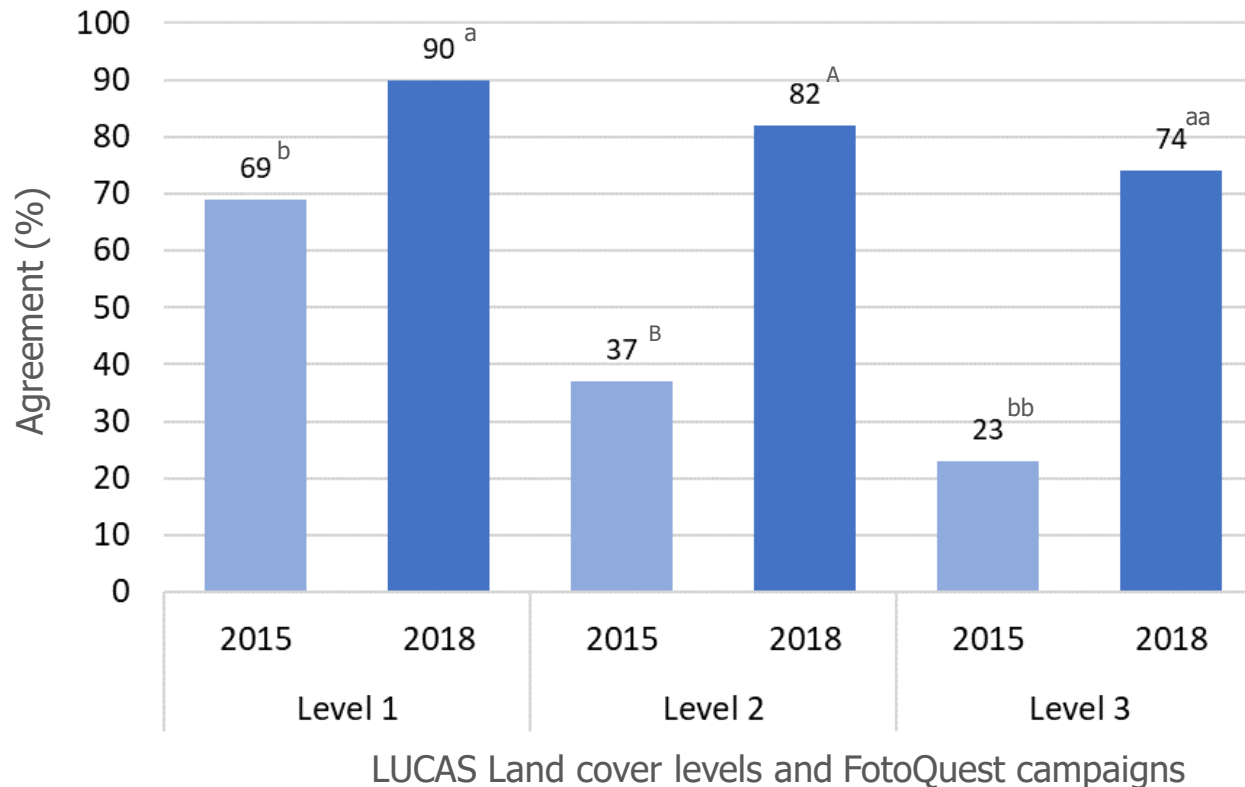
**140**

**18 EU  
countries**

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



# Some Results



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,  $p < 0.001$ ,  $n_1 = 1006$ ,  $n_2 = 955$ ,  $n_3 = 696$ )



## Some Conclusions

- Improved protocol and visual guidance resulted in **higher accuracy in 2018** compared to 2015
- Near real-time feedback allowed some degree of quality control but feedback with players on a regular basis provided a **'sense of community'**
- People are motivated to participate, but promotion and support would be needed for **massive** uptake
- Cost analysis and full description of 2018 campaign (e.g., accuracy per class, effects of feedback) is currently being undertaken but usable, high-quality results can be obtained of **relevance to Earth Observation**



# The Evolution of FotoQuest



<https://laco-wiki.net>

<https://paysages.ign.fr/>

Other apps built from FotoQuest are under development:

- CityOases
- Urundata
- FRAQuest



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**THANK YOU!**

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*Any Questions?*

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