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Crowdsourcing reference data collection for land cover and land use mapping: Findings from picture pile and FotoquestGo

FotoQuest Austria 2015

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FotoQuestGo Europe 2018

GEO-Wiki Center for Earth Observation and Citizen Science (EOCS)

Supported by the European Research Council erc

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EGU 2020: Sharing Geoscience Online, May 2020

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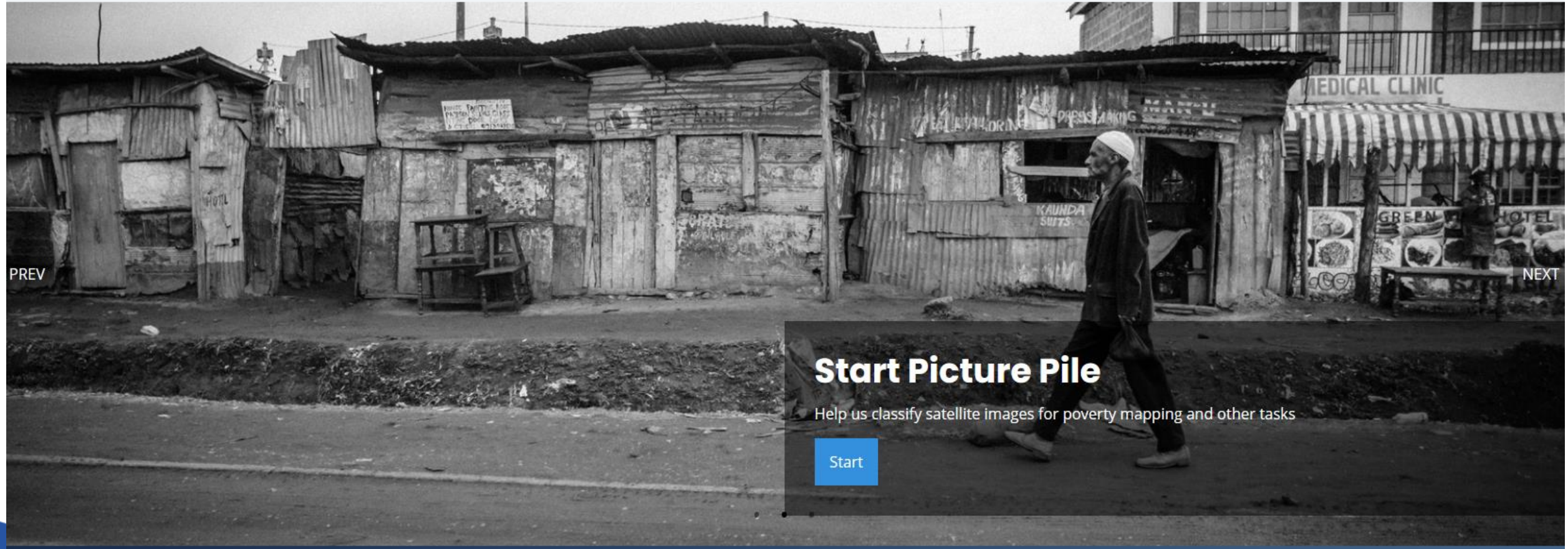

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Start Picture Pile

Help us classify satellite images for poverty mapping and other tasks

Start

"We use earth observation and citizen science to conduct research and provide innovative, cost

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).

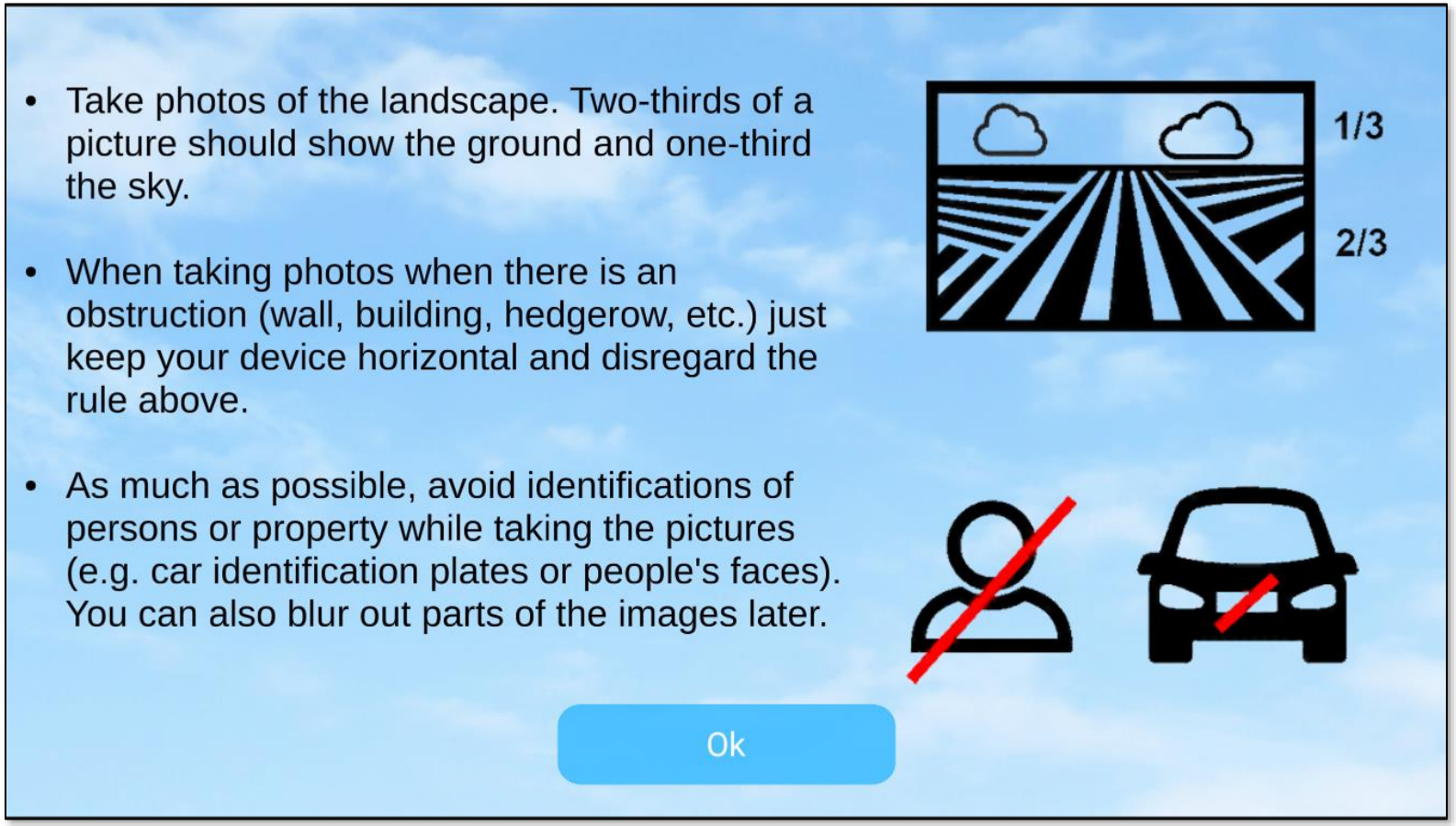
FotoQuest Europe-wide campaign: **2018**

FotoQuestGo Europe **2018**

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

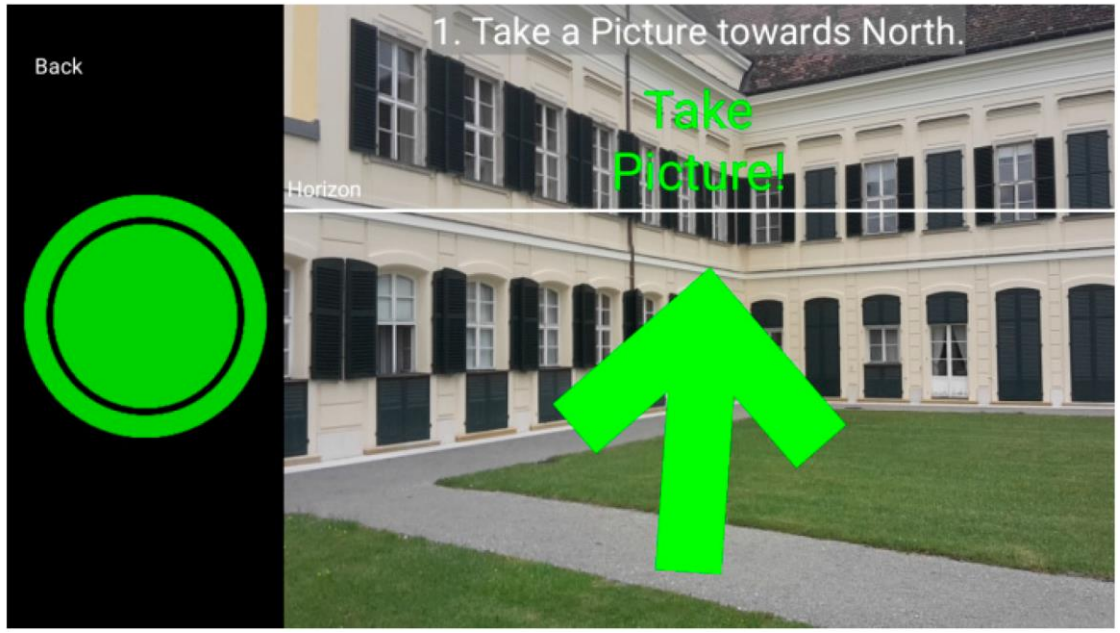
In both campaigns, the app **asked** and **guided** the user to take **pictures** in the four cardinal directions and **of the location** visited

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"



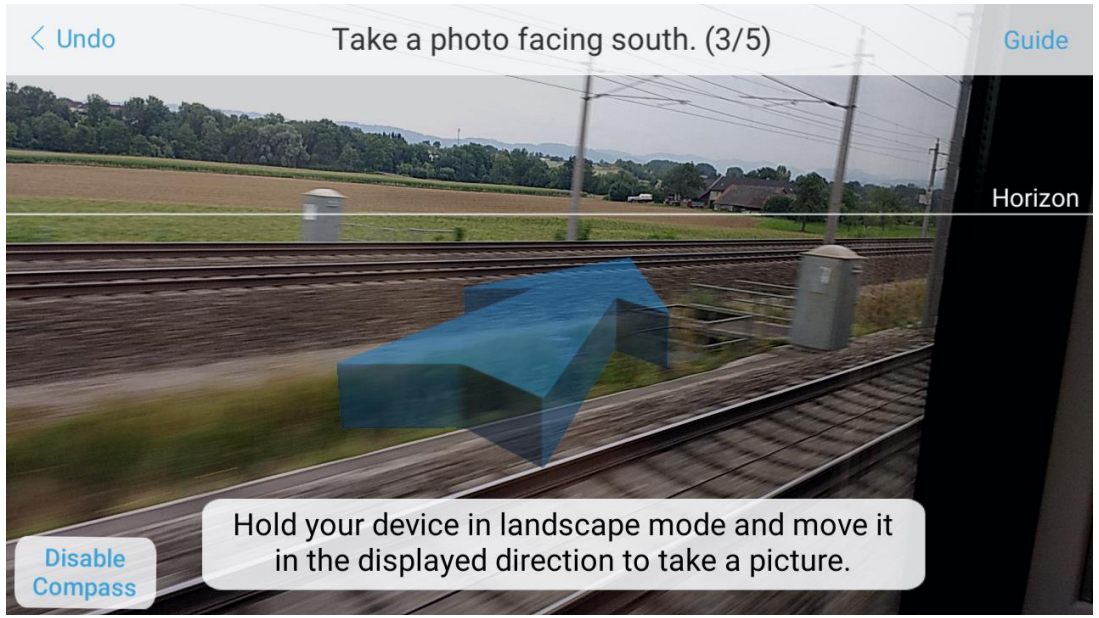
FotoQuest: Picture taking

In 2015



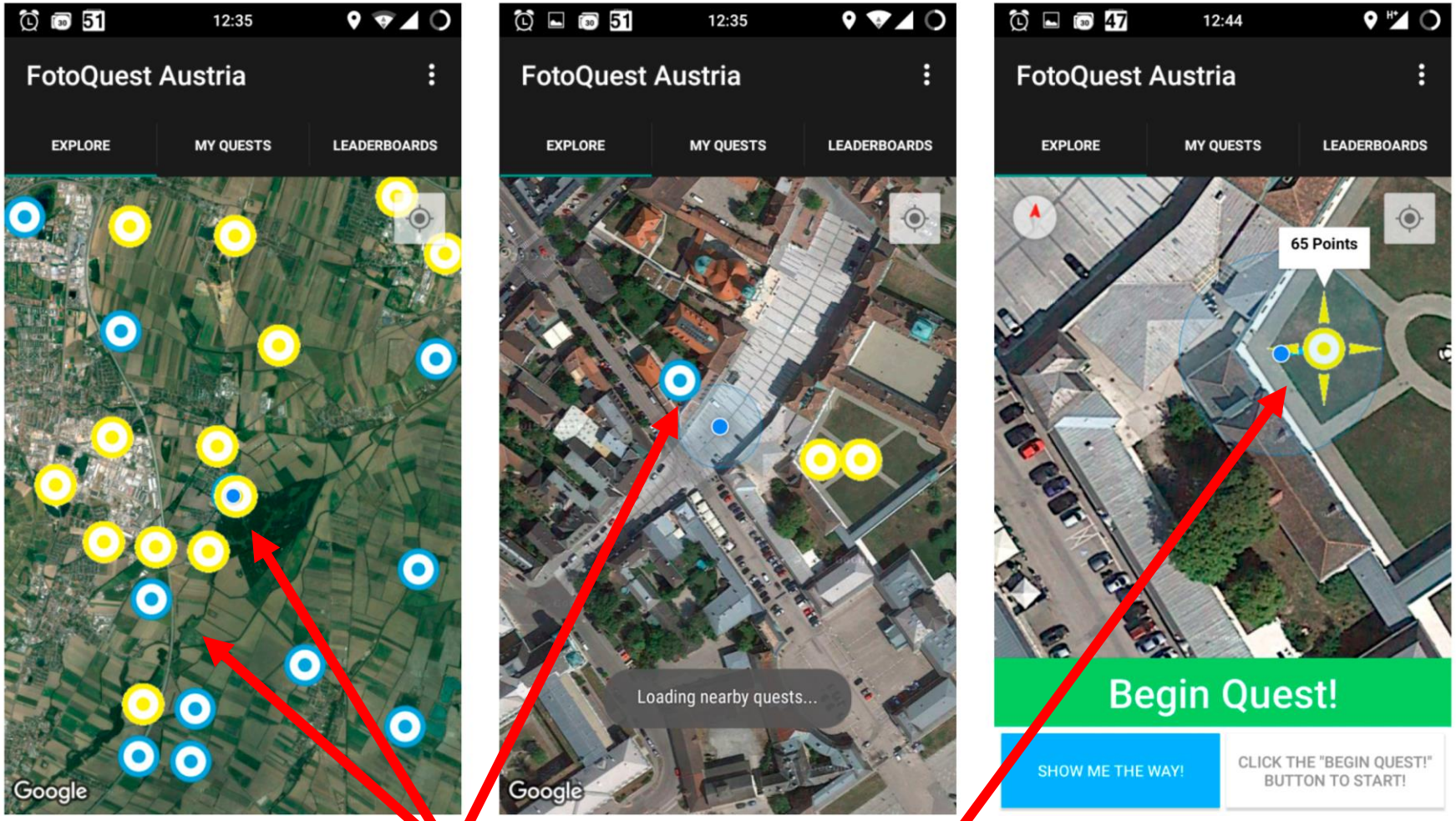
FotoQuest
Austria

In 2018



FotoQuestGo
Europe

FotoQuest Austria 2015: Interface



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

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

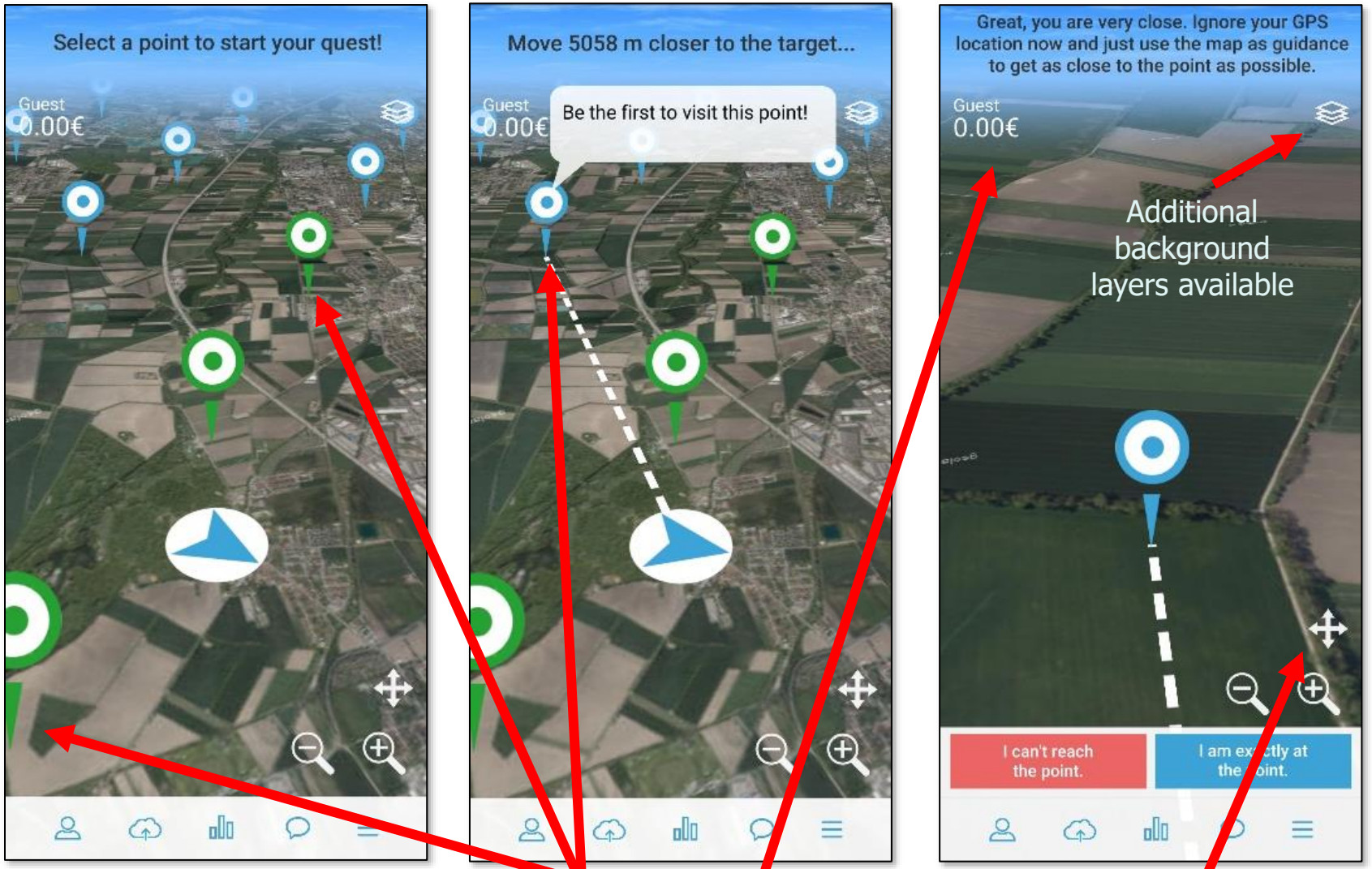
FotoQuest Austria

Rewards:

Citizens accumulated **points**

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

FotoQuest Go Europe 2018: Interface



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

FotoQuestGo Europe

Rewards:

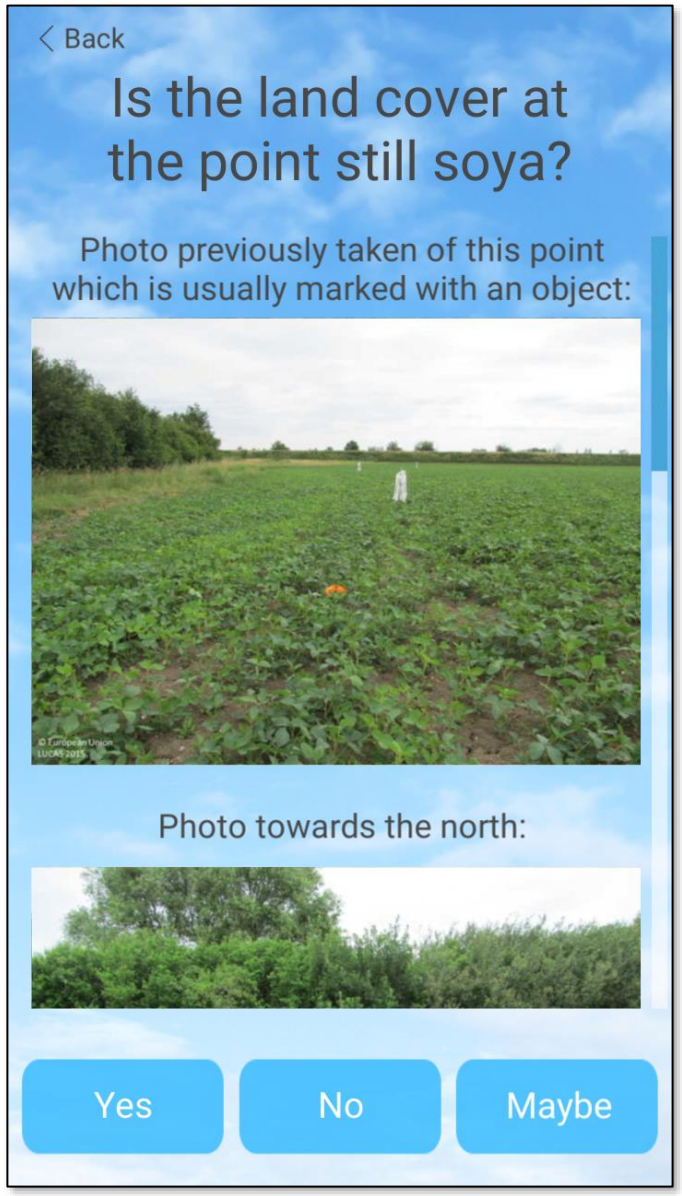
Each location visited awarded the participant between **1 to 3 Euros**, depending on the level of difficulty, e.g. €3 for visiting points on sites far from roads

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

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.



FotoQuestGo Europe

FotoQuest Go Europe 2018: Land cover selection

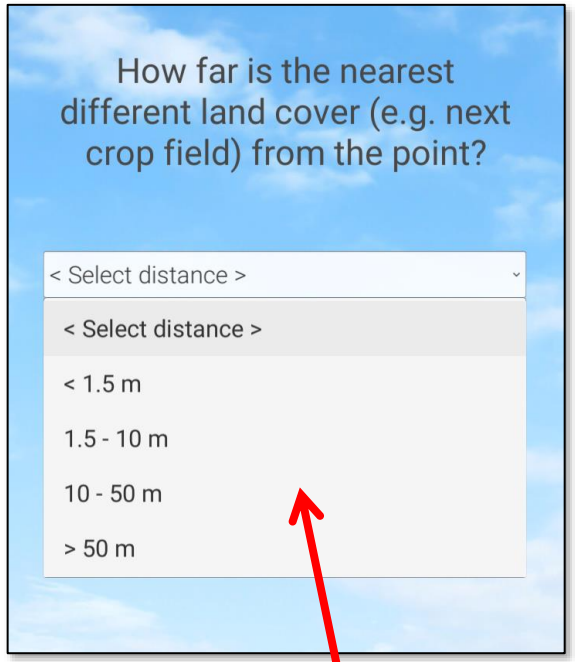
Land cover selection at level 1, corresponding level 2, and 3 sequentially

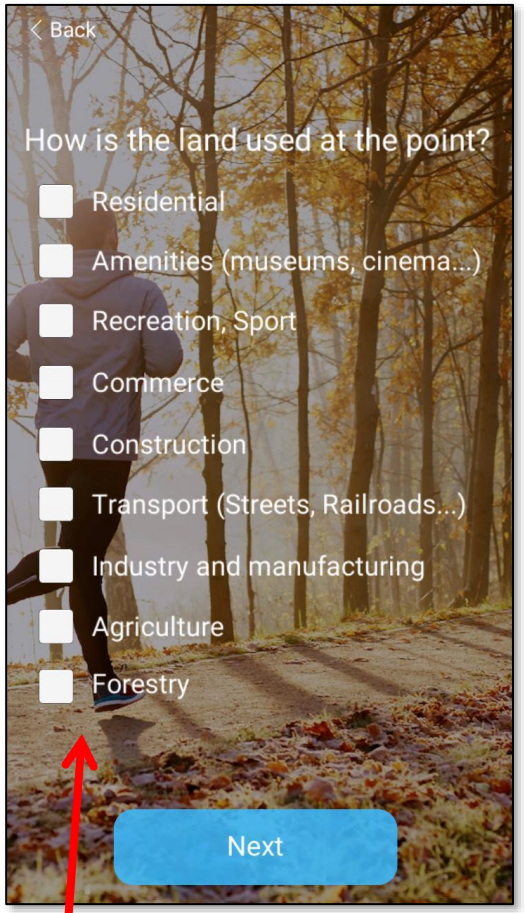
FotoQuestGo Europe

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**

FotoQuest Go Europe 2018: Homogeneity and land use selection





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

FotoQuestGo Europe

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

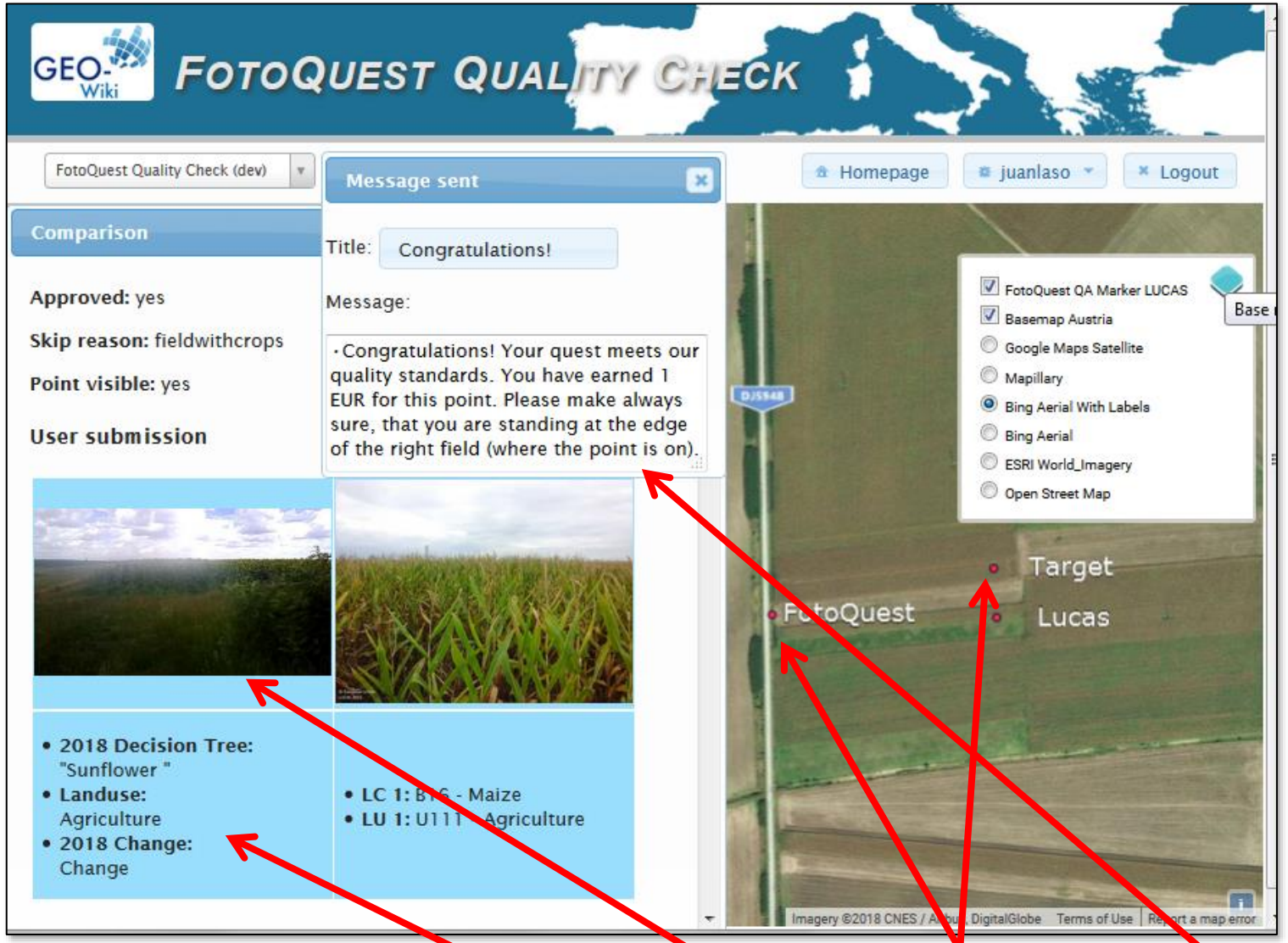
Land use selection was limited to a list of 9 options where users could **select up to 3 of them**

FotoQuest Go Europe 2018: NRT-Feedback

FotoQuestGo
Europe

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**

FotoQuest Austria

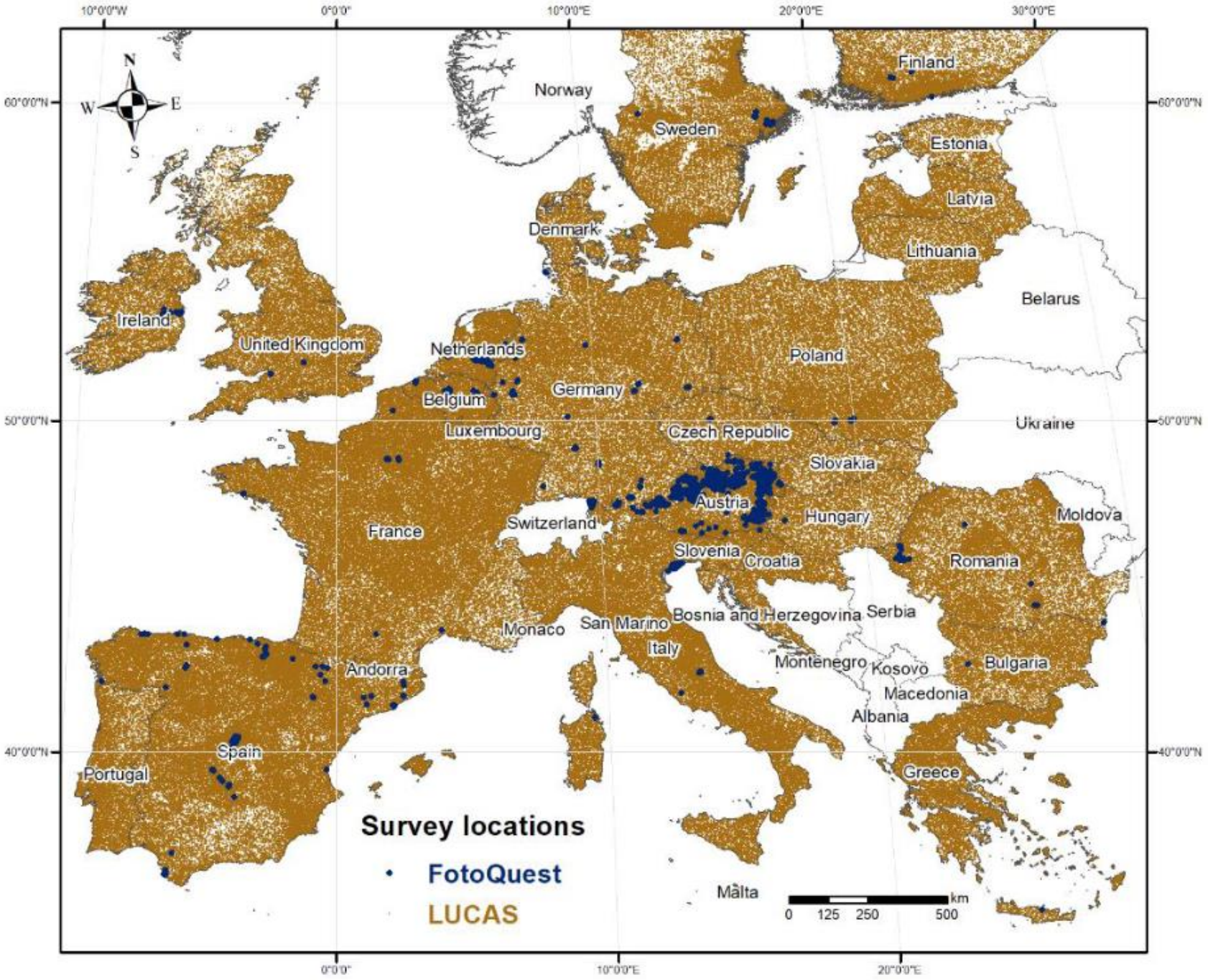
2018:

- **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**

FotoQuestGo Europe

Initial results compared

FotoQuest Austria 2015		FotoQuestGo Europe 2018
76	Number of users	140
Only Austria	Geographical reach	18 EU countries
1699 (~300 used for analyses)	Number of unique locations	1612 (~700 used for analyses)


10°0'0"W
0°0'0"
10°0'0"E
20°0'0"E
30°0'0"E
60°0'0"N
50°0'0"N
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Sweden
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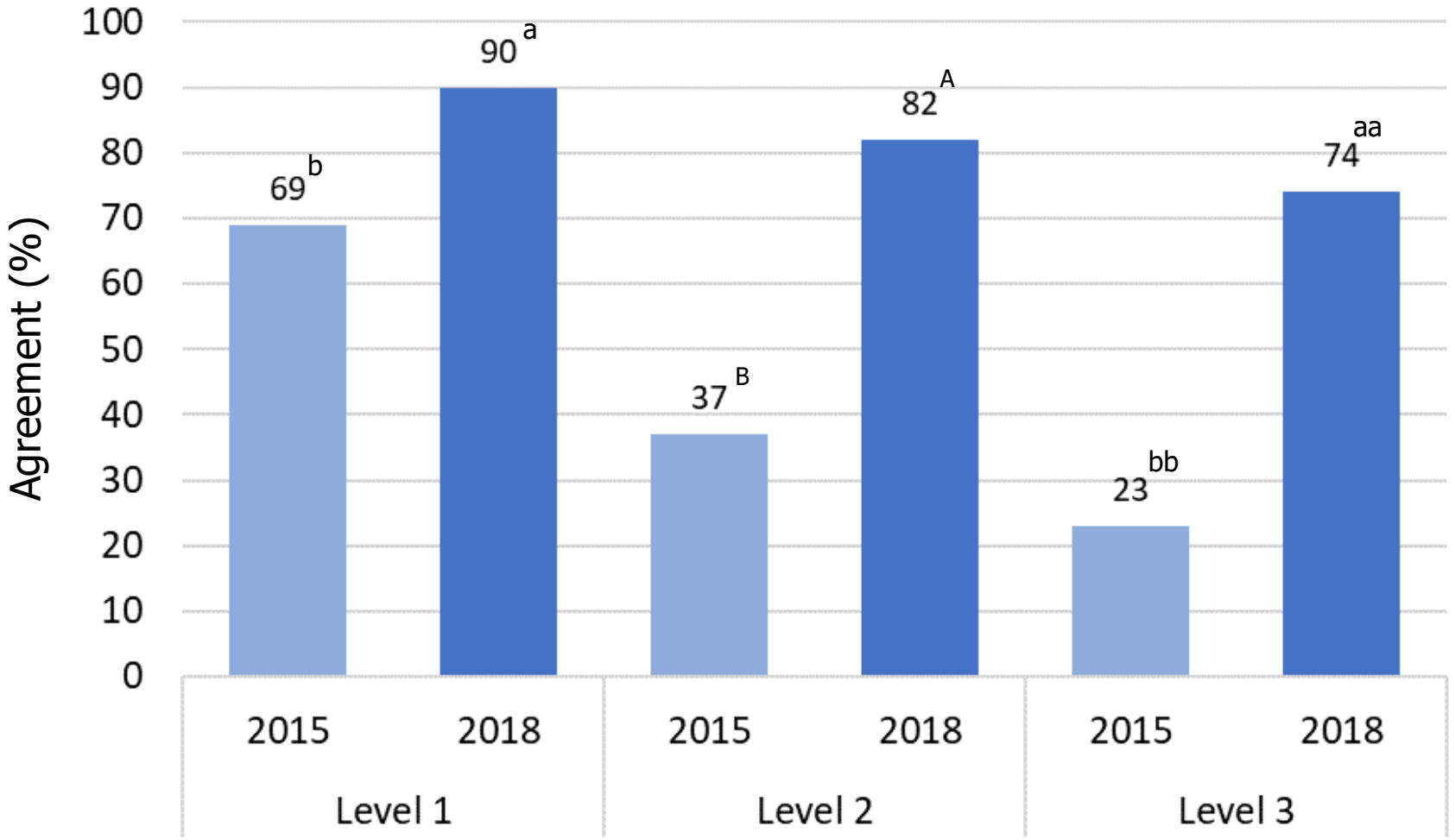
Slovenia
Croatia
Romania
Bosnia and Herzegovina
Serbia
Monaco
San Marino
Italy
Montenegro
Kosovo
Bulgaria
Andorra
Macedonia
Albania
Spain
Portugal
Greece
Survey locations
FotoQuest
LUCAS
Malta
km
0
125
250
500

Initial results compared



Land cover levels and FotoQuest campaigns

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

Table 5. Confusion matrix showing level 1 LC classifications from FotoQuest Go Europe and LUCAS 2018.

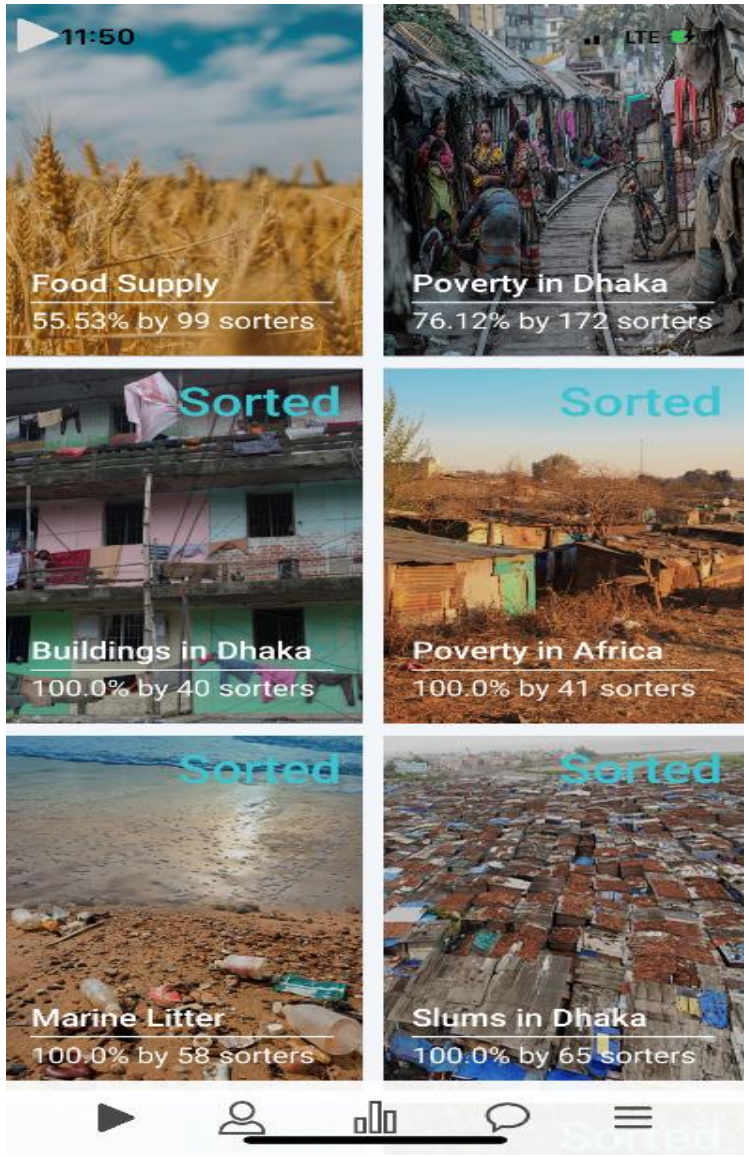
		Artificial	Cropland	Woodland	Shrubland	Grassland	Bareland	Water	Wetland	User Acc. (%)
FotoQuest Go Europe	Artificial	157	1	6	0	3	0	0	0	94
	Cropland	3	184	1	0	8	6	0	0	91
	Woodland	0	0	149	2	1	2	0	0	97
	Shrubland	1	0	1	10	2	0	0	0	71
	Grassland	8	14	9	2	121	0	0	0	79
	Bare land	0	4	0	0	0	3	0	0	43
	Water	0	0	0	0	1	0	8	0	89
	Wetland	1	0	0	0	0	0	0	3	75
	Prod. Acc. (%)	92	92	86	94	82	0	100	100	

More information on the FotoQuest Austria 2015:

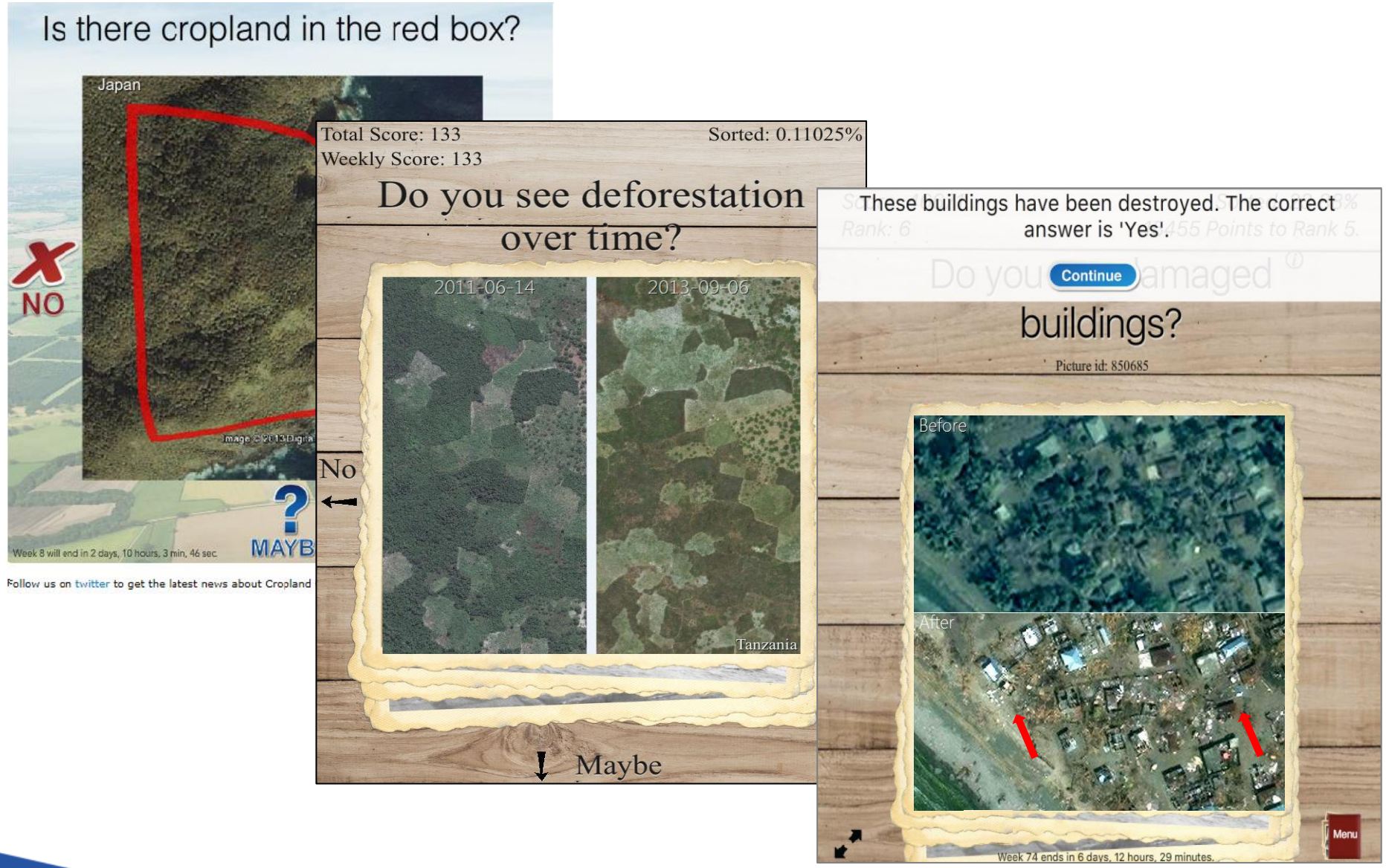
Laso Bayas, J. C. *et al.* **Crowdsourcing In-Situ Data on Land Cover and Land Use Using Gamification and Mobile Technology**. *Remote Sens.* **8**, e905 (2016)

Crowdsourcing LUCAS: **Citizens GeneratingReference Land Cover and Land Use Data with a Mobile App**, Land, 9, 446 (2020)

- Picture Pile



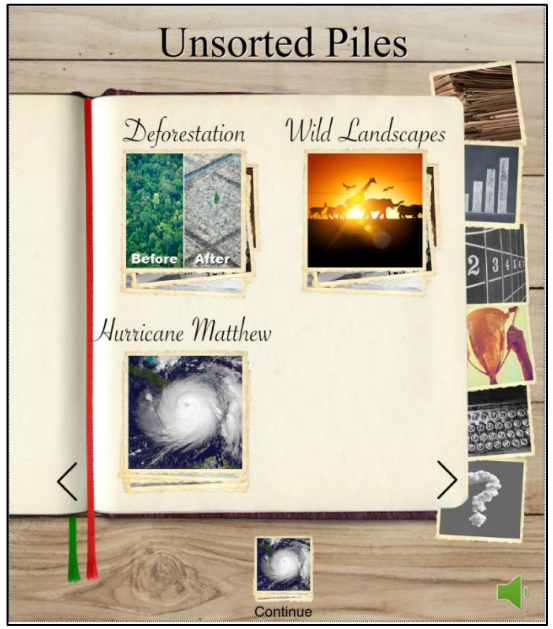
1 - Rapid image assessment



Picture Pile

Mobile and web application designed for
(1) **rapid image assessment** and (2) **change detection**

geo-wiki.org/games/picturepile



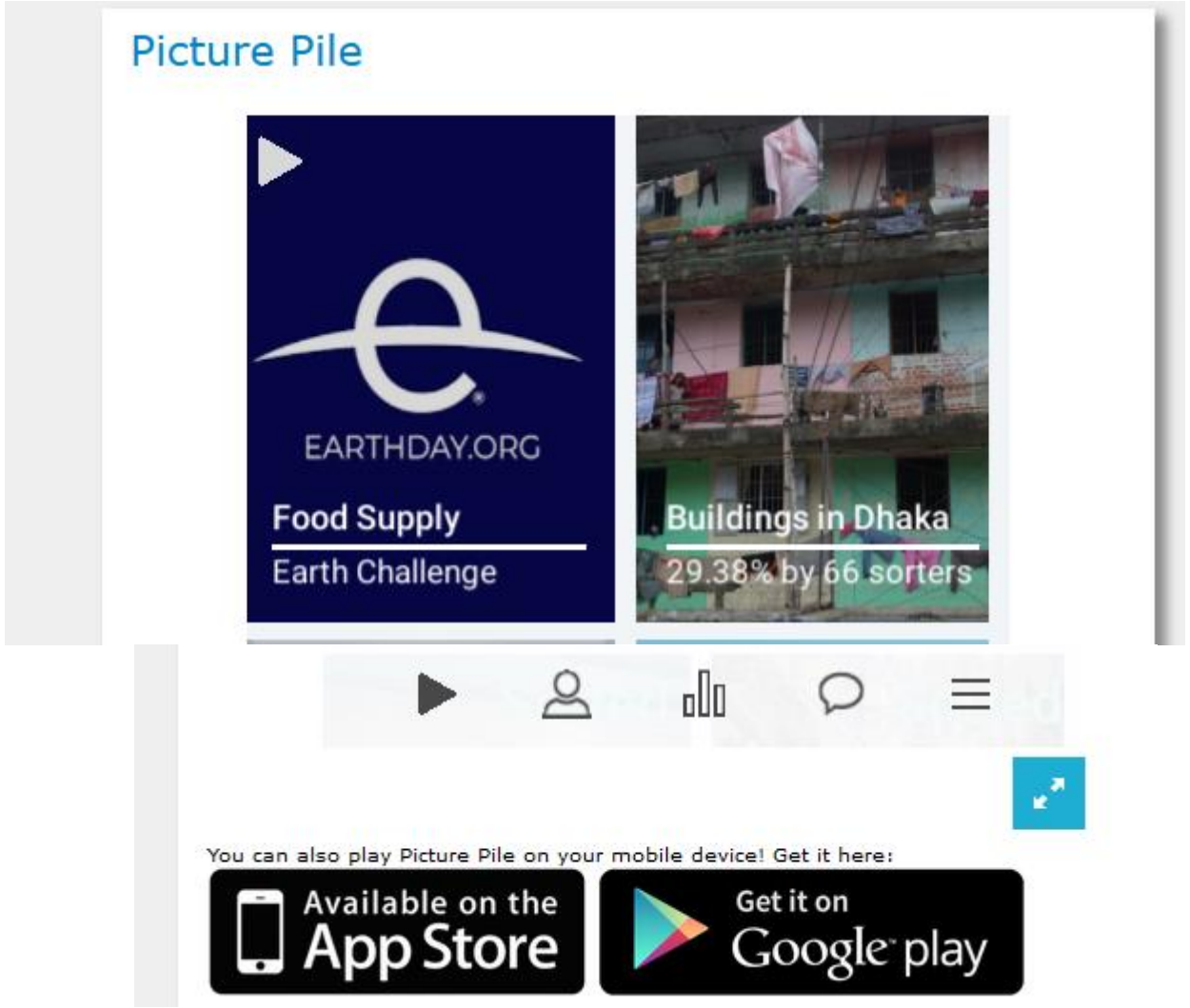
Designed to be **generic and flexible** tool customizable to different domains that requires EO data as an input resource.

Available on the App Store

Get it on Google play

Check it out yourself

https://geo-wiki.org/games/picturepile



Street level photography

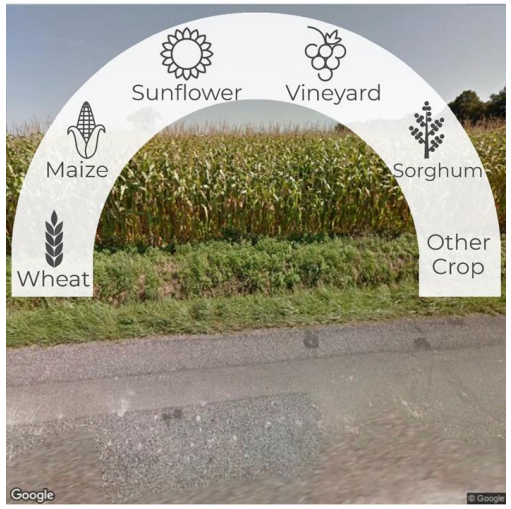
Crop field

Photograph taken along roads

Score: 48

What do you see?

(Drag to answer)



Undo

Can't tell

Menu

Score: 48

Maize

Undo

Can't tell

Menu

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Hope you enjoyed!

Please write your questions on the live chat session

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