International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

Tree-Quest: Citizen Science App to Measure Single Tree Attributes

-ADAPT4K Kick-off Meeting-

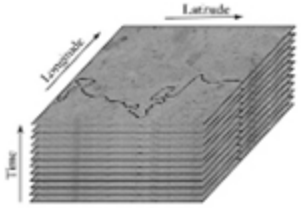
Florian Hofhansl, Victor Bruckman, and Milutin Milenković

Citizens for Copernicus (**C4C**): Combining Copernicus and Crowdsourced Data for Forest Resources Monitoring

Citizens for Copernicus (C4C)

Sentinel-1

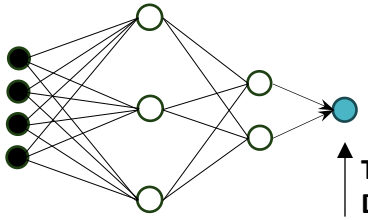
Sentinel-2



Sentinel-1

Sentinel-2

EO Data



Prediction

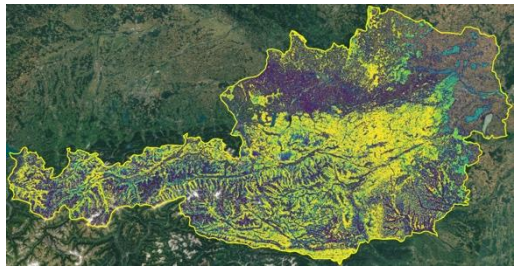
Training Data

Geo-Quest

Tree-Quest

Three Use Cases:

1. **Biomass/Carbon Mapping**
2. **Tree Species Mapping**
3. **Urban Trees Mapping**



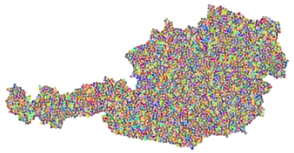
0 AGB CCI [t/ha] 300

Sep. 1. 2023 3 years **Aug. 31. 2026**

Mobile app for CS forest carbon quest

ML-ready DB with CS, in-situ and Copernicus data

ML models for mapping forests



CS-based forest maps of biomass and tree species

CS forest-carbon community

Geo-Quest Mobile App

- The hub mobile application with a collection of different IIASA's Citizen Science quests
- Include quests such as:
  - Tree-Quest
  - Forest-Quest
  - Crop Capture
- Available for Android and iOS phones

Geo-Quest

Download on the App Store

GET IT ON Google Play

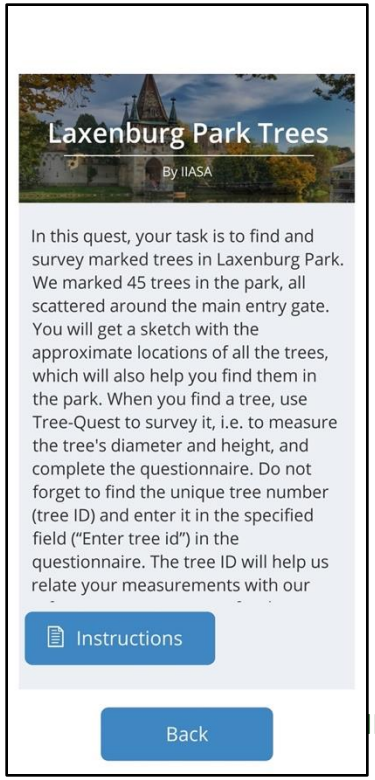
Tree-Quest: Single Tree Measurements

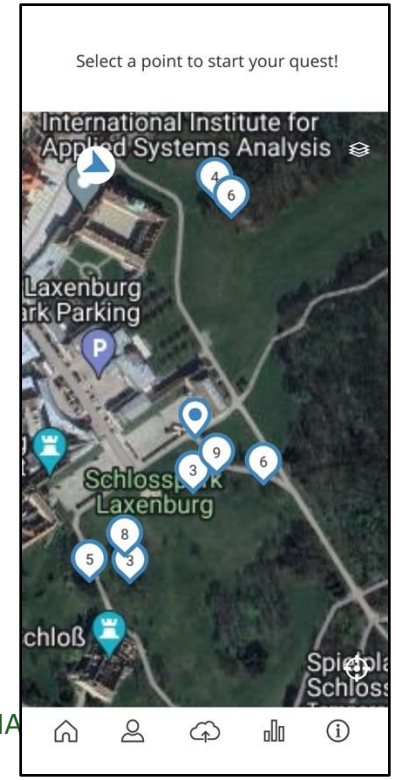
- Users can collect ground data such as:
  - tree **Diameter**
  - tree **Height**
  - tree **Species**
- Based on the measurements, the app will estimate:
  - Volume of the tree
  - Biomass of the tree
  - Carbon stored in the tree
- Two quest types:
  - Opportunistic
  - Predefined locations
- Use augmented reality
  - 3D points
  - Circle fit
  - Cilinder

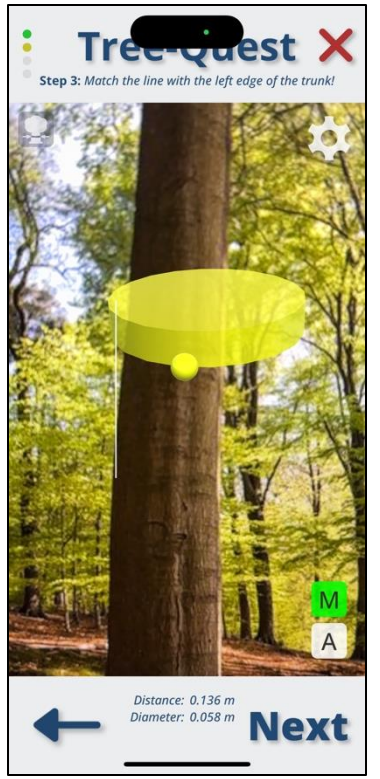
Seedpoint

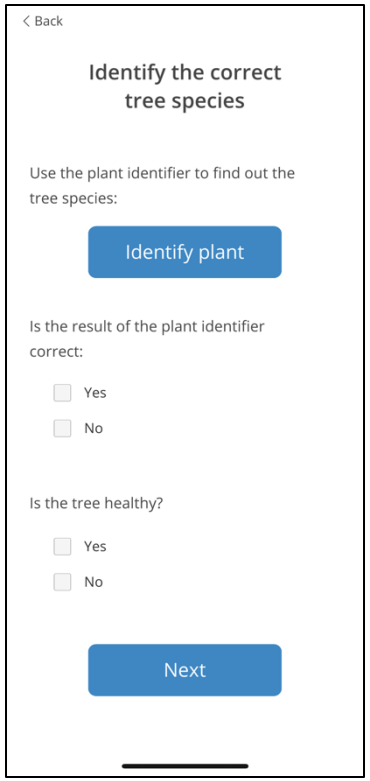
Auto Circle Fit

Manual Line Alignment





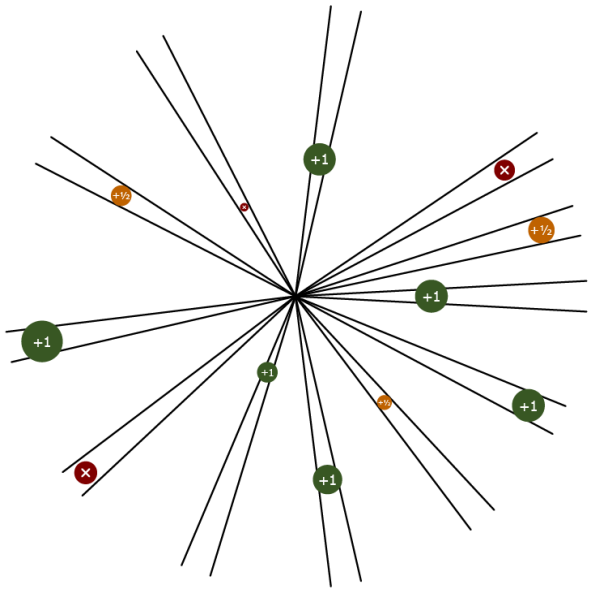


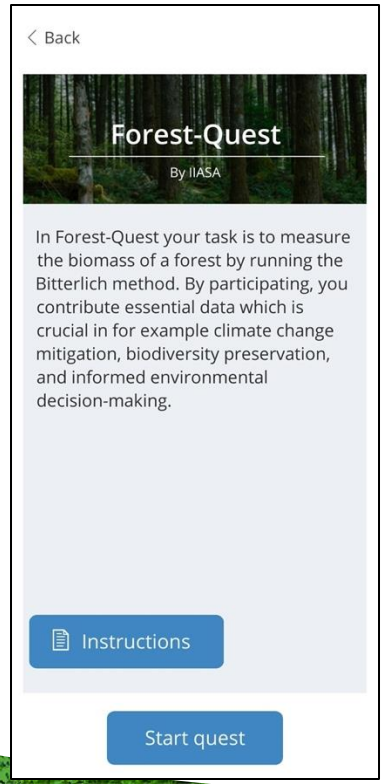


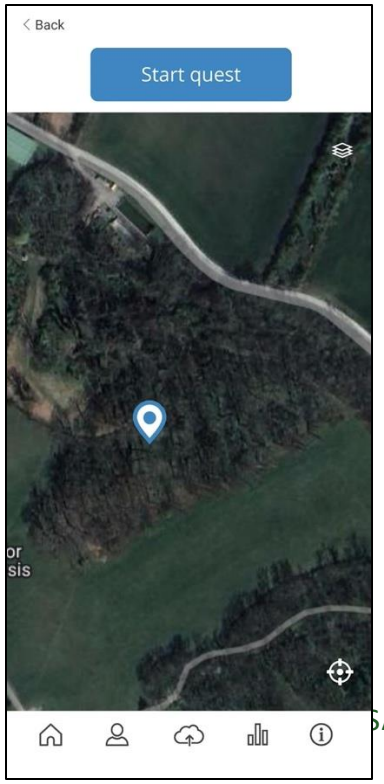
Forest-Quest: Forest Plot Measurements

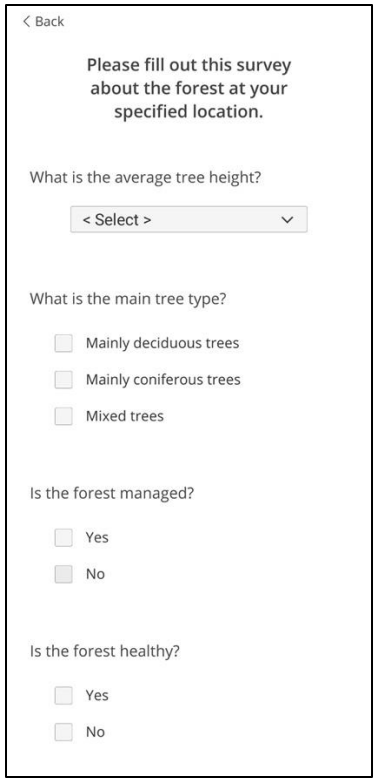
- Users can measure a forest plot's Basal Area
  - Angle count sampling (Walter Bitterlich method)
- In combination with Tree-Quest measurements (height and tree species), you can estimate:
  - Volume of the forest plot
  - Biomass of the forest plot
  - Carbon stored in the forest plot
- We are working on a new quest that will combine Tree-Quest and Forest-Quests
- Forest-Quest is an opportunistic quest

Angle count sampling



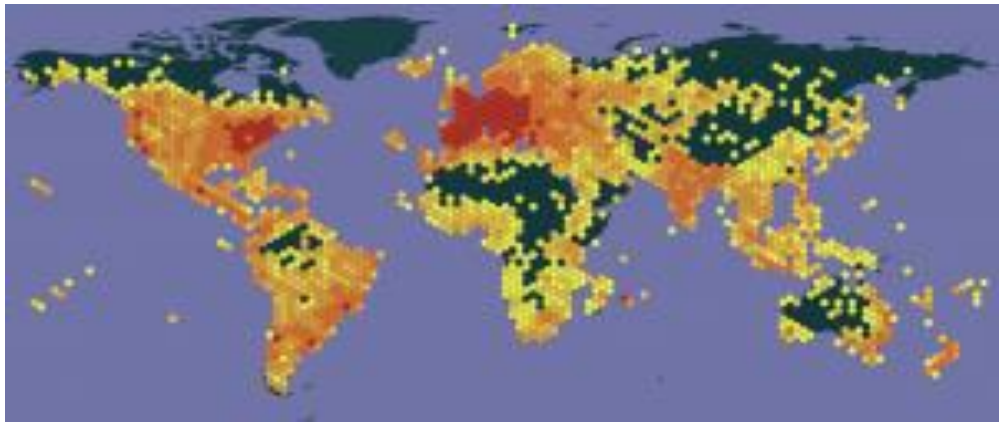






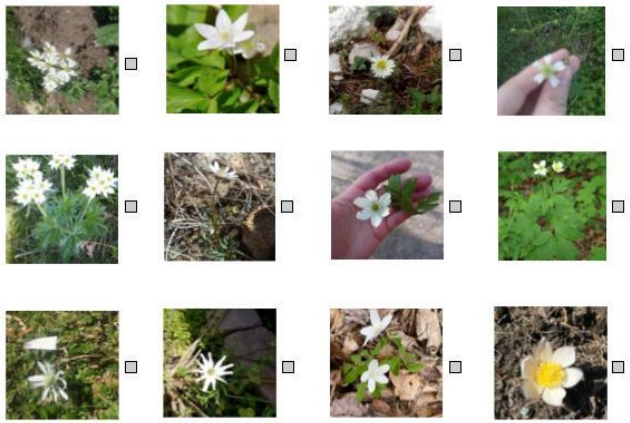
Spp-ID: species identification (Pl@ntNet)

The GBIF-Global Biodiversity Information Facility Data



Plant identification: a difficult problem

Exercise: link the pictures to the right plant name



Identify the correct tree species

Use the plant identifier to find out the tree species:

Identify plant

zenodo Search Upload Communities

There is a **newer version** of this record available.

April 29, 2021 Dataset Open Access

Pl@ntNet-300K image dataset

Camille Garcin; Alexis Joly; Pierre Bonnet; Maximilien Servajean; Joseph Salmon

Pl@ntNet-300K is an image dataset aimed at evaluating set-valued classification. It was built from the database of Pl@ntnet citizen observatory and consists of 306146 images, covering 1081 species. We highlight two particular features of the dataset, inherent to the way the images are acquired and to the intrinsic diversity of plants morphology:

i) The dataset exhibits a strong class imbalance, meaning that a few species represent most of the images.

ii) Many species are visually similar, making identification difficult even for the expert eye.

These two characteristics make the present dataset a good candidate for the evaluation of set-valued classification methods and algorithms. Therefore, we recommend two set-valued evaluation metrics associated with the dataset (top-K and average-K) and we provide the results of a baseline approach based on a resnet50 trained with a cross-entropy loss. The full description of the dataset can be found in (to be provided soon).

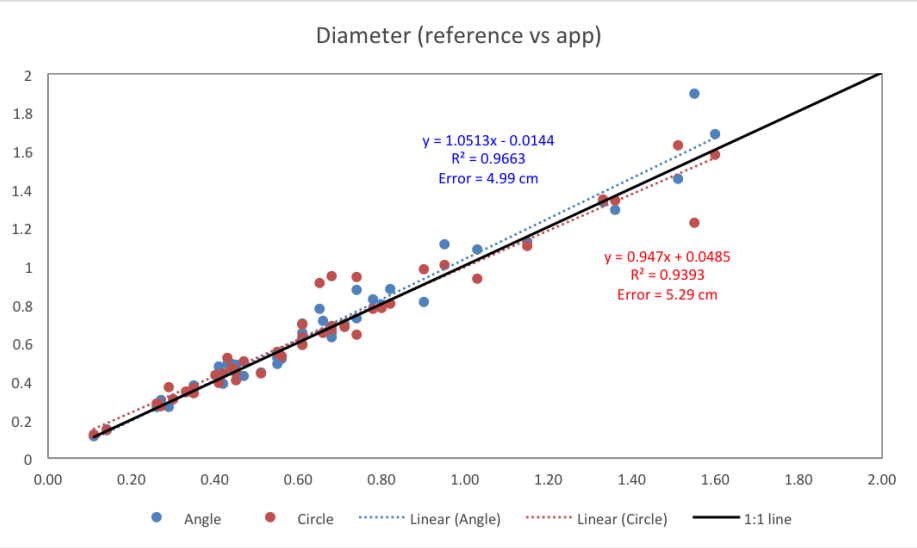
The scientific publication (NEURIPS 2022) describing the dataset and providing baseline results can be found here: https://openreview.net/forum?id=eLYinD0TtIt

Utilities to load the data and train models with pytorch can be found here: https://github.com/plantnet/PlantNet-300K/

https://zenodo.org/record/4726653

Quality: assessment of measurement accuracy

Tree diameter (cm)



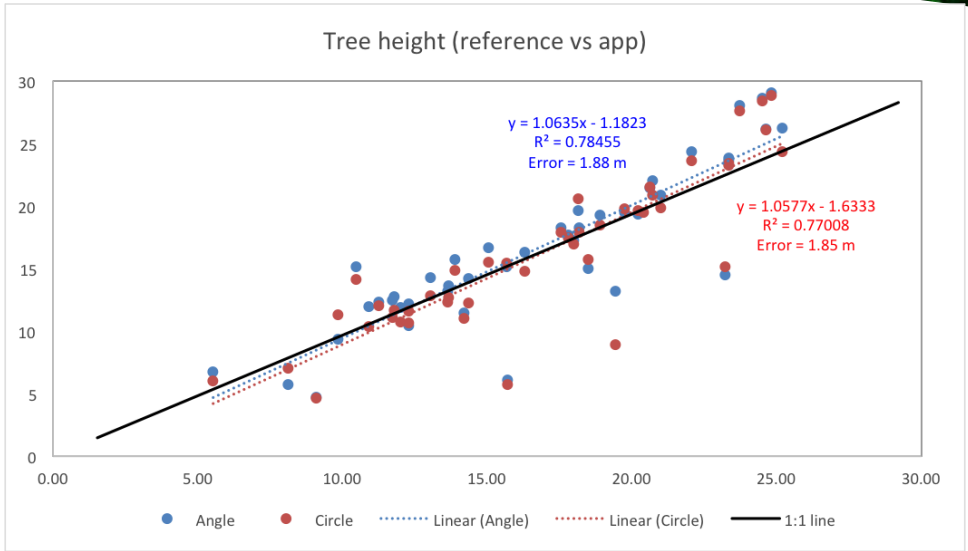
Citizen-campaign

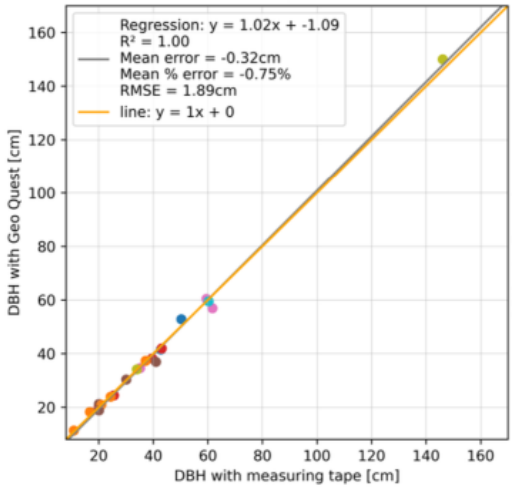
<u>Measurement error (cm)</u>

Tree diameter = 5 cm

Tree Height = 1.8 m

Tree height (m)



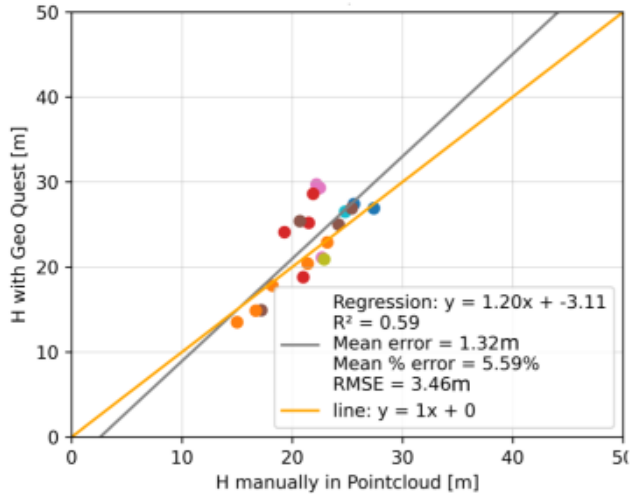


Expert-campaign

<u>Measurement error (cm)</u>

Tree diameter = 2 cm

Tree Height = 1.3 m



Outlook: comparison to other Apps

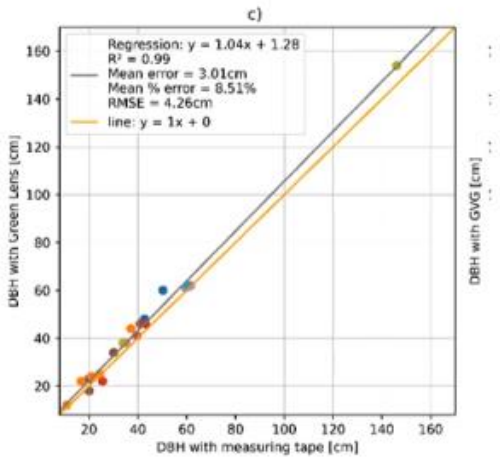
GreenLens

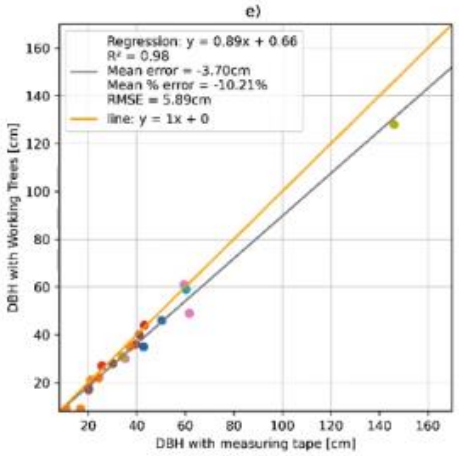
- China, only DBH
- Not available on PS
- Automatic trunk recognition

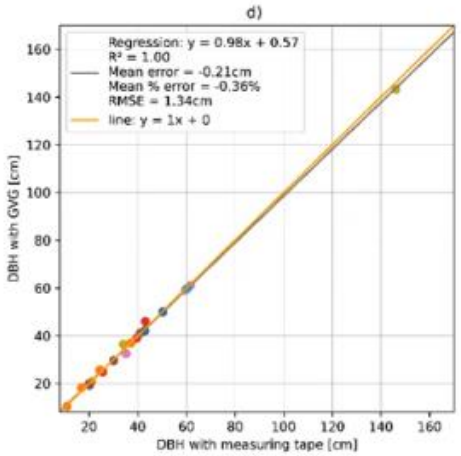
- US start-up
- Free
- UI well-designed

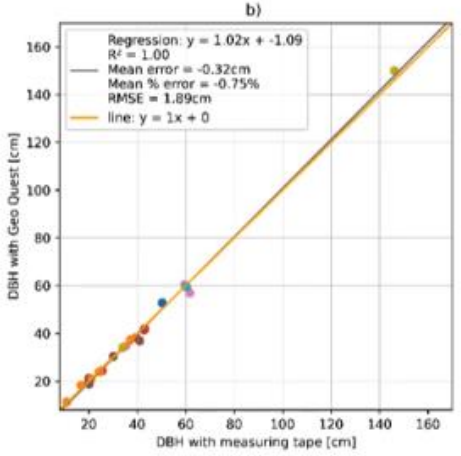
GVG

- By NASA
- Go around tree
- Best results









Online portal: user dashboard for data access

https://c4cweb.main.geo-wiki.org/

Campaigns: Leaderboard & Prices

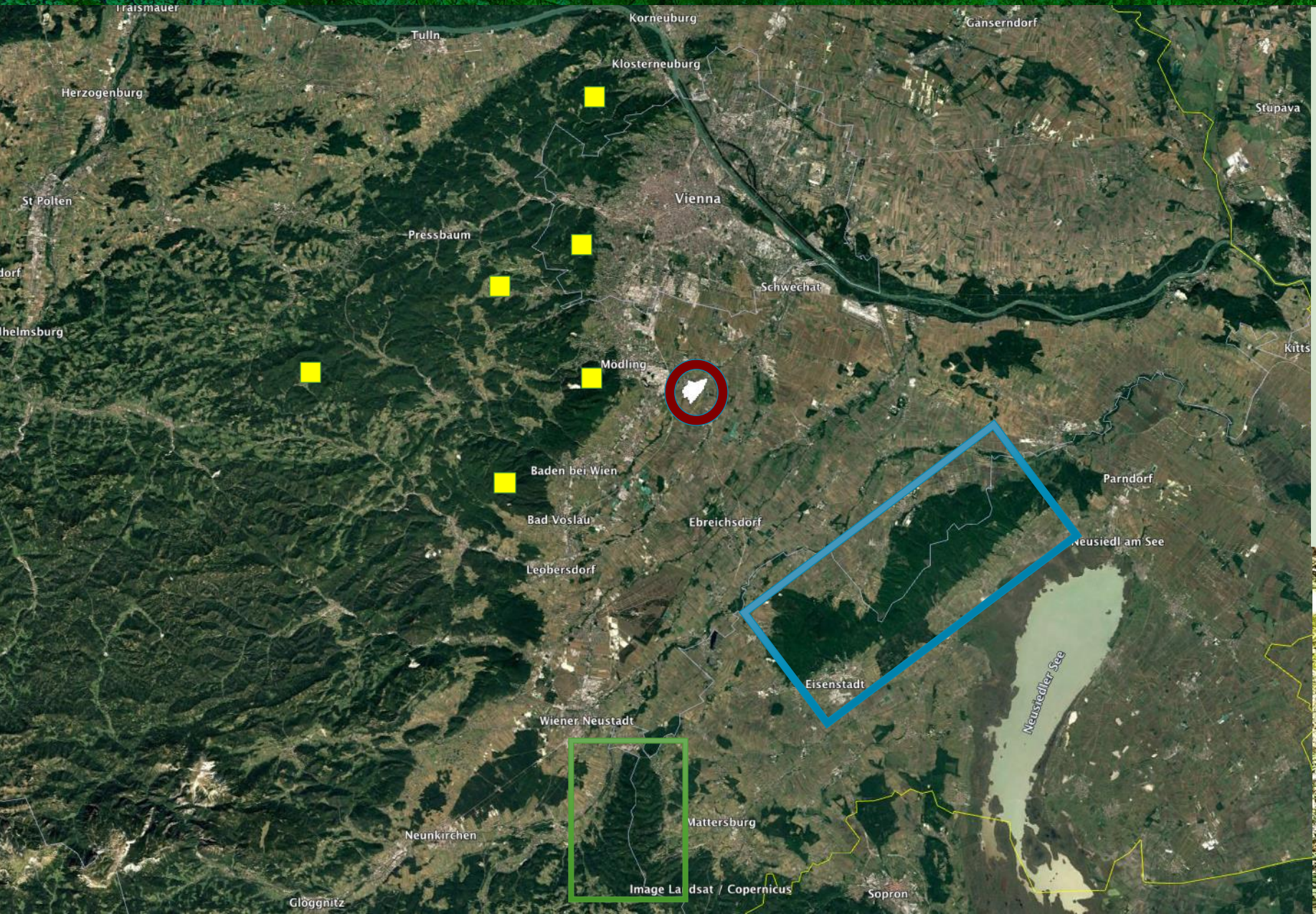
Laxenburg Park Campaign

- Aim
  - Survey all 45 trees or as many as possible
- 30 Participants
  - 23 from GEO-OPEN-HACK 2024
  - 7 from the C4C project (IIASA)
- Ranking
  - Score (0, 1) is calculated for each tree based on your measurement accuracy
  - Scores for all surveyed trees are summed up for ranking
- Prices to the top 3 ranked participants

Leaderboard

Rank	User Name	AggregatedQualityScore	Submissions	Images
1	FloH	44.97064	91	720
2	Milutin	37.62045	92	910
3	Tester5000	22.18958	50	406
4	weihaodong	20.10067	35	396
5	lucazappa	18.35297	47	382
6	FloP	16.99564	52	438

Potential co-benefits: Field campaigns



Wald-Feldtage 2025

(Ort wird bekannt gegeben)

25. April, Freitag

9. Mai, Freitag

12. Juni, Donnerstag

12. September, Freitag

26. September, Freitag

Time for action: download the app (QR code)

Download on the App Store

GET IT ON Google Play

Thank you!
